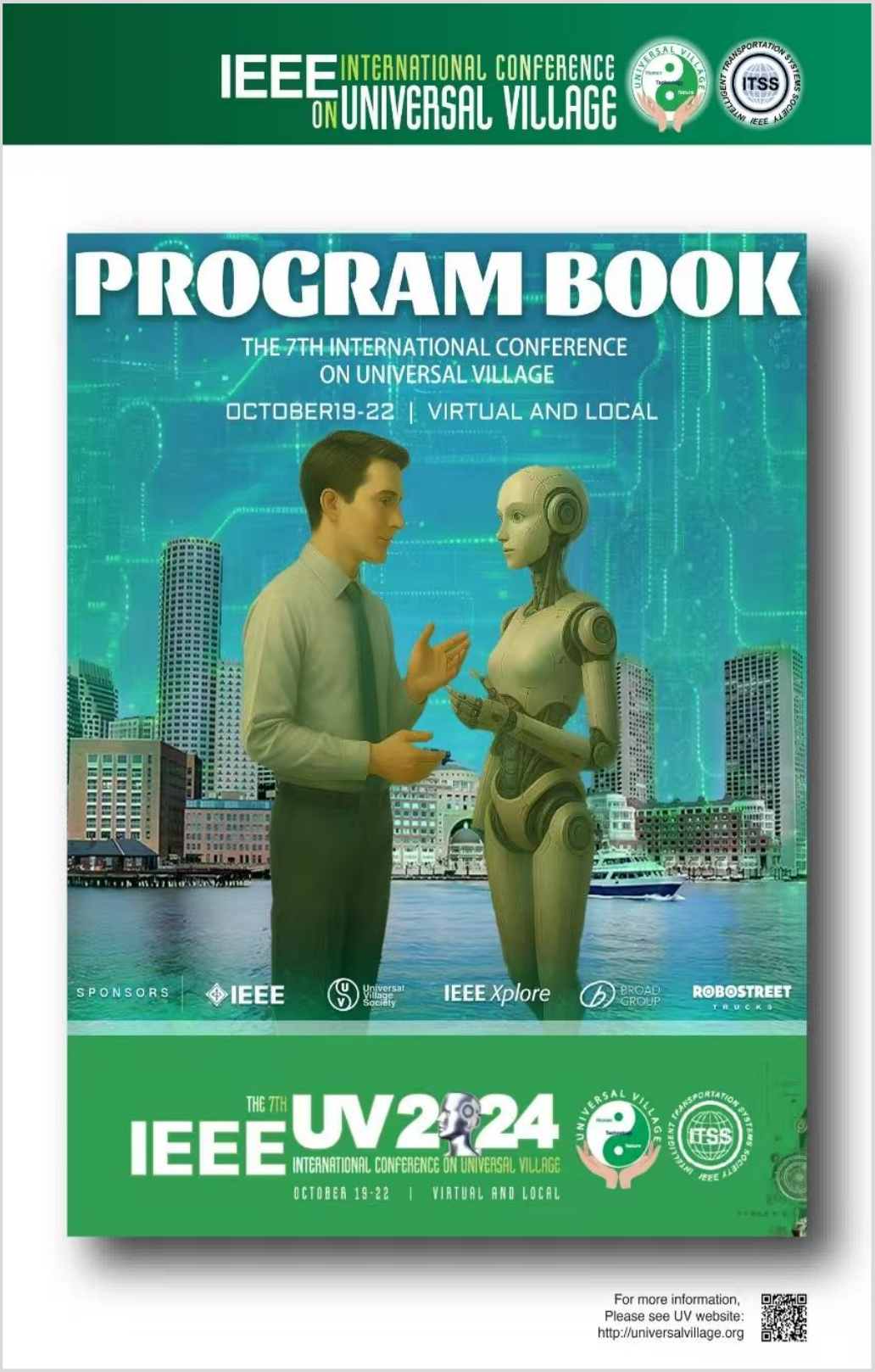
IEEE INTERNATIONAL CONFERENCE ON UNIVERSAL VILLAGE
PROGRAM BOOK
THE 7TH INTERNATIONAL CONFERENCE
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OCTOBER19-22 | VIRTUAL AND LOCAL
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THE 7TH IEEE
UV
2024
www.Universalvillage.org
Oct. 19-22, 2024
Boston, MA, USA
Reflections on the Human-AI Relationship
and AI-Pervasive Societal Transformation:
Human-centricity, Explainable AI,
and Intent & Behavior Understanding
for Integration, Resilience, Inclusiveness,
and Sustainability.
THE THEME OF IEEE UV2020 IS
SEEKING INTEGRATED
UV—ORIENTED SOLUTIONS FOR INCLUSION
BOSTON USA
HARMONY
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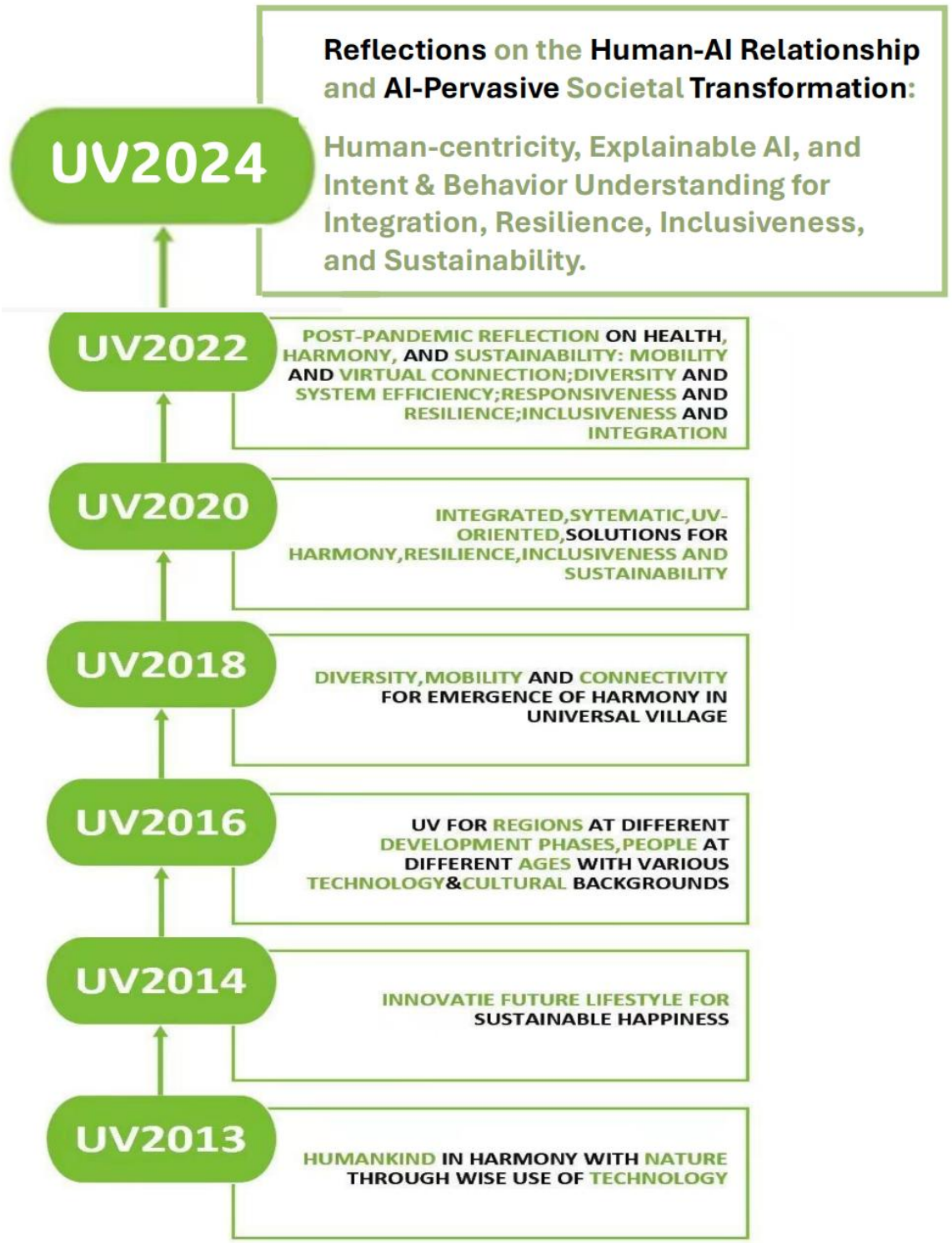
The 7th International Conference on Universal Village

IEEE UV2024
Program Book

October 19-22, 2024
Virtual and Boston, USA

UV Theme


UV2024
Reflections on the Human-AI Relationship and AI-Pervasive Societal Transformation:
Human-centricity, Explainable AI, and Intent & Behavior Understanding for Integration, Resilience, Inclusiveness, and Sustainability.
UV2022
POST-PANDEMIC REFLECTION ON HEALTH, HARMONY, AND SUSTAINABILITY: MOBILITY AND VIRTUAL CONNECTION;DIVERSITY AND SYSTEM EFFICIENCY;RESPONSIVENESS AND RESILIENCE;INCLUSIVENESS AND INTEGRATION
UV2020
INTEGRATED,SYTEMATIC,UV-ORIENTED,SOLUTIONS FOR HARMONY,RESILIENCE,INCLUSIVENESS AND SUSTAINABILITY
UV2018
DIVERSITY,MOBILITY AND CONNECTIVITY FOR EMERGENCE OF HARMONY IN UNIVERSAL VILLAGE
UV2016
UV FOR REGIONS AT DIFFERENT DEVELOPMENT PHASES,PEOPLE AT DIFFERENT AGES WITH VARIOUS TECHNOLOGY&CULTURAL BACKGROUNDS
UV2014
INNOVATIE FUTURE LIFESTYLE FOR SUSTAINABLE HAPPINESS
UV2013
HUMANKIND IN HARMONY WITH NATURE THROUGH WISE USE OF TECHNOLOGY

CONTENTS

GREETINGS FROM CONFERENCE CHAIRS

Honorary Chairs

Berthold K.P. Horn (MIT, USA)

It is great to see all of you here at the Universal Village Conference.

We live at a unique time in history where, on the one hand, marvelous new technology is available, and on the other hand, great societal needs have arisen. The new technology comes in part from the maturation of computer hardware and software and in part from better understanding and modeling of the physical processes underlying systems interactions particularly those of a living community.

In some cases, we even have the unique opportunity to "start from scratch" in that, with rapid growth in some of the developing world, it is possible to actually design communities and the underlying infra-structure to better suit the modern world.

At MIT, we have a diverse set of efforts addressing different aspects relevant here today, including intelligent traffic research and work on machine vision, my own specialty. But there is much more to this topic and we will hear about that in the next few days.

But I won't take any more of your time since I am sure you are eager to hear the technical presentations, as I am, since that, after all, is why we are all here.

General Chairs

Roy E. Welsch (MIT, USA)

Kazuya Takeda (Nagoya Univ., Japan)

Ozaki Nobuyuki (Nagoya Univ., Japan)

Ji Li (Tsingda, China)

Zhang Xiong (Beihang Univ.,China)

Lionel C. Kimerling (MIT, USA)

Shuguang Zhang (MIT, USA)

Welcome to the 7th International Conference on Universal Village, UV2024. The Universal Village (UV) represents our vision for a future society that delivers sustainable happiness to its residents. To build this UV, we adopt a top-down, or in other words, a system-oriented approach as opposed to a bottom-up or element-oriented approach.

Throughout this development process, overarching objectives such as the sustainable happiness of residents inform and define more specific objectives. These include environment protection, energy management, communication, healthcare, transportation, and other related systems. Feedback mechanisms from bottom to top also play a critical role in this integrative and collaborative process.

We sincerely hope this conference stimulates various kinds of collaborations. Thank you for joining us at this conference!

International Chairs

Yajun Fang	***Xiaoman Duan***	***Yasha Yi***
(UVS, USA)	***(UVS, USA)***	***(UMich, USA)***



On behalf of the Universal Village International Conference Committee, we warmly welcome you to the 7th Universal Village International Conference. We are gathering from around the world with a singular purpose: to make this world a better place, a Universal Village that we can all call home. We are here to confront environmental problems threatening our quality of life; to share our advanced research findings and experiences working within the framework of the Universal Village; to discuss challenges encountered in our research endeavors, collectively find potential solutions, and pose new questions. Lastly, we are here to strategize on creating milestones for the Universal Village through innovation, technology, and the boundless human capacity for learning and discovery.

We are profoundly grateful for your significant contributions to UV2024. Without you, UV2024 would not be happening today. It is your efforts that will ensure the success of UV2024 and give our "Universal Village" a brighter future. Please accept our deepest appreciation from the UV International Committee.

Conference Chairs

Lin Zhang (Beihang Univ., China)

Clinton Andrews (Rutgers Univ., USA)

Juejun Hu (MIT, USA)

Francisco Bozzano Barnes (Tenure&Ecology LLC, Spain)

As Conference Chairs, we welcome you to UV2024, the 7th International Conference on Universal Village. Universal Village (UV) represents our desired future society, designed to provide its residents with sustainable happiness. In order to develop UV, we take a top-down, or, in other words, a system-oriented approach, rather than a bottom-up or element-oriented approach. During the development process, higher-level objectives such as the sustainable happiness of residents inform lower-level objectives, which include environment protection, energy management, communication, healthcare, transportation, and other related systems. Feedback from the bottom to the top is crucial in this process of integration and collaboration. We hope that this conference will stimulate various forms of collaboration. As we conclude our greeting, we would like to extend a hearty "Congratulations!" to everyone who contributed to the initiation of this conference. Please enjoy the conference. Thank you very much!

Executive Conference Chairs

Lin Zhang (MIT, USA)	*Longfei Zhou (Gannon Univ., USA)*	*Viksit Kumar (Novateur, USA)*	*Lijuan Su (Joy Wisdom, China)*




It is our greatest pleasure to welcome you to the 7th International Conference on Universal Village (UV2024). As your Executive Conference Chairs, we are honored to support you throughout this inspiring gathering.

Over the next four days, a wealth of knowledge from multidisciplinary fields will be shared, fostering collaboration among researchers who are advancing AI beyond the traditional boundaries of individual disciplines. With the theme "Reflections on the Human–AI Relationship and AI-Pervasive Societal Transformation: Human-centricity, Explainable AI, and Intent & Behavior Understanding for Integration, Resilience, Inclusiveness, and Sustainability," UV2024 provides a unique platform to examine how humanity and technology can evolve together in harmony.

We hope that through these exchanges, you will discover systematic, coordinated, and long-term pathways for building a sustainable future—where AI not only empowers innovation but also respects human values, cultural diversity, and ecological balance. Our aspiration is to broaden our horizons by exploring how Universal Village concepts can be adapted across regions at different developmental stages and embraced by people of all ages and backgrounds.

Finally, we extend our deepest gratitude to all who have devoted their time, energy, and expertise to making UV2024 a success. Your dedication makes this conference possible.

Thank you very much for joining us on this journey, and welcome to UV2024!

Local Chairs

Wei Wang (Robostreet, USA)	***Guoping Zhang (Harvard, USA)***	***Xinyu Tan (China Three Gorges Univ., China)***	***Yue Wang (XianUAT, China)***	***Bing Zhu (Urban Design, China)***





It is our greatest pleasure to welcome you to the 7th International Conference on Universal Village (UV2024). As your local conference chairs, we're here to provide support! A wealth of information from multidisciplinary fields will be presented during this four-day conference, encouraging collaboration among researchers from diverse backgrounds beyond the traditional boundaries of their individual research fields. We hope that by the end of this conference, you will have found systematic, coordinated, and long-term solutions for the future of humanity and nature. As the theme for UV2024, we aspire to broaden our horizons: exploring UV for regions at different developmental stages, and for people of different ages and diverse technological and cultural backgrounds. Lastly, we want to extend our sincere gratitude to those who have made UV2024 a success by devoting their time and energy. Thank you very much for attending UV2024.

Program Chairs

Shengsheng Cao (Ningbo Univ., China)

Hao Sheng (Beihang Univ., China)

Wenya Du (MIT, USA)

Hirofumi Aoki (Nagoya Univ., Japan)

Zili Li (MIT, USA)

Yi Tao (UVS, USA)

Juntao Jiang (UVS, USA)

Zhenyao Liu (UPENN, USA)

It is with great pleasure and honor that we welcome you to the 7th Universal Village Conference, UV2024! On behalf of the program committee, we would like to extend our heartfelt appreciation to all the participants. Thanks to the diligent efforts of the organizing committee, we proudly present a series of attractive events and technical sessions as part of UV2024. We hope all participants will enjoy the technical presentations and engage actively in discussions throughout the conference. Once again, thank you for your significant support and active participation in UV2024.

Publication Chairs

Hao Yuan
(Stevens Institute of Technology, USA)

Hongyan Cui
(MIT/BUPT, USA/China)

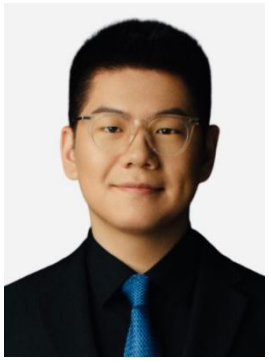
Lifeng Zhang
(BJMU, China)

 c

On behalf of the Publication Committee, it is our great pleasure to welcome you to the 7th International Conference on Universal Village (UV2024). Our role as Publication Chairs is simple yet meaningful: to make sure the work presented here is carefully collected, prepared, and shared, so that the thoughts and achievements of this gathering can travel far beyond these few days. The conference proceedings are not just pages of papers; they are a record of our conversations, our discoveries, and our hopes for what is to come.

This year's program reflects a wide range of important topics, and every contribution represents time, dedication, and passion, and we deeply thank all the authors, reviewers, and editorial team members who made it possible. We hope that what is discussed and documented here will spark new connections and collaborations, and that you will leave this conference with fresh ideas, lasting friendships, and renewed inspiration. Thank you for being here, and we wish you a meaningful and enjoyable UV2024.

IT Chairs

Jieren Kou (NYU, USA)	***Hanxia Li (UVS, USA)***	***Zhenqian Huang (Hohai Univ., China)***	***Chuqiao Gu (Google, USA)***
			

On behalf of the IT Committee, we warmly welcome you to the 7th International Conference on Universal Village (UV2024). For the IT team, our mission has been to make sure every connection works, every presentation runs smoothly, and every participant, no matter where they are, can fully engage with the conference. We have prepared platforms, tested systems, and stayed ready behind the scenes so that technology can be invisible when it works, and helpful the moment you need it. UV2024 is not only about exchanging knowledge, but also about staying connected. In today's hybrid setting, technology allows us to extend the conference hall far beyond these walls, bringing together people and ideas without borders. We are grateful to all participants for adapting to new formats, and for your patience. We hope that over the next few days, you will find the technology seamless, the communication easy, and the experience enriching. Our team is always here to help, and we look forward to supporting you in making UV2024 a smooth, inspiring, and memorable event.

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- **Y: Hao Yuan**
- **Z: Qianchao Zhao, Jinxi Zhang, Lifeng Zhang, Siqi Zhang, Wuyang Zhang, Yongquan Zhang, Zejun Zhang, Zhize Zhou**

GENERAL INFORMATION

Following great success in China (Beijing, UV2013), the United States (Boston, UV2014), Japan (Nagoya, UV2016), and three additional times in the United States (Boston, UV2018, UV2020 and UV2022), the 7th International Conference on Universal Village (UV2024) will once again be held in Boston, United States. UV2024 aims to broadly illustrate a desired future society that seeks harmony between humans and nature through the thoughtful application of advanced technologies. The concept represents an evolved and advanced form of Smart Cities, signifying our commitment to follow universal laws in order to protect the environment and ecosystems, while innovating new lifestyles to sustain happiness for humanity's future.

UV2024 will persistently appeal for collective efforts across multi-disciplinary fields. The goal is to develop a platform where researchers of diverse backgrounds can collaborate beyond traditional field boundaries and discover a systematic, coordinated, long-term solution for the future of humankind and Mother Nature.

The subjects for UV2024 include, but are not limited to, the following topics:

- Systematic methodologies to advance UV technologies and to develop UV systems, including intelligent transportation, smart infrastructure, smart energy system, smart environmental and ecosystem protection, smart home & communities, smart healthcare, smart intelligent food systems, smart humanity, smart lifestyle innovation, etc.
- New life styles enabled by IT / New energy sources / New materials / Effective microorganism technology and environmental protection.
- Suitable paths of design, development, implementation, engineering and integration appropriate for different regions.

- Ways to benefit governments, companies, universities as well as societies on specific UV topics as well as practical UV solutions.
- The theme for UV2024 is "Reflections on the Human-AI Relationship and AI-Pervasive Societal Transformation: Human-centricity, Explainable AI, and Intent & Behavior Understanding for Integration, Resilience, Inclusiveness, and Sustainability."

The 7th International Conference on Universal Village (IEEE UV2024) will be held as an hybrid conference: onsite & online via Microsoft Teams from October 19 to 22, 2024.

UV2024 Website

https://universalvillage.org/

Contact Information

Please contact us at this email address whenever you have any questions:

uv.conf.committee@universal-village.org

PROGRAM AT A GLANCE

IEEE UV2024 Program at a Glance (October 19-22th, 2024, EDT)

Date (US EDT)	Time (US EDT)	Session ID	Description	Meeting Teams (Join in Microsoft Teams)
10/18, 2024 (Friday)	09:00pm-11:55pm	[TS2-A]	Systematic and Integrated Frameworks for UV Subsystems and Contributing Factors	[TS2-A] IEEE UV2024 Session
	08:00pm(Oct.18) - 02:10am(Oct.19)	[SF-Part 1 & Part2]	Student Forum - Pitch Competition & Workshop	[SF] IEEE UV2024 Student Forum
10/19, 2024 (Saturday)	07:40am-11:00am	[SF-Part 3]	Student Forum - Research Presentation	[SF] IEEE UV2024 Student Forum
	08:00am -08:41am	[TS9-A]	AI-assisted Healthcare Monitoring	[TS9-A & TS9-B] IEEE UV2024 Session
	09:00am -12:05pm	[TS9-B]	Smart Medicine and Smart Healthcare - Part I	
	20:30pm(Oct.19) -04:20 am(Oct.20)	[TS10-C]	Integrated Solutions for Smart Humanity	[TS10-C & TS10-D] IEEE UV2024 Session
		[TS10-D]	Smart Design and Design Ethics	
10/20, 2024 (Sunday)	08:00am -10:45am	[TS11-A] [TS11-B]	Responsible and Ethical Data Management and Processing	[TS11-A & TS11-B] IEEE UV2024 Session
			Learning Algorithm Development, Analysis and Interpretability	
	09:00am -10:45am	[TS12-A]	Advance in Distributed Energy System: Design, Simulation and Operation	[TS12-A] IEEE UV2024 Session
	09:00am -11:50am	[TS2-B]	Intelligent Modeling, Simulation, and System Analysis	[TS2-B] IEEE UV2024 Session
	09:00am -11:50am	[TS12-E]	Equitable AI for the Voiceless and Vulnerable Groups	[TS12-E] IEEE UV2024 Session
	10:20am -12:30pm	[TS12-B]	UV Underground: Underground Infrastructure & Future Urbanization Needs	[TS12-B] IEEE UV2024 Session
	11:00am -12:35pm	[TS12-C]	The Fusion of Traditional Chinese Medicine and Modern Science	[TS12-C] IEEE UV2024 Session
	22:00 -23:00	[TS9-B]	Smart Medicine and Smart Healthcare - Part II	[TS9-A & TS9-B] IEEE UV2024 Session
	20:00pm-20:40pm	[PE]	Rethinking Education	[PE] IEEE UV2024 Session
10/21, 2024 (Monday)	08:00am-13:00pm	[PS]	Opening Ceremonty & Plenary 1 & 2	[Main] IEEE UV2024
	13:20pm-18:35pm		Plenary 3 & 4	
	09:00pm-10:05pm	[SF-Part 4]	Student Forum - Research Presentation	[SF] IEEE UV2024 Student Forum
10/22, 2024 (Tuesday)	06:50am-09:35am	[TS4-A]	Renewable Energy and Smart Energy Management	[TS4-A] IEEE UV2024 Session
	07:00am-10:30am	[TS5]	Manufacturing Innovations for Efficiency, Safety, and Sustainability	[TS5] IEEE UV2024 Session
	07:30am-11:30am	[TS4-B]	Smart Materials and Devices	[TS4-B] IEEE UV2024 Session
	08:00am-09:10am	[TS3-A]	Intelligent Transportation, Urban Planning, and Smart City Infrastructure	[TS3-A & TS3-B & TS3-C & TS3-D] IEEE UV2024 Session
		[TS3-B]	Intelligent Vehicles, Mobility Support for Vulnerable Groups	
		[TS3-C]	Crowd Management, Smart Response Systems for City Emergencies	
		[TS3-D]	Information Flow, Communication, Networks, and Security	
	08:00am-11:10am	[TS6]	Agriculture Innovations for Efficiency, Safety, and Sustainability	[TS6] IEEE UV2024 Session
	08:30am-09:30am	[TS7-A]	Smart Ecological and Environmental Systems	[TS7-A & TS7-B] IEEE UV2024 Session
	09:30am-11:00am	[TS7-B]	Mobility Enabled Material Cycles, the Circular Economy, Trash and Scrap Collection, Processing, Reuse, and Recycling	
	08:00am-11:10am	[TS12-D]	AI-Driven Sports Training, Exercise, and Fitness	[TS12-D] IEEE UV2024 Session
	09:00am-10:50am	[TS10-A] [TS10-B]	Urbanization and Smart Communities	[TS10-A & TS10-B] IEEE UV2024 Session
			Smart Government and Social Services	
	11:45am-01:25pm	[TS1-C]	Digital Analytics, Digital Transformations and UV Index Evaluation	[TS1-C] IEEE UV2024 Session
	20:00pm-22:00pm	[PS]	Closing Ceremony	[Main] IEEE UV2024
10/28, 2024 (Monday)	08:00am-10:20am	[TS1-A] [TS1-B]	Vision for Universal Village and UV Indices	[TS1-A & 1-B] IEEE UV2024 Session
			Development Status of Universal Village	
11/16, 2024 (Saturday)	06:00am -11:35am	[TS8-A] [TS8-B]	Smart Homes and Community, Virtual Living	[TS8-A & TS8-B] IEEE UV2024 Session
			Mobility, Connectivity, and Innovative Lifestyles	

[DSC] Data Science Competition

[Introduction] The 1st International "Vision Meets Algae" Challenge (VisAlgae) is a part of IEEE 7th Village International Conference on Universal Village. It is held to encourage participants to pay attention to marine environment and use computer vision methods to better monitor marine biology. The task is to develop an object detection algorithm to detect 8 classes of microalgaes (*Bacillariophyta, Chlorella pyrenoidosa, Platymonas, Dunaliella salina, Chrysophyta,* Normal *Symbiodiniacea,* Translating *Symbiodiniacea,* and Bleaching *Symbiodiniacea*) in obtained microscopy images.

[PC] Pitch Competition

[Aims] UV Student Forum encourages students to share their entrepreneurial ideas and to transform their ideas and research results into meaningful products that can make the world better.

[Contents] Talent selection, research guidance, and innovation incubation.

[Topics]

♦ Coordinated UV Solutions for Epidemic Prevention and Control

♦ Coordinated UV Solutions for Trash and Scrap Collection, Processing, Reuse, and Recycling

♦ Integrated, systematic, UV-oriented solutions for harmony, resilience, inclusion and sustainability

♦ UV Subsystems

♦ UV Impacting Factors

Oct. 18-22 : [SF] UV Student Forum

[Aims] Increase awareness among the young generation about the challenges and dilemmas humans are facing, cultivate young people's creativity and leadership, encourage students' entrepreneurial enthusiasm, and contribute to building a better world.

[Contents] Students will exchange their research experience and visions with peers, host round-table discussion, propose future plans for UV student clubs and participate in interactive activities.

[Events]

Theme 1: Science & Technology

- ♦ UV Introduction
- ♦ UV workshop
- ♦ Data Science competition
- ♦ UV Mathematical modeling competition
- ♦ UV Research Project Report
- ♦ Round-table meeting
- ♦ In-depth Panel Discussion

Theme 2: Art, Humanity & Design

- ♦ City Evaluation
- ♦ UV Philosophy & Stories Sharing
- ♦ Talk Show
- ♦ Art & Technology Exhibition
- ♦ Talent Shows and Online Games

Theme 3: Management & Entrepreneurship

- ♦ UV Pitch Competition
- ♦ UV Club and Roadmap

Oct. 21: Plenary Session

[Aims] UV encourages interdisciplinary cooperation for a coordinated and systematic solution to future human-nature harmony

[Contents] Researchers across multi-disciplinary fields will share their novel ideas pursuing intelligent technologies for harmony, resilience, inclusiveness, and sustainability.

[Events]

- ♦ Opening Ceremony
- ♦ Keynote Speech

Oct. 19-22: Technical Program

[Theme] Integrated, Systematic, UV-Oriented Solutions for Harmony, Resilience, Inclusiveness, and Sustainability

[Sessions] Research Reports

- ♦ Session TS1-A Vision for Universal Village and UV Indices
- ♦ Session TS1-B Development Status of Universal Village
- ♦ Session TS1-C Evaluation of Smart City-Related Methods, Technologies, and Systems
- ♦ Session TS2-A Systematic and Integrated Frameworks for UV Subsystems and Contributing Factors
- ♦ Session TS2-B Intelligent Modeling, Simulation, and System Analysis
- ♦ Session TS3-A Intelligent Transportation, Urban Planning, and Smart City Infrastructure
- ♦ Session TS3-B Intelligent Vehicles, Mobility Support for Vulnerable Groups
- ♦ Session TS3-C Crowd Management, Smart Response Systems for City Emergencies
- ♦ Session TS3-D: Information Flow, Communication, Networks, and Security
- ♦ Session TS4-A: Renewable Energy and Smart Energy Management
- ♦ Session TS4-B: Smart Materials and Devices
- ♦ Session TS5-A: Smart Manufacturing
- ♦ Session TS5-B: Smart Agriculture
- ♦ Session TS6-A: Smart Ecological and Environmental Systems
- ♦ Session TS6-B: Mobility Enabled Material Cycles, the Circular Economy, Trash and Scrap Collection, Processing, Reuse, and Recycling
- ♦ Session TS7-A: Smart Homes and Community, Virtual Living
- ♦ Session TS7-B: Mobility, Connectivity, and Innovative Lifestyles
- ♦ Session TS8-A: Ultrasound Technologies for Biomedical Application
- ♦ Session TS8-B: Smart Medicine and Smart Healthcare
- ♦ Session TS8-C: Public Health, Epidemic Prevention and Control
- ♦ Session TS9-A: Urbanization and Smart Communities
- ♦ Session TS9-B: Smart Government and Social Services
- ♦ Session TS9-C: Integrated Solutions for Smart Humanity
- ♦ Session TS9-D: Smart Design and Design Ethics
- ♦ Session TS10-A: Responsible and Ethical Data Management and Processing

- Session TS10-B: Learning Algorithm Development, Analysis and Interpretability
- Session TS11-A&PE: Education Systems in the Universal Village City of the Future
- Session TS11-B: UV Data Science Competition: Algorithm Report Session
- Session TS11-C: Advance in Distributed Energy System: Design, Simulation and Operation
- Session [TS12-A] : New results in low carbon and zero carbon technology
- Session [TS12-B] : UV Underground: Underground Infrastructure & Future
- Session [TS12-C] : The Fusion of Traditional Chinese Medicine and Modern Science
- Session [TS12-D] : AI-Driven Sports Training, Exercise, and Fitness
- Session CF: Digital City Forum
- Session AF: UV Art Forum
- Session PE1: UV Poster
- Session PE2: UV Exhibition: Art & Technologies that present the UV concept
- Session WS-UV: UV Workshop
- Session RMD: UV Roadmap Discussion
- Session PD: UV Panel Discussion
- Session RTB: UV Round Table Discussion

PLENARY SESSION

IEEE UV2024 Opening Ceremony & Plenary Session Agenda (October 21th, 2024, EDT)

No.	Time	Name	Organization	Topics
	Opening Ceremony	**Host: Clinton Andrews (Rutgers University)**		
1	8:00-8:05	Clinton Andrews	Rutgers University	Welcome by Host
2	8:05-8:15	Roy E. Welsch	MIT Sloan School	Opening Speech by General Chair
3	8:15-8:25	Stephen Orlins	National Committee on United States China Relations	Opening Speech by Keynote Speakers
4	8:25-8:55	Ahmed Hussein	ITSS Vice President; IAV GmbH	Opening Speech by IEEE ITSS
	Plenary - 1	**Host: Lin Zhang (University of Buffalo)**		
1	8:55-9:35	Georgios Theodoropoulos	SUSTech Shenzhen	Digital Twins for Managing Blockchain Systems
2	9:35-10:15	Tobiloba Oni	Whitehead Institute	AI & Cancer; Cell Renewal
3	10:15-10:55	Jennifer Lynes Murray	University of Waterloo	Business and The Environment; Marketing of Sustainability
	10:55-11:00	**Break**		
	Plenary - 2	**Host: Viksit Kumar (Novateur)**		
4	11:00-11:40	Yushun Fan	Tsinghua University	Service Recommendation based on Graph Reasoning
5	11:40-12:20	Dinh Nguyen	The University of Alabama in Huntsville	Towards Resilient Internet-of-Things over Wireless Networks via Federated Learning
6	12:20-13:00	Jina Huh-Yoo	Stevens Institute of Technology	The Role of AI in Social Relationships
	13:00-13:20	**Break**		
	Plenary - 3	**Host: Longfei Zhou (Gannon University)**		
7	13:20-14:00	Julian Togelius	NYU Tandon	Artificial General Intelligence
8	14:00-14:40	Jose Campos	San Francisco Office of Community Investment and Infrastructure	San Francisco's Transbay Area Planning: Vision, Finance and Systems Thinking for Large-Scale Urban Development
9	14:40-15:20	Sara Abdali	Microsoft Research	Generative AI: Balancing Innovation and Responsibility
10	15:20-16:00	Francisco Bozzano Barnes	Center for Media & Peace Initiative	AI and Sociotechnical Transformation
	16:00-16:05	**Break**		
	Plenary - 4	**Host: Lin Zhang (University of Buffalo)**		
11	16:05-16:45	Agnis Stibe	RMIT University Vietnam	How Human Artificial Intelligence Can Foster Sustainable Future
12	16:45-17:25	Jingyan Qin	University of Science and Technology Beijing.	Design For Sustainable in the Paradigm of Digital and Natural Civilization
13	17:25-18:05	Jagannath Aryal	University of Melbourne	Earth Observation and Digital Transformation: an Outlook From Infrastructure Engineering
14	18:05-18:35	Longfei Zhou	Gannon University	Session Introduction

Meeting Room (Microsoft Teams): [Main] IEEE2024]Plenary

[P0] Opening Ceremony

Host: Clinton Andrews (Rutgers University)

<>October 21, 8:00am - 8:55am (EDT)

- **Agenda [EDT]**
  1. **[8:00-8:05 am][OC][G-1] *Clinton Andrews,*** *Rutgers University*; Welcome by Host
  2. **[8:05-8:15 am][OC][G-2] *Roy E. Welsch*,** *MIT Sloan School*; Opening Speech by General Chair
  3. **[8:15-8:25am][OC][G-3] *Stephen Orlins,*** *National Committee on United States China Relations;* Opening Speech by Keynote Speakers
  4. **[8:25-8:55 am][OC][G-4] *Ahmed Hussein,*** *ITSS Vice President; ; IAV GmbH;* Opening Speech by IEEE ITSS

Session Assistant: Zhenqian Huang, Guangjun Zeng

[P1] Plenary - 1

Host: Lin Zhang (University of Buffalo)

<>October 21, 8:55am - 10:55am (EDT)

- **Agenda [EDT]**
  1. **[8:55-9:35am][1][P-1]** ***Georgios Theodoropoulos,*** *SUSTech Shenzhen*; **Digital Twins for Managing Blockchain Systems**
  2. **[9:35-10:15 am][1][P-2]** ***Tobiloba Oni*****,** *Whitehead Institute*; <AI & Cancer; Cell Renewal>
  3. **[10:15-10:55 am][1][P-3]** ***Jennifer Lynes Murray,*** *University of Waterloo;* Business and The Environment; Marketing of Sustainability

Session Assistant: Zhenqian Huang, Zhongyu Liu, Guangjun Zeng

[P2] Plenary - 2

Host: Viksit Kumar (Novateur)

<>October 21, 11:00am - 13:00pm (EDT)

- **Agenda [EDT]**
  4. **[11:00-11:40am][2][P-4]** ***Yushun Fan,*** *Tsinghua University;* **Service Recommendation based on Graph Reasoning**
  5. **[11:40-12:20pm][2][P-5]** ***Dinh Nguyen,*** *The University of Alabama in Huntsville;***Towards Resilient Internet-of-Things over Wireless Networks via Federated Learning**
  6. **[12:20-13:00pm][2][P-6]** ***Jina Huh-Yoo,*** *Stevens Institute of Technology,* **The Role of AI in Social Relationships**

Session Assistant: Zhongyu Liu, Guangjun Zeng

[P3] Plenary - 3

Host: Longfei Zhou (Gannon University)

<>October 21, 13:20am - 16:00pm (EDT)

- **Agenda [EDT]**
  7. **[13:20-14:00am][3][P-7]** ***Julian Togelius,*** *NYU Tandon;* **Artificial General Intelligence**
  8. **[14:00-14:40pm][3][P-8]** ***Jose Campos,*** *San Francisco Office of Community Investment and Infrastructure;* **San Francisco's Transbay Area Planning: Vision, Finance and Systems Thinking for Large-Scale Urban Development**
  9. **[14:40-15:20pm][3][P-9]** ***Sara Abdali,*** *Microsoft Applied Sciences Group;* **Generative AI: Balancing Innovation and Responsibility**

10. **[15:20-16:00pm][3][P-10]** ***Francisco Bozzano Barnes,*** *Center for Media & Peace Initiative;* **AI and Sociotechnical Transformation**

Session Assistant: Zhongda Wang, Zhongyu Liu

[P4] Plenary - 4

Host: Lin Zhang (University of Buffalo)

<>October 21, 16:05am - 18:35pm (EDT)

- **Agenda [EDT]**
  11. **[16:05-16:45am][4][P-11]** ***Agnis Stibe,*** *RMIT University Vietnam;* **How Human Artificial Intelligence Can Foster Sustainable Future**
  12. **[16:45-17:25pm][4][P-12]** ***Jingyan Qin,*** *University of Science and Technology Beijing;* **Design For Sustainable in the Paradigm of Digital and Natural Civilization**
  13. **[17:25-18:05pm][4][P-13]** ***Jagannath Aryal,*** *University of Melbourne;* Earth Observation and Digital Transformation: an Outlook From Infrastructure Engineering
  14. **[18:05-18:35pm][4][P-14]** ***Longfei Zhou,*** *Gannon University;* **Session Introduction**

Session Assistant: Zhongda Wang, Yuezhi Luo, Zhongyu Liu

Opening Remarks

Time: 8:00am-8:05am, **October 21, U.S. Eastern Daylight Time**

Host by Clinton Andrews (Rutgers University)

- Welcome by *Clinton Andrews (Rutgers University)*
- Opening Speech

  Roy E. Welsch (MIT Sloan School)

  Stephen Orlins (National Committee on United States China Relations)

  Ahmed Hussein ITSS Vice President; IAV GmbH

  *Kazuya Takeda (*Nagoya University)

  Yajun Fang & Xiaoman Duan (UVS)

  Lin Zhang (MIT), Longfei Zhou (Duke University)

Keynote Speeches

Agenda Details

Opening Ceremony:

Host by Clinton Andrews (Rutgers University)

Time: *8:00am-8:05am, October 21st , U.S. Eastern Daylight Time*

Welcome by Host

Clinton Andrews

Organization|Position: *Rutgers University|Professor*

Time: *8:05am-8:15am, October 21st, U.S. Eastern Daylight Time*

Opening Speech by General Chair

Roy E. Welsch

Organization|Position: *MIT Sloan School|Professor*

Time: *8:15am-8:25am, October 21st, U.S. Eastern Daylight Time*

Opening Speech by Keynote Speakers

Stephen Orlins

Organization|Position:

National Committee on United States China Relations | President

Time: *8:25am-8:55am, October 21st, U.S. Eastern Daylight Time*

Opening Speech by Keynote Speaker

Ahmed Hussein

Organization|Position: *IEEE ITSS | Vice President; IAV GmbH*

Morning Plenery-1:

Host by Lin Zhang (Beihang University)

Time: *8:55am-9:35am, October 21st, U.S. Eastern Daylight Time*

Title: *Digital Twins for Managing Blockchain Systems*

Georgios Theodoropoulos

Organization|Position: *SUSTech| Professor*

Profile:

Georgios Theodoropoulos is currently a Chair Professor at the Department of Computer Science and Engineering at SUSTech in Shenzhen, China. He was previously the inaugural Executive Director of the Institute of Advanced Research Computing, a Chair Professor in Computer Engineering and the Head of the Innovative Computing Group at the School of Engineering and Computing Sciences at the University of Durham, UK. He has been a Senior Research Scientist with IBM Research and senior faculty at the University of Birmingham, UK, where he was also founding Director of one of UK's e-Science Centres of Excellence. He has held an Adjunct Chair at Trinity College Dublin and visiting appointments at the Nanyang Technological University and National University in Singapore. His research interests and contributions are in Info-Symbiotic Systems, Distributed Simulation and Distributed Virtual Environments, Parallel, Distributed and Intelligent Computer Systems, Complex and Multi-agent systems, Interdisciplinarity and Sustainability.

Abstract:

The potential of blockchain technology in advancing the Sustainable Development Goals (SDGs) is well acknowledged while tokenisation is viewed as the key technology to promote and power ESG, impact investment and sustainable finance. Ironically, however, blockchain technology faces a sustainability challenge itself due mainly to the energy requirements of this technology. In addition, blockchain systems are challenged by the so-called Trilemma tradeoff: decentralization, scalability, and security. Infrastructure and node configuration, choice of the

consensus protocol, and complexity of the application transactions are some of the factors that affect both the performance and energy footprint of blockchain systems. Given that blockchains are complex, dynamic systems, a dynamic approach to their management and reconfiguration at runtime is thus deemed necessary. The talk will put forward the idea of utilising Digital Twins as an effective strategy for the dynamic management of blockchain systems, highlighting both the benefits and challenges of this approach.

Time: *9:35am-10:15am, October 21st, U.S. Eastern Daylight Time*

Title: *Harnessing AI to Transform Cancer Research and Treatment*

Tobiloba Oni

Organization|Position: *Whitehead Institude|Professor*

Profile:

Dr. Tobiloba Oni completed his undergraduate studies in Biology at the State University of New York (SUNY) in Plattsburgh. He earned his PhD in Cell and Molecular Biology from Stony Brook University in 2020. Under the guidance of David Tuveson at Cold Spring Harbor Laboratory (CSHL), Dr. Oni's doctoral research centered on developing antibody-based tools for early detection of pancreatic cancer and identifying the mechanisms that drive malignant progression. In 2021, he was appointed a Fellow at Whitehead Institute, and he simultaneously joined the Koch Institute at MIT as an extramural member. His laboratory takes a multifaceted approach to comprehend and manipulate cellular interactions in cancer. Specifically, the Oni lab focuses on pancreatic cancer with a mission to delineate the fundamental interactions between tumor cells and their microenvironment, and to

leverage principles of these interactions to detect and treat this lethal disease. Beyond his research, Dr. Oni seeks to inspire and mentor the next generation of scientists from diverse backgrounds, and build collaborative networks across disciplines to solve some of the most challenging biological questions.

Abstract:

Advances in Artificial intelligence (AI) are set to revolutionize cancer research and treatment, offering unprecedented opportunities to accelerate discoveries and improve patient outcomes. In this talk, I will discuss our work in pancreatic cancer, a highly lethal disease. I will use this as a launching point to explore key areas in which AI can transform our understanding of cancer biology, early diagnosis, and personalized therapies. By integrating complex datasets, AI can identify novel biomarkers, predict treatment responses, and optimize drug development.

Time: *10:15am-10:55am, October 21st, U.S. Eastern Daylight Time*

Title: Business and The Environment; Marketing of Sustainability

Jennifer LYNES

Organization|Position: *University of Waterloo|Professor*

Professor, Center Director, and Associate dean, E.J. Bloustein School of Planning and Public Policy, Rutgers University

Profile:

Associate professor at University of Waterloo

Program Director Environment and Business Undergraduate Program

Chair of the non-profit organization Residential Energy Efficiency Program (REEP Green Solutions)

Co-founder of the North American Sustainable Concerts Working Group
Program Co-director of Sustainability and Financial Management (SFM) at the University of Waterloo

Abstract:

Investigating the marketing of sustainability, social and community-based green marketing, residential energy conservation behaviour and engaging youth in environmental issues.

Morning Plenery-2:

Host by Viksit Kumar (Novateur)

Time: *11:00am-11:40am, October 21st, U.S. Eastern Daylight Time*

Title: *Service Recommendation based on Graph Reasoning*

Yushun Fan

Organization|Position: *Tsinghua University|Professor*

Profile:

He received the M.S. and Ph.D. degrees from Tsinghua University, Beijing, China, in 1987 and 1990. He is currently tenure Professor of Tsinghua University, Deputy Director of National CIMS Engineering Research Center of China, Director of Modern Service Technology and Engineering Research Center. He is also guest Professor of Shanghai Jiaotong University, Université Paris DAUPHINE – PSL. He is the editorial member of the International Journal of Computer Integrated Manufacturing, Journal of Computer, Aeronautical Manufacturing, Information and Control. He is a member of the IFAC Advanced Manufacturing Technology Committee. From 1993 to 2004, he has worked as expert in the Field of Computer Integrated Manufacturing Systems of the China High technology R & D Program. He served on the Program Committees of many International conferences. He authored 14 books and published more than 540 papers in journals and conferences. His research interest includes Artificial Intelligence, Big Data, modern service science and technology, enterprise modeling methods, workflow management, system integration and integrated platform.

Abstract:

Service recommendation systems are vital for providing personalized services, adapting to users' dynamic preferences and alleviating information overload. Most existing recommendation methods rely on user-service interaction graphs to model complex relationships, where graph reasoning plays a crucial role. Graph reasoning enhances recommendation performance by capturing intricate connections among users, services, and their attributes, enabling more accurate, dynamic, and zero-shot recommendations.

In this context, a framework is proposed that utilizes graph structures to model historical mashup interactions, enabling time-aware service recommendations. By introducing cross-view graph alignment, the representation of users and mashups are further enhanced by aligning collaborative associations across different graph views, capturing more nuanced user behaviors.

Building on insights from graph structures, the Reciprocal Dual-Channel Network (RDCN) is put forward to focus on users' preferences for service categories. The RDCN leverages graph-based co-occurrence information to jointly model both interest and category preferences. This approach addresses the intertwined relationship between services and categories, allowing for a more precise reflection of users' dynamic preferences.

Next, to address challenges such as data sparsity and uncertainty in graph-based recommendation systems. The Neighborhood-Augmented Graph Attention Network (NA-GAT) enhances graph reasoning by identifying potential neighbors for each item node through attention mechanisms. This model strengthens the connection between sparse interactions and increases the utilization of graph structures for more robust item recommendations.

Finally, graph reasoning is extended into Large Language Models (LLMs) with the Graph Reasoning LLM Ranker (G-LLMRanker). By constructing semantic trees enriched with higher-order graph information, this framework integrates complex user-item relationships into LLMs, allowing for accurate recommendations in zero-shot scenarios. By integrating graph reasoning across these approaches, service recommendation systems are significantly improved in their ability to capture

complex relationships, thereby enhancing recommendation accuracy and adaptability to dynamic user preferences.

Time: *11:40pm-12:20pm, October 21st, U.S. Eastern Daylight Time*

Title: *Towards Resilient Internet-of-Things over Wireless Networks via Federated Learning*

Dinh Nguyen

Organization|Position: *The University of Alabama in Huntsville|Professor*

Profile:

Dinh Nguyen is an assistant professor at the Department of Electrical and Computer Engineering, The University of Alabama in Huntsville (UAH). He worked as a postdoctoral research associate at Purdue University from 2022 to 2023. He obtained the Ph.D. degree in computer science from Deakin University, Australia in 2021. He is leading the Networking, Intelligence, and Security (NIS) group at UAH, focusing on the intersection of secure wireless networking and distributed learning. He has published over 50 papers on IEEE/ACM conferences and journals in the field. He is an Editor of the IEEE Internet of Things Journal, IEEE Open Journal of the Communications Society, and ACM Computing Surveys Journal. He is a technical program chair of the 6G connectivity workshop at the IEEE Wireless Communications and Networking Conference (WCNC) 2024 conference.He received the Best Editor Award from IEEE Open Journal of Communications Society in 2023.

Abstract:

The wireless Internet-of-Things (IoT) is becoming increasingly prevalent in various aspects of our daily lives, thanks to the growing number of intelligent services and

applications driven by artificial intelligence (AI). Traditionally, AI techniques require centralized IoT data collection and processing that may not be feasible in realistic application scenarios due to the high scalability of modern IoT networks and growing data privacy concerns. Federated Learning (FL) has emerged as a distributed collaborative AI approach that can enable resilient IoT applications, by allowing for AI training at distributed IoT devices without the need for data sharing. In this talk, we will introduce the FL concept and its enabling technologies for FL over wireless IoT networks. In particular, we will present the state-of-the-art of FL with recent advances, key services and applications in wireless IoT networks. The importance of FL to current IoT ecosystems will be explored, focusing on its role in safeguarding data privacy, improving AI model training, and conserving network communication resources. The fundamental impacts of wireless communications on the performance of FL in IoT networks will be also investigated. Two case studies on the applications of FL in wireless IoT systems will be given, including FL for safe health data analytics and FL for satellite networks. Finally, we will point out several promising directions for future research in this booming area.

Time: *12:20pm-13:00pm, October 21st, U.S. Eastern Daylight Time*

Title: *The Role of AI in Social Relationships*

Jina Huh-Yoo

Organization|Position: *The University of Alabama in Huntsville|Professor*

Profile:

Dr. Huh-Yoo is an associate professor of Computer Science at the Charles V. Schaefer, Jr. School of Engineering and Science Stevens Institute of Technology where she

leads the Health and Happiness Design Lab. Previously, she held faculty positions at the College of Computing and Informatics at Drexel University, the University of California San Diego School of Medicine, and the College of Communication Arts and Sciences at Michigan State University. As PI, she have been awarded career grants as well as research grants from the National Institutes of Health and the National Science Foundation. She received her PhD from the University of Michigan Ann Arbor School of Information and a Master in HCI at Human-Computer Interaction Institute at Carnegie Mellon University School of Computer Science. She is interested in how technological innovation can support people's everyday health as well as serious illnesses. She is interested in how emerging technologies can maintain or further foster, and not hinder, social connections.

Abstract:

The human brain governs cognitive processes and behavior. It is the most complex organ in nature, composed of 100 billion neurons within the gray matter. Each neuron functions as a computational unit. These neurons are interconnected either through fibers in the white matter, through information coupling, or by neurotransmitter modulation. This intricate organization forms vast multi-modal, multi-state, multi-level, multi-scale neural networks, or "super networks," that perform distributed computations and dynamically evolve along temporal and spatial dimensions. These networks support human cognitive processes. State-of-the-art study of such networks may uncover how the brain works, providing great theoretical and practical value of profound significance.

This study is multidisciplinary and multilevel, operating in a positive feedback manner. To accurately study the human brain, we need to master and continually improve the most advanced multidisciplinary theories and algorithms, such as neuroscience, brain imaging, computational algorithms, and machine learning. This includes the development of revolutionary new theories and algorithms. Conversely, we can apply what we have learned from studying the human brain to improve human-made networks such as deep learning networks, making these networks or AI-based techniques more self-developed and intelligent. This talk will introduce the

background of these topics, the state-of-the-art brain imaging techniques, including multimodal magnetic resonance imaging (MRI) and deep learning, and their applications in revealing neural circuits that underlie human cognitive processes and mental disorders.

The goal of psychiatry research is to gain a better understanding of the common and distinct neural mechanisms underlying psychiatric disorders, such as depression and schizophrenia. This knowledge could enable the delivery of more effective, person-tailored treatments. To this end, it appears that the analysis of experimental samples using conventional statistical approaches has largely failed to capture the heterogeneity underlying psychiatric phenotypes. Cutting-edge algorithms and approaches from machine learning, particularly deep learning, provide new tools to address these issues given their outstanding predictive performance in other disciplines. The strength of deep learning algorithms lies in their ability to implement very complicated, and theoretically arbitrary, predictor-response mappings efficiently. We have applied state-of-the-art deep learning algorithms to brain imaging datasets acquired from participants with and without various types of psychiatric disorders, in order to classify these disorders and predict risk of developing these disorders. We will present some of these works in this talk.

Afternoon Plenery-3:

Host by Viksit Kumar (Novateur)

Time: *13:20pm-14:00pm, October 21st, U.S. Eastern Daylight Time*

Title: *Artificial General Intelligence*

Julian Togelius

Organization|Position: *NYU Tandon|Professor*

Profile:

Julian Togelius is an Associate Professor in the Department of Computer Science and Engineering, New York University, and a co-founder of modl.ai. He works on artificial intelligence for games and on games for artificial intelligence. His current main research directions involve procedural content generation in games, general video game playing, player modeling, and fair and relevant benchmarking of AI through game-based competitions. Additionally, he works on topics in evolutionary computation, quality-diversity algorithms, and reinforcement learning. From 2018 to 2021, he was the Editor-in-Chief of the IEEE Transactions on Games. Togelius holds a BA from Lund University, an MSc from the University of Sussex, and a PhD from the University of Essex. He has previously worked at IDSIA in Lugano and at the IT University of Copenhagen. His most recent book, "Artificial General Intelligence", is out now from MIT Press in the Essential Knowledge Series.

Abstract:

Artificial intelligence surrounds us. More and more of the systems and services you interact with every day are based on AI technology. Although some very recent AI systems are generalists to a degree, most AI is narrowly specific; that is, it can only

do a single thing, in a single context. For example, your spellchecker can't do mathematics,
and the world's best chess-playing program can't play Tetris. Human intelligence is different. We can solve a variety of tasks, including those we have not seen before. In this talk, I ask what general artificial intelligence means and what its existence could mean for human civilization. I start by giving examples of narrow AI that have superhuman performance in some way. Interestingly, there have been AI systems
that are superhuman in some sense for more than half a century. I then discuss what it would mean to have general intelligence, by looking at definitions from psychology, ethology, and computer science. I briefly discuss technical approaches to AGI, and then investigate potential artificial general intelligence beyond the strictly technical aspects,
in particular societal aspects.

Time: *14:00pm-14:40pm, October 21st, U.S. Eastern Daylight Time*

Title: *San Francisco's Transbay Area Planning: Vision, Finance and Systems Thinking for Large-Scale Urban Development*

Jose Campos

Organization|Position:

San Francisco Office of Community Investment and Infrastructure|Professor

Profile:

José Campos is the Manager of Planning and Design Review at the San Francisco Office of Community Investment and Infrastructure, with twenty years' experience in land use planning, community building, and urban redevelopment. His former

posts include Planning Division Manager at the San Francisco Redevelopment Agency and Director of Citywide Planning at the San Francisco Planning Department. Mr. Campos was the Secretary General of the Association of Mediterranean Cruise Ports. He holds a BA in Urban Studies and Planning from the University of California at San Diego and, as a National Urban Fellow, an MPA from Baruch College, City University of New York.

Abstract:

Mr. Campos will present a case-study of a project he led, the planning of the Transbay Redevelopment Project, which resulted in a 30-year, large-scale redevelopment program currently underway and transforming a portion of downtown San Francisco. Using a "systems-thinking" approach and a win-win-win strategy, city planners and community members developed the vision, the methods of financing, and the implementation tools to attract and channel billions of dollars in investment to reshape the city's skyline, to provide thousands of units of affordable housing, and to realize the largest public transportation infrastructure currently underway in the city.

Time: *14:40pm-15:20pm, October 21st, U.S. Eastern Daylight Time*

Title: *Generative AI: Balancing Innovation and Responsibility*

Sara Abdali

Organization|Position:*Microsoft Researchr|Professor*

Profile:

I am a Senior Researcher at Applied Sciences Group (ASG) working on a variety of NLP and multimodal tasks including customization and distillation of Microsoft

Turing LLMs for downstream tasks, multitask architectures, multimodal generative models, causal inferencing and more recently multimodal conversational agents. Before joining Microsoft, I was a postdoctoral CIFellow at Georgia Tech, working on my
NSF funded project, “Adversarially robust multimodal misinformation detection. I earned
my Ph.D. from the University of California, Riverside, where I mainly worked on misinformation detection leveraging multilinear (tensor) algebra along with a variety of
NLP and vision techniques. I also worked on Deepfake video detection and development of text augmentation techniques in few-shot settings. I have interned at Lenovo Research and Microsoft in Fall 2020 and Summer 2021 accordingly.

Abstract:
Generative AI has unlocked remarkable innovation, but with it comes the crucial task of balancing ethical considerations. Deepfakes, which manipulate videos and audio to create false but realistic content, pose significant challenges in trust and authenticity. Text generated by models like GPT can spread misinformation or produce biased results if not carefully managed. Image caption discordance, where AI-generated captions don't accurately reflect the visual content, further complicates the landscape. Ensuring responsible AI practices is essential, focusing on transparency, accuracy, and the mitigation of potential misuse.

Time: *15:20pm-16:00pm, October 21st, U.S. Eastern Daylight Time*

Title: *AI and Sociotechnical Transformation*

Francisco Bozzano Barnes

Organization|Position:*Center for Media & Peace Initiative|Professor*

Profile:

Francisco Bozzano-Barnes is an independent researcher on and promoter of Sustainable Eco Development, focused on Ecological Economics, Urban ecology, the Urban-Rural Continuum, Education and Communications. He researched at McGill University on Communication Systems for Agricultural Transitions (unfinished), received a Masters in Environmental Studies from York University with an Area of Concentration on A New Perspective for International Development. His research and promotional interests have spanned from local to regional to international phenomena, in his field. He has worked on water and the Doñana Spanish National Park, the urban footprint of Madrid, Spain, the location of a petroleum refinery in Badajoz, Spain, the design and promotion of a Mediterranean Development Bank, municipal, regional environmental concerns of the city of Xalapa, Veracruz, Mexico, settlement patterns in the Peel Region, Ontario, Canada, organic agriculture in Canada, and energy and water/energy co-generation in the Canary Islands in Spain. He also participated in the organization of conferences on energy and green cities in Toronto, Canada, and on Sustainable Development Aid and Trade in Madrid, Spain in cooperation with Canadian Organic Growers.

He organised the Panel Discussion on Urban Ecology and Land Tenure, a side-event of the Conference on the World Financial and Economic Crisis and Its Impact on Development, on June 24, 2009 at the NY United Nations Headquarters, with the NGO Committee on Human Settlements in partnership with UN-HABITAT, and spoke on Restoration of Urban Harmony. He published with a team From Frontier to Mainstream: Sustainable Agriculture in Canada (Agriculture Canada), Visión

Mediterránea (proposal for the creation of the Mediterranean Development Bank), and New Paradigms, Practices and Precursors; From the Misiones Pedagógicas (MP) of the Spanish Second Republic (SSR) to AI Democracy (October 2018), published by IEEE.

Abstract:

This lecture Lecture will be a philosophical discussion on the potential sociotechnical transformations that could emerge with a widespread implementation of AI. Introducing its ecological, social and ethical dilemmas. This holistic vision will be related to indigenous approaches and their sophisticated knowledge of their natural habitats.

Sociotechnical systems will be understood as being inter-related, open and participatory or strategic or functional in nature organizations, requiring different management approaches (opening, positioning and maintaining respectively). We will endeavor to relate theory to practice. Briefly exploring and suggesting relevant case settings. Encouraging audience participation.

The idea is to look at the present sociotechnical changes from as many angles as possible, moving from indeterminate unknown, unpredictable, incalculable to the determinate, calculable, predictable, known phenomenons.

The main theme to be discussed will be the development, deployment, regulation and the legislation of AI IN THE EU.

Afternoon Plenery-4:

Host by Lin Zhang (University of Buffalo)

Time: *16:05pm-16:45pm, October 21st, U.S. Eastern Daylight Time*

Title: *How Human Artificial Intelligence Can Foster Sustainable Future*

Agnis Stibe

Organization|Position: *RMIT University Vienam|Professor*

Profile:

Agnis Stibe is a world-renowned expert on social engineering, transformative technologies, and sustainable urban development. He is an Associate Head of the Business Innovation Department at The Business School of RMIT University Vietnam, an Extraordinary Professor of Artificial Intelligence for Society 5.0 at the University of Pretoria, and an Adjunct Professor of Human-City Interaction at the University of Oulu. He established research on Persuasive Cities at the prestigious Massachusetts Institute of Technology (MIT Media Lab). With a background in academia and industry, Prof. Stibe has been at the forefront of integrating artificial intelligence with behavioral science to drive large-scale societal transformations. As a sought-after speaker at international conferences, Agnis shares his vision of harnessing technology to create healthier, more resilient, and sustainable communities. His work, which emphasizes the importance of blending human-centered design with cutting-edge AI, not only adapts to the needs of its inhabitants but also inspires lasting behavioral change toward sustainability.

Abstract:

In the rapidly evolving technological landscape, the fusion of artificial intelligence (AI) with human nature presents a unique opportunity to address global

sustainability challenges. This keynote explores the transformative potential of human artificial intelligence designed to enhance human performance, foster evolution, and drive sustainable outcomes across industries and societies. It combines the cognitive skills and intuition of humans with the data processing and analytical strengths of AI. This interdisciplinary approach enhances decision-making, innovation, and problem-solving in entrepreneurial environments and broader societal contexts. By leveraging the unique strengths of both human and artificial intelligence, the goal is to achieve hyper-performance—markedly superior results in efficiency, productivity, and creativity. The keynote focuses on how these human-AI synergies can accelerate sustainable development goals (SDGs), improve resource management, and innovate solutions for climate action, clean energy, and sustainable urbanization. It shares insights into how this collaboration between human intuition and AI advances can transform businesses, address societal challenges, and realize human potential, ultimately contributing to a more resilient, productive, and sustainable future.

Time: *16:45pm-17:25pm, October 21st, U.S. Eastern Daylight Time*

Title: *Design For Sustainable in the Paradigm of Digital and Natural Civilization*

Jingyan Qin

Organization|Position: *University of Science and Technology Beijing |Professor*

Profile:

Professor Dr. QIN Jingyan is the Vice Dean of the School of Intelligent Science and Technology and the Director of the Science and Technology Art Education Center, University of Science & Technology Beijing(USTB). She obtained the

interdisciplinary PhD in Information Design of computer science, design and journalism communication from Tsinghua University and is responsible for three national first-class undergraduate courses, including "Artificial Intelligence and Innovation Design". Dr. QIN has published over 170 papers, 12 books and 15 patents. She is the deputy editor in chief of the Information Interaction Design Branch of the Encyclopedia of China. Dr. QIN presided over 50 projects which include artificial intelligence for innovation, big data visual analytics for material DNA, big data user study for Psychometrics, autonomous vehicle and robot interaction design, Design For Sustainability, digital culture heritage and culture industry for Ministry of Science of China, and more than 70 awards have been won. She has been invited to give over 100 speeches and reports at the APEC Global Youth Innovators Conference, UNESCO Creative Cities Beijing Summit, United Nations Conference on Sustainable Development, HCII International Human Computer Interaction Conference, the First World MOOC Conference, Harvard Education Forum, and other events.

Professor Qin Jingyan has cultivated thousands of outstanding talents in artificial intelligence, innovation design and human-computer interaction design, proposed quantum innovation thinking and meaning centered design methods, CMR+FBS design ontology, reviewed the 17 sustainable development goals proposed by the United Nations, proposed new 17 sustainable development goals, guided the green IT sustainable design of big data+Internet of Everything+artificial intelligence metaverse, deeply integrated China's eight aesthetic consciousness with the scientific and aesthetic of intelligent design, and proposed a new evaluation standard system for sustainable design. It has an important impact on promoting the integration of artificial intelligence with innovation design, industrial design, information design, and cultural and creative industries. Its research provides new perspectives and methods for sustainable design and digital cultural heritage protection. She has also held important positions in multiple academic organizations and professional associations both domestically and internationally, making outstanding contributions to the development of the design methodology and interdisciplinary innovation.

Abstract:

The report proposes that with the emergence of GPT LLM large language model, metaverse virtual reality, and DAO Decentralized Autonomy Organization approach, digital ecological civilization has been formed in a decentralized and accelerated manner. AI has revolutionized production tools, production methods, productivity, and production relations to form creative quality driven productive dynamic new quality productivity. At the same time, it also faces the problem of symbiotic game relationship and sustainable development between digital and natural ecological civilization caused by AI Hallucinations. The construction of a new human-machine social contract relationship in digital ecological civilization has formed a new civilization law. Designers plan the world by envisioning the future, using AI scientists, AI writers, AI artists AI biologists are the foundation of meta design, achieving the integration of AI artificial intelligence and HI human intelligence through the 8 innovation missions of natural and digital ecological civilization. Intelligence is based on high information dimension, high qualia, high aesthetics, high interaction, and high value, and EIOFS early indicators of future success are used as design evaluation. From the perspective of sustainable development of technological aesthetics and technological ethics, the three body meta (source, original) universe is evaluated for the ecological cycle sustainable development of ecological civilization. A meaning centered design method, SSPSS sustainable smart product and service ecosystem is constructed to guide various types of meta design methods. CMR+FBS design ontology is used, quantum thinking vision is guided, and meaning centered meta design is carried out. Through the new 17 sustainable development goals, we follow The general principle of artificial intelligence loving human intelligence is to create reality (virtual) for real (virtual) people. Our motivation and mission is to achieve the significance of human survival and realize the design value of sustainable development of ecological civilization.

Time: *17:25pm-18:05pm, October 21st, U.S. Eastern Daylight Time*

Title: *Earth Observation and Digital Transformation: an Outlook From Infrastructure Engineering*

Jagannath Aryal

Organization|Position: *University of Melboume|Professor*

Profile:

Abstract:

The emphasis on the spread of infectious diseases has been underscored by COVID-19. Public transportation, being a prevalent means of travel, becomes an important subject for studying the transmission of infectious diseases. However, there have been no studies comparing the transmission of these diseases across different public transportation routes. This paper examines the propagation of infectious diseases based on the quantity of public vehicles and their direction of travel within a given system.

A simulation model is constructed to analyze different scenarios, thereby addressing the above-stated problem efficiently. We subsequently propose a function known as the Weighted Integral of Passenger Close Contacts (WIPCC) to assess the spread of infectious diseases. The WIPCC function takes into account the number of cumulative passengers on every bus on the route at any given time.

Our analysis reveals that having a greater number of buses on a loop can significantly decrease transmission. We deduce that the transmission of infectious diseases is directly related to the efficiency of any public transportation system. If buses are not all traveling in the same direction, the WIPCC function will yield a higher value than that of a loop where all buses travel in the same direction.

Through some cost-effective changes, the spread of infectious diseases can be mitigated. We anticipate alterations in public transportation routes as required to minimize disease transmission. We believe that these findings will prove beneficial to city planners overseeing public transportation systems.

TECHNICAL PROGRAM

Session [TS1-A] [TS1-B]: Vision for Universal Village & Development Status of Universal Village

Time: 08:00am - 10:20am, October 28th, U.S. Eastern Daylight Time
Meeting Room (Microsoft Teams): [TS1-A,1-B] IEEE UV2024 Session
Chair(s): Yifan Yu (Tongji University)
Assistant(s): Zhongyu Liu

Meet Our Speakers

Session Overview: Compact cities that are friendly to people and the environment have been proposed as one urban model for realizing a sustainable society. On the other hand, the concept of smart city with using "Information and Communication Technology (ICT)" have been emerged and may influence the opposite effect to the compact city which promote smart shrinking from sprawling suburban development.

- **Agenda [EDT]**
  1. **[08:00am-08:10am][Oct.28][TS1-A&1-B][K-1]** ***Yifan Yu,*** *Session Chair*; Opening and Speech
  2. **[08:10am-08:30am][Oct.28][TS1-A&1-B][K-2]** ***Kun Liu*****,** *Invited Speaker*; Exploring the positive effects of high-density built environment on children's growing up
  3. **[08:30am-08:50am][Oct.28][TS1-A&1-B][K-3]** ***Youyang Zhao,*** *Invited Speaker;* Chinese old railway stations and surrounding areas renewal strategy——for Beijing Zhangjiakou railway site park
  4. **[08:50am-09:10am][Oct.28][TS1-A&1-B][K-4]** ***Jiawen Wang,*** *Invited Speaker;* Towards the ALL-Age-Friendly Cities: Research on City Public Social Welfare Facilities Planning Standards of Chinese in New Era
  5. **[09:10am-09:30am][Oct.28][TS1-A&1-B][K-5]** ***Qinglai Zhang,*** *Invited Speaker;* Dose-Response Relationships Between Built Environment Exposure and Active Travel Behavior For Older Adults
  6. **[09:30am-09:40am][Oct.28][NR-TS1-A-1][6010]** ***Jiawen Wang, Siyuan Wang, Jiyuan Hu, Panpan Zhang, Jianlong Wang, Hao Mu and Yifan Yu,*** *Author,* Research on Urban Public Social Welfare Facilities Planning Standards in New Era: Towards the All-Age-Friendly Society
  7. **[09:40am-10:00am][Oct.28][NR-TS1-B-1][4969]** ***Yiran Li, Kun Liu, Yue Zhou, Ying Zhao and Wenna Luo,*** *Author,* Connecting Nearby Nature: Spatial Practices and Pro-nature Performance of Children's Community Nature-Friendly Workshop
  8. **[10:00am-10:10am][Oct.28][NR-TS1-B-2][1076]** ***Yifan Yu and Ying Jin,*** *Author,* Aging Challenges and Cities Countermeasures in China
  9. **[10:10am-10:20am][Oct.28][NR-TS1-B-3][7608]** ***Xinran Li and Yajun Wen,*** *Author,* Participatory Research on the Color Environment of Waterfront Public Spaces from a Child's Perspective: A Case Study of the Yangpu Riverside in Shanghai

[TS1-A&1-B][K-1] Opening and Speech

Time: 08:00am-08:10am, October 28th, U.S. Eastern Daylight Time
***Invited Speaker(s)*: Yifan Yu,** *Session Chair*

[TS1-A&1-B][K-2] Exploring the positive effects of high-density built environment on children's growing up

Time: 08:10am-08:30am, October 28th, U.S. Eastern Daylight Time
***Invited Speaker(s)*: Kun Liu**

[TS1-A&1-B][K-3] Chinese old railway stations and surrounding areas renewal strategy——for Beijing Zhangjiakou railway site park

Time: 08:30am-08:50am, October 28th, U.S. Eastern Daylight Time
***Invited Speaker(s)*: Youyang Zhao**

[TS1-A&1-B][K-4] Towards the ALL-Age-Friendly Cities: Research on City Public Social Welfare Facilities Planning Standards of Chinese in New Era

Time: 08:50am-09:10am, October 28th, U.S. Eastern Daylight Time
***Invited Speaker(s)*: Jiawen Wang**

[TS1-A&1-B][K-5] Dose-Response Relationships Between Built Environment Exposure and Active Travel Behavior For Older Adults

Time: 09:10am-09:30am, October 28th, U.S. Eastern Daylight Time
***Invited Speaker(s)*: Qinglai Zhang**

[NR-TS1-A-1][6010] Research on Urban Public Social Welfare Facilities Planning Standards in New Era: Towards the All-Age-Friendly Society

Time: 09:30am-09:40am, October 28th, U.S. Eastern Daylight Time
***Invited Speaker(s)*: Yifan Yu**

Author(s): **Jiawen Wang, Siyuan Wang, Jiyuan Hu, Panpan Zhang, Jianlong**

Wang, Hao Mu and Yifan Yu

Abstract: The "Outline of the 14th Five-Year Plan for National Economic and Social Development and Vision 2035 of the People's Republic of China" has put forward new development goals for China's social welfare facility system. The current urban public social welfare facilities and the planning standards have been unable to meet the needs of new social development goals. Based on the current state of social welfare development in China, this study analyzes the primary issues present in the urban public social welfare facility system targeting "the elderly, children, and the disabled." Amidst the "rapidly increasing demand" and "severely inadequate supply" in urban spaces, the research employs planning models and empirical data analysis to identify a balance point for standard formulation between supply and demand. It proposes an overall revision for the planning standards in national level and provides optimization suggestions, such as system improvement, grading optimization, index revision, site selection, etc.

Keywords—urban public social welfare facilities, planning standards of national level, the elderly, children, the disabled.

[NR-TS1-B-1][4969] Connecting Nearby Nature: Spatial Practices and Pro-nature Performance of Children's Community Nature-Friendly Workshop

Time: 09:40am-10:00am, October 28th, U.S. Eastern Daylight Time
***Invited Speaker(s)*: Kun Liu**

Author(s): **Yiran Li, Kun Liu, Yue Zhou, Ying Zhao and Wenna Luo**

Abstract: In the current urbanization process, children's connection with nature is becoming increasingly distant. To address this issue, many cities around the world advocate for increasing children's nature connection by nature education. However, researches in the field have largely focused on parks, with less emphasis on children's daily lives. This study selected communities in Shenzhen as case studies to explore the potential of community environments in nature education, involving 91 children across four representative communities. Through a series of practical activities, it deeply promoted children's interaction with the community natural environment and systematically collected data on children's participation, levels of nature connection, and subjective feedback. The environmental characteristics and the combination of suitable activities were verified as the core path to stimulating pro-nature performance through practical activities. Furthermore, this study constructs a "community environment-nature education-daily activities" framework. The framework uses the community's natural environment as the foundation, nature education as guidance, and daily pro-nature activities as practice. The positive role of community environmental features, such as rich natural elements in marginal spaces, concentrated natural elements in community parks, and

continuous natural elements along community pathways, in promoting children's pro-nature behaviors is particularly emphasized by the framework. The results of this study not only provide a scientific basis for optimizing the design of community natural environments and enhancing their nature education functions but also offer practical guidance and strategic support for conducting nature education practices at the community level.

Keywords—children, nature education, community environment,nature-friendly workshop, pro-nature performance.

[NR-TS1-B-2][1076] Aging Challenges and Cities Countermeasures in China

Time: 10:00am-10:10am, October 28th, U.S. Eastern Daylight Time
***Invited Speaker(s)*: Yifan Yu**

Author(s): **Yifan Yu and Ying Jin**

Abstract: China is aging rapidly, with more and more senior people living in cities in the future. People aged 60 years and above reached 310 million in 2024 and is likely to reach 487 million in 2050. However, city planning and construction, as well as infrastructure and service provision today is mainly designed without necessary consideration of the senior people in mind. They need to be adjusted to fit the changing lifestyle and needs of the elderly, so that they can age in place and enjoy good quality of life. In addition to policies on social security and pension reforms, senior health care and life-long education, policies targeting the physical environment and facilities for the aging society in cities are equally important and affect the day-to-day experience of the elderly. The study, funded by the Urban Research Department of the World Bank, aims to explore the key issues in face of population aging in China: a)urbanization challenges in China associated with aging, e.g. market failure or absence of institutional arrangement or lack of funding; b) possible options for addressing the issues, especially those that have not been considered by the government; and c) a few indicators to monitor progress and measure success.

Keywords—aging, age-friendly, urban planning, technology, China.

[NR-TS1-B-3][7608] Participatory Research on the Color Environment of Waterfront Public Spaces from a Child's Perspective: A Case Study of the Yangpu Riverside in Shanghai

Time: 10:10am-10:20am, October 28th, U.S. Eastern Daylight Time

Author(s): **Xinran Li and Yajun Wen**

Abstract: Children's perceptual and emotional needs are often marginalized in the planning of urban public spaces, resulting in color environments that are visually alienating, emotionally inadequate, and behaviorally disengaging for young users. Integrating children's participation into the planning and design of childfriendly color environments is not only a meaningful recognition of their subjectivity and rights, but also a critical pathway for enhancing the relevance and responsiveness of urban spaces to their developmental needs. This study addresses this challenge by investigating how children perceive, interpret, and respond to color in urban waterfront environments, taking the Yangpu Riverside in Shanghai as a case study. Employing Photovoice as a participatory research method and applying semantic analysis through ROST CM6, the study constructs data-driven perceptual models that map the relational pathways between children's visual perception, emotional responses, and spatial behaviors across both positive and negative color environments. The findings reveal that children are active interpreters of color cues, capable of forming nuanced aesthetic and emotional judgments. They show strong preferences for bright hues—particularly green, red, and blue—which they associate with positive feelings such as happiness, relaxation, and safety. These colors are typically present in natural settings and child-oriented recreational spaces, where they encourage outdoor activities including play, sports, and exploration. In contrast, environments dominated by lowlightness, low-chroma colors such as black, gray, and brown evoke negative emotions—fear, discomfort, and unease—and result in behavioral avoidance. Children are particularly sensitive to deteriorated color elements, such as rust, stains, and dark surfaces, which they describe as "dirty" or "scary," revealing a psychological defense mechanism against visually hostile environments. By uncovering the perceptual logic through which color environments influence children's emotional well-being and spatial behavior, this research offers both theoretical advancement and practical guidance for child-friendly urban design. It establishes a replicable methodological framework for integrating children's voices into planning processes and proposes actionable strategies for creating color environments that are perceptually inclusive, emotionally supportive, and developmentally appropriate. In doing so, the study contributes to the broader vision of human-centric, inclusive, and sustainable urban transformation promoted by the Universal Village framework.

Keywords—color environment, child participation, waterfront public space, photovoice.

Session [TS1-C]: Digital Analytics, Digital Transformations and UV index Evaluation

Time: 11:45am - 01:25pm, October 22nd ,Eastern Daylight Time
Meeting Room (Microsoft Teams): [TS1-C] IEEE UV2024 Session
Chair(s): Guoping Zhang (Nankai & Harvard Univ.)
Assistant(s): Zhongyu Liu

Meet Our Speakers

- **Agenda [EDT]**
  1. **[11:45am-11:50am][Oct.22][TS1-C][K-1]** ***Guoping Zhang***, *Session Chair*; **Opening and Speech**
  2. **[11:50am-12:20pm][Oct.22][TS1-C][K-2]** ***Gang Wu,*** *Invited Speaker*; Carbon-based economic Turning point Singularity: Sustainable Development of the AI Industry
  3. **[12:20pm-12:50pm][Oct.22][TS1-C][K-3]** ***Yajun Fang,*** *Invited Speaker*; Reflection of Human - AI Relationship and AI-Pervasive Society Transformation: Human-centricity, Explainable AI, and Intent & Behavior Understanding for Integration, Resilience, Inclusiveness and Sustainability
  4. **[12:50pm-01:25pm][Oct.22][TS1-C][K-4]** ***Zeyao Wang,*** *Invited Speaker;* International Comparison of Data Asset Development: Innovation Practices of Big Data and Artificial Intelligence

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  5. **[09:35pm-09:50pm][Oct.21][SF-TS1-C-1][5197]*Hongyang Hua,*** *Presenter*; Preliminary Study on Evaluation of Smart-Cities Technologies and Proposed UV Lifestyles
  6. **[09:50pm-10:05pm][Oct.21][SF-TS1-C-2][8970]** ***Beifeng Wang,*** *Presenter*; Preliminary Study on Evaluation of UV Smart Systems

[TS1-C][K-1] Opening and Speech

Time: 11:45am-11:50am, October 22nd, U.S. Eastern Daylight Time
***Invited Speaker(s)*: Guoping Zhang,** *Session Chair*

[TS1-C][K-2] Carbon-based economic Turning point Singularity: Sustainable Development of the AI Industry

Time: 11:50am-12:20pm, October 22nd, U.S. Eastern Daylight Time
***Invited Speaker(s)*: Gang Wu**

[TS1-C][K-3] Reflection of Human - AI Relationship and AI-Pervasive Society Transformation: Human-centricity, Explainable AI, and Intent & Behavior Understanding for Integration, Resilience, Inclusiveness and Sustainability

Time: 12:20pm-12:50pm, October 22nd, U.S. Eastern Daylight Time
***Invited Speaker(s)*: Yajun Fang**

[TS1-C][K-4] International Comparison of Data Asset Development: Innovation Practices of Big Data and Artificial Intelligence

Time: 12:50pm-01:25pm, October 22nd, U.S. Eastern Daylight Time
***Invited Speaker(s)*: Zeyao Wang**

[SF-TS1-C-1][5197] Preliminary Study on Evaluation of Smart-Cities Technologies and Proposed UV Lifestyles

Time: 09:35pm-09:50pm, October 21st, U.S. Eastern Daylight Time
Presenter(s): **Hongyang Hua**

[SF-TS1-C-2][8970] Preliminary Study on Evaluation of UV Smart Systems

Time: 09:50pm-10:05pm, October 21st, U.S. Eastern Daylight Time
Presenter(s): **Beifeng Wang**

Abstract: This study mainly summarizes the concept of each subsystem of UV and the related operation mode, and explains the characteristics of different subsystems and their relations with each other, and puts forward some suggestions for the operation of the system from an economic point of view.

Session [TS2-A]: Systematic and Integrated Frameworks for UV Subsystems and Contributing Factors

Time: 09:00pm - 11:55pm, October 18th, U.S. Eastern Daylight Time
Meeting Room (Microsoft Teams): [TS2-A]IEEE UV2024 Session
Chair(s): Xinwei Xu (AHUT, China) and Wei Zhao (AHUT, China)
Assistant(s): Zhenqian Huang, Zhongda Wang

Meet Our Speakers

Session Overview: Framework Design, Modeling, and System Integration in smart cities involves coordinating various sectors such as healthcare, urban planning, infrastructure, and energy management to enhance urban living. This approach integrates advanced technologies across different domains—like Smart Humanity initiatives, community-focused developments, healthcare innovations, and sustainable urban practices—to create interconnected, efficient, and sustainable urban environments. These systems work together to optimize city functions, improve residents' quality of life, and ensure environmental sustainability.

- **Agenda [EDT]**
  1. **[09:00pm-09:10pm][Oct.18][TS2-A][K-1]*Xinwei Xu and Wei Zhao***, *Session Chair*; **Opening and Speech**
  2. **[09:10pm-09:45pm][Oct.18][TS2-A][K-2] *William Ryan,*** *Invited Speaker*; Systematic Frameworks for UV Subsystems and Contributing Factors
  3. **[09:45pm-10:20pm][Oct.18][TS2-A][K-3] *Wei Zhao,*** *Invited Speaker;* Integrated Frameworks for UV Subsystems and Contributing Factors
  4. **[10:20pm-10:55pm][Oct.18][TS2-A][K-4] *Xun Shao,*** *Invited Speaker*; Distributed Smart Multihome Energy Management Based on Federated Deep Reinforcement Learning
  5. **[10:55pm-11:30pm][Oct.18][SI-TS2-A–1][3782] *Tangjie Weng, Wei Zhao, Xinwei Xu and Xun Shao***, *Author;* Application of Deep Reinforcement Learning in UAV Networks and Mobile Edge Computing
  6. **[11:30pm-11:55pm][Oct.18] Discussion and Feedback**

[TS2-A][K-1] Opening and Speech

Time: 09:00pm-09:10pm, October 18th, U.S. Eastern Daylight Time
***Invited Speaker(s)*: Xinwei Xu and Wei Zhao,** *Session Chair*

[TS2-A][K-2] Systematic Frameworks for UV Subsystems and Contributing Factors

Time: 09:10pm-09:45pm, October 18th, U.S. Eastern Daylight Time
***Invited Speaker(s)*: William Ryan**

[TS2-A][K-3] Integrated Frameworks for UV Subsystems and Contributing Factors

Time: 09:45pm-10:20pm, October 18th, U.S. Eastern Daylight Time
***Invited Speaker(s)*: Wei Zhao**

[TS2-A][K-4] Distributed Smart Multihome Energy Management Based on Federated Deep Reinforcement Learning

Time: 10:20pm-10:55pm, October 18th, U.S. Eastern Daylight Time
***Invited Speaker(s)*: Xun Shao**

[SI-TS2-A-1][3782] Application of Deep Reinforcement Learning in UAV Networks and Mobile Edge Computing

Time: 10:55pm-11:30pm, October 18th, U.S. Eastern Daylight Time
***Invited Speaker(s)*: Wei Zhao and Xun Shao**

Author(s): **Tangjie Weng, Wei Zhao, Xinwei Xu and Xun Shao**

Abstract: Deep reinforcement learning (DRL) has demonstrated significant potential in managing dynamic and complex networked systems. In this paper, we address the challenge of efficient task offloading and energy-aware trajectory planning in unmanned aerial vehicle (UAV) networks within mobile edge computing (MEC) environments, where limited resources and real-time demands pose critical constraints. We propose a DRLbased optimization framework that leverages the proximal policy optimization (PPO) algorithm to jointly optimize task scheduling and UAV trajectory control, with the goal of minimizing system latency and energy consumption. Our approach integrates adaptive resource allocation with fight-aware decision-making to enhance both responsiveness and operational stability. Extensive simulation results validate the effectiveness of our method, demonstrating improved convergence speed, battery performance, and energy efficiency compared to baseline approaches. These findings further confirm that dynamic UAV networks can substantially benefit from the stability and adaptability offered by PPO, enabling robust task scheduling and trajectory control under resource constraints.

Keywords—deep reinforcement learning, UAV networks, mobile edge computing.

Session [TS2-B]: Intelligent Modeling, Simulation, and System Analysis

Time: 09:00am - 11:50am, October 20th, U.S. Eastern Daylight Time
Meeting Room (Microsoft Teams): [TS2-A]IEEE UV2024 Session
Chair(s): Lin Zhang (Beihang Univ.) and Chun Zhao (Beijing Information Science and Technology University)
Assistant(s): Zhongda Wang, Charles Zhang

Meet Our Speakers

Session Overview: The applied range of Modeling and Simulation (M&S) covers almost all aspects of the economy, society, and military, especially for key fields concerning national strength and national security. For complex systems or some special fields, M&S technology can play its unique role, sometimes even becoming the only means. At present, M&S plays an extremely important role in the smart manufacturing field. By integrating with information technology, manufacturing systems are gradually developed to be digitized, networked, collaborative, personalized, service-oriented, and intelligent. This session will introduce the key technology of the M&S and smart manufacturing involves current status and hot issues, and future development trends.

- **Agenda [EDT]**

1. **[09:00am-09:05am][Oct.20][TS2-B][K-1]** ***Lin Zhang and Chun Zhao*** **,** *Session Chairs;* **Opening and Speech**
2. **[09:05am-09:45am][Oct.20][TS2-B][K-2]** ***Qinglei Ji,*** *Invited Speaker*; Modeling, Simulation, and Control of a Soft Quadruped Robot
3. **[09:45am-10:25am][Oct.20][TS2-B][K-3]** ***Qiang Tong,*** *Invited Speaker*; Modeling and Application of Trajectories for Various Targets
4. **[10:30am-10:50am][Oct.20][SI-TS2-B-1][0656]** ***Jun Jiang, Longfei Zhou, Maojie Fu, Qining Shi, Yi Zhang, Yihao Chen and Xiuwen Xu,*** *Author*; PPO-based Dynamic Flexible Job-Shop Scheduling
5. **[10:50am-11:10am][Oct.20][TS2-B-2][1584]** ***Yijing Fan, Chun Zhao, Heming Zhang and Ning Li***, *Author,* A Brain-Inspired Spiking Neural Network Model for Decision-Making in Reinforcement Learning: Intelligent Self-Balancing Control
6. **[11:10am-11:30am][Oct.20][TS2-B-3][0459]** ***Wenqiao Li, Qiang Tong, Na Yan, Tianyu Wu and Xiulei Liu,*** *Author,* Task-Aware Generative Score: A New Metric for Generated Images in Object Detection Task
7. **[11:30am-11:50am][Oct.20][TS2-B-4][1185]** ***Zhen Chen, Yuteng Zhang, Zhuoyi Wu, Chun Zhao and Lin Zhang,*** *Author,* Enhanced-MBSE: Integrated and Intelligent Model-Based Systems Engineering

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8. **[08:00am-08:15am][Oct.19][SF-TS2-B-1][3256]:** ***Yue Zhong, Ling Chen and Zexiang Chen,*** *Author;* Research and Development of Digital Twin System for Deep In-situ Fidelity Coring

[TS2-B][K-1] Opening and Speech

Time: 09:00am-09:05am, October 20th, U.S. Eastern Daylight Time
***Invited Speaker(s)*: Lin Zhang and Chun Zhao,** *Session Chairs*

[TS2-B][K-2] Modeling, Simulation, and Control of a Soft Quadruped Robot

Time: 09:05am-09:45am, October 20th, U.S. Eastern Daylight Time
***Invited Speaker(s)*: Qinglei Ji**

[TS2-B][K-3] Modeling and Application of Trajectories for Various Targets

Time: 09:45am-10:25am, October 20th, U.S. Eastern Daylight Time
***Invited Speaker(s)*: Qiang Tong**

[SI-TS2-B-1][0656] PPO-based Dynamic Flexible Job-Shop Scheduling

Time: 10:30am-10:50am, October 20th, U.S. Eastern Daylight Time

Author(s): **Jun Jiang, Longfei Zhou, Maojie Fu, Qining Shi, Yi Zhang, Yihao Chen and Xiuwen Xu**

Abstract: With the development of artificial intelligence technologies, intelligent production management systems greatly enhance the competitiveness of an organization or supply chain when facing challenges such as flexibility, dynamic operations, multi-threading and complex rules. However, meta-heuristic algorithms often perform poorly when dealing with dynamic job shop scheduling problems. In this context, we employ an improved Proximal Policy Optimization (PPO) algorithm to solve complex dynamic flexible job shop scheduling problems and compare it with IMPROVED FCFS and Dynamic SPT. On this basis, we perform static global optimization for the same tasks, i.e., in the elimination of dynamic arrivals, all the task data are provided, and the global optimization is performed using a genetic algorithm to obtain the theoretically optimal scheduling plan. Although the PPO algorithm is prone to local optimality in large-scale task scheduling, its total completion time is close to that of the genetic algorithm, and it outperforms the previous two methods in terms of overdue tasks, showing great potential for application. The results show that improved FCFS and Dynamic SPT, as relatively primitive methods, do not perform well, although they still have some problem solving ability. Deep reinforcement learning algorithms show promising applications in dynamic and flexible job shop scheduling problems due to their

ability to effectively handle complex events through learning.

Keywords—job shop scheduling, flexible job-shop scheduling, reinforcement learning, dynamic scheduling, real-time systems, manufacturing, genetic algorithm.

[TS2-B-2][1584] A Brain-Inspired Spiking Neural Network Model for Decision-Making in Reinforcement Learning: Intelligent Self-Balancing Control

Time: 10:50am-11:10am, October 20th, U.S. Eastern Daylight Time

Author(s): **Yijing Fan, Chun Zhao, Heming Zhang and Ning Li**

Abstract: Spiking Neural Networks (SNNs) combined with temporal dynamics and spiking behavior inherent in biological neural systems show better explanations and performance in real- time control. We proposed a self-balancing model equipped with a bio-inspired, reward- modulated SNN that employs Reward-spiking-timing-dependent Plasticity (R-STDP). Self-balancing model allows for bio-inspired learning (synaptic weight modification), in which the data essential for modifying weights is accessible at local level. Local learning mirrors the extraordinary learning processes observed within different sections of the human brain. The proposed method reconstructs the task-oriented state space and reward mechanism to realize a practice of the cross-task model, with an average decision time of 15 milliseconds. This study aims to provide a method to bridge the gap between SNNs and traditional feedback mechanisms in control systems and suggests how bio-inspired approaches can enhance these mechanisms. Cases on the proposing model show the ability of SNNs on control application. SNNs make low-power embedded real-time control and the practical application of neuromorphic hardware platforms possible in the future.

Keywords—spiking neural networks (SNNs), reward-spiketiming-dependent plasticity (RSTDP), control system.

[TS2-B-3][0459] Task-Aware Generative Score: A New Metric for Generated Images in Object Detection Task

Time: 11:10am-11:30am, October 20th, U.S. Eastern Daylight Time

Author(s): **Wenqiao Li, Qiang Tong, Na Yan, Tianyu Wu and Xiulei Liu**

Abstract: Current large-scale image generation models have gained increasing attention for realistic and creative generated images. However, existing generation metrics for evaluating generated images lack the exploration of object detection tasks. To address this issue, we introduce Task-Aware Generative Score(TAGS),

which combines detector scores with natural image quality evaluation, focusing on both the natural quality of the image and its suitability for object detection tasks. Using TAGS, we found that the images generated by the existing image generation model add samples and scenes that do not exist in the dataset when used as augmented data in the object detection task, which damage the accuracy. Therefore, we propose Reference-Guided Data Augmentation model(RGA) based on reference image guidance. It automatically selects reference images from the dataset and generates them based on the specified area of the image using the generative ability of the Stable Diffusion large model. Additionally, a two-stage allocation strategy is proposed to help the model learn more complete knowledge through two stages of training with different data. Our experiments show that TAGS has a higher correlation with downstream task results than other metrics. We further conducted experiments to demonstrate the powerful capabilities of RGA model and the two-stage allocation strategy.

Keywords—image generation, data augmentation, allocation strategy.

[TS2-B-4][1185] Enhanced-MBSE: Integrated and Intelligent Model-Based Systems Engineering

Time: 11:30am-11:50am, October 20th, U.S. Eastern Daylight Time

Author(s): **Zhen Chen, Yuteng Zhang, Zhuoyi Wu, Chun Zhao and Lin Zhang**

Abstract: This paper reviews existing methodologies in ModelBased Systems Engineering (MBSE), highlighting the limitations of traditional MBSE in integrating modeling and simulation processes and in supporting intelligent functionalities. This paper introduces the concept of Enhanced-MBSE, which centers on enhancing the integration of modeling and simulation and incorporating intelligent technologies to improve the efficiency and outcomes of systems engineering. This study elaborately discusses two key features of Enhanced-MBSE: the integration and the intelligence of modeling and simulation. It also analyzes the essential technologies required to implement these features. Then, this paper introduces a new technological matrix, Xfamily, specifically designed for Enhanced-MBSE. X-family aims to provide a comprehensive solution architecture to meet the complex needs of future systems engineering. At the end, we made additional discussions on the intelligent technologies for modeling and simulation processes.

Keywords—MBSE, simulation, X-family.

[SF-TS2-B-1][3256] Research and Development of Digital Twin System for Deep In-situ Fidelity Coring

Time: 08:00am-08:15am, October 19th, U.S. Eastern Daylight Time

Author(s): **Yue Zhong, Ling Chen and Zexiang Chen**

Abstract: Geological coring technology plays an important role in mineral and energy exploration, engineering geological survey and geoscience research, especially in realizing the sustainable development of energy. With the increase of drilling depth and formation complexity, the traditional coring technology is faced with the problems of core information loss and limited geological value. Conventional fidelity coring usually only considers temperature and pressure, so it shows limited fidelity ability in deep geological exploration, which is difficult to meet the demand. For this reason, the development of deep in-situ fidelity coring technology is necessary. In this paper, digital twinning technology is introduced into this field, and the coring process is innovated by establishing a deep in-situ fidelity coring system. This system significantly improves the digitization, visualization and intelligence of the coring process, promotes the efficiency of equipment research and development, greatly shortens the operation cycle and cost, and improves the accuracy and integrity of geological information acquisition. The application of digital twinning technology not only supports the real-time simulation and data mapping of deep rock samples, but also accurately reflects the geological environmental conditions and ensures the high fidelity geological value of the samples. This study provides technical support for the efficient and low-cost development of deep resources, contributes a lot to the sustainable development of global energy, and promotes the upgrading of intelligent geological exploration equipment. Through system architecture design, functional module division and twin model construction, the research shows the effectiveness and practicability of the digital twin system, which lays a foundation for future research and application in related fields.

Keywords—digital twinning, fidelity coring, modeling, twin system.

Session [TS3]: Mobility, Planning, Management, and Infrastructure Innovations to achieve safety, efficiency, and connectivity

[TS3-A] Intelligent Transportation, Urban Planning, and Smart City Infrastructure
[TS3-B] Intelligent Vehicles, Mobility Support for Vulnerable Groups
[TS3-C] Crowd Management, Smart Response Systems for City Emergencies
[TS3-D] Information Flow, Communication, Networks, and Security

Time: 08:00am-09:10am, October 22nd, U.S. Eastern Daylight Time
Meeting Room (Microsoft Teams): [TS3-A,3-B,3-C,3-D]IEEE UV2024 Session
Chair(s): Yapeng Wang (Macao Polytechnic University) ; Chan-Tong Lam (Macao Polytechnic University)
Assistant(s): Siying Qu, Zhongyu Liu

Meet Our Speakers

Session Overview: Urban mobility and infrastructure innovations are transforming cities into safer, more efficient, and connected environments. Intelligent transportation and smart infrastructure optimize traffic flow and urban sustainability. Intelligent vehicles improve efficiency and accessibility for all, including vulnerable groups. Data-driven crowd management and emergency systems enhance public safety, while a secure digital infrastructure ensures seamless information exchange. These advancements collectively foster smarter, inclusive urban spaces where safety and connectivity thrive.

- **Agenda [EDT]**

1. **[08:00am-08:05am][Oct.22][TS3-A][K-1]** ***Yapeng Wang,*** *Session Chair;* **Opening and Speech**
2. **[08:05am-08:30am][Oct.22][TS3-A][K-2]** ***Yapeng Wang***, *Session Chair;* Key Technologies and Applications of Geographic Information Enabled Intelligent Mobile Networks
3. **[08:30am-08:50am][Oct.22][NR-TS3-A-1][1478]** ***Eoghan O'Shaughnessy, Guangbo Hao, Zhiyuan Dai and Zili Li,*** *Author;* Enhancing Urban Infrastructure Management with UAV-Based Parking Solutions: A Case Study at UCC
4. **[08:50am-09:10am][Oct.22][TS3-A-2][3638]** ***Jiali Deng, Ying Hao, Jiayi Wang and Zhanpeng Jin***, *Author,* FediTT: A Federated Learning Approach for Privacy-Preserving Traffic Flow Prediction

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Student Forum

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5. **[08:15am-08:30am][Oct.19][SF-TS3-A-1][4165]** ***Xiaoyuan Wang,*** *Presenter;* Analyzing road safety development for G20 countries through a reformative ROCOSD-ORESTE-LDA model with MLP to enhance decision reliability
6. **[08:30am-08:45am][Oct.19][SF-TS3-B-1][3599]** ***Jordon Li***, *Presenter*, Safeguarding Autonomous Driving - Preliminary Study on Common Mistakes and Challenges and Proposed UV-Oriented Solutions

[TS3-A][K-1] Opening and Speech

Time: 08:00am-08:05am, October 22nd, U.S. Eastern Daylight Time
Invited Speaker(s)**: Yapeng Wang,** *Session Chair*

[TS3-A][K-2] Key Technologies and Applications of Geographic Information Enabled Intelligent Mobile Networks

Time: 08:05am-08:30am, October 22nd, U.S. Eastern Daylight Time
***Invited Speaker(s)*: Yapeng Wang,** *Session Chair*

[NR-TS3-A-1][1478] Enhancing Urban Infrastructure Management with UAV-Based Parking Solutions: A Case Study at UCC

Time: 08:30am-08:50am, October 22nd, U.S. Eastern Daylight Time

Author(s): **Eoghan O'Shaughnessy, Guangbo Hao, Zhiyuan Dai and Zili Li**

Abstract: As urban areas continue to expand, efficiently managing resources and infrastructure becomes more challenging due to growing population densities and limited spatial resources. This paper presents a novel approach to urban management using Unmanned Aerial Vehicles (UAVs) integrated with computer vision and AI technologies. Using the University College Cork (UCC) satellite car park as a case study, we demonstrate the potential of UAVs in optimising parking space management. Traditional parking management systems often fail to provide real-time data and adapt to changing usage patterns. Our system addresses these limitations by offering real-time analysis of parking space occupancy through advanced computer vision techniques applied to aerial imagery. This research highlights the effectiveness of UAV technology in solving urban challenges like parking management and its broader applications in urban planning and asset management. Through the UCC case study, we showcase the system's ability to support informed decisionmaking in urban contexts. This work lays the foundation for future research into the application of drone technology for urban problem-solving.

***Keywords*—**unmanned aerial vehicle (UAV), computer vision, artificial intelligence (AI), real-time data analysis.

[TS3-A-2][3638] FediTT: A Federated Learning Approach for Privacy-Preserving Traffic Flow Prediction

Time: 08:50am-09:10am, October 22nd, U.S. Eastern Daylight Time

Author(s): **Jiali Deng, Ying Hao, Jiayi Wang and Zhanpeng Jin**

Abstract*:* Traffic flow prediction (TFP) is critical to the development of intelligent transportation systems, yet current deep learning models often rely on centralized

training with sensitive location and mobility data, leading to significant privacy concerns. To address this, we propose FediTT, a novel federated learning framework that integrates the iTransformer architecture to enable accurate and privacy-preserving traffic forecasting. By training models locally on distributed clients and aggregating updates without sharing raw data, FediTT ensures data privacy while maintaining strong modeling capacity. Unlike traditional federated baselines such as FedGRU, FediTT employs a Transformer-based backbone to better capture long-range dependencies and multivariate correlations in time series data. We conduct extensive experiments on real-world traffic datasets, evaluating performance across multiple prediction horizons (96, 192, and 336 time points). Results show that FediTT consistently achieves lower MSE and MAE than centralized deep learning models (Transformer, PatchTST, Crossformer) and federated baselines, demonstrating both superior accuracy and enhanced privacy protection. These findings validate the effectiveness of combining a high-capacity forecasting model with federated learning and position FediTT as a practical and scalable solution for privacy-sensitive applications in smart transportation systems.

Keywords—federated learning, traffic flow prediction, iTransformer, privacy protection.

[SF-TS3-A-1][4165] Analyzing road safety development for G20 countries through a reformative ROCOSD-ORESTE-LDA model with MLP to enhance decision reliability

Time: 08:15am-08:30am, October 19th, U.S. Eastern Daylight Time
***Presenter(s)*: Xiaoyuan Wang**

Abstract*:* Multi-criteria decision-making (MCDM) problems require a decision model and outcomes that are stable and reliable, which is especially true for safety systems. To this end, we develop a hybrid MCDM model that combines robustness, correlation, and standard deviation (ROCOSD), organísation, rangement et Synthèse dedonnées relationnelles (ORESTE), and linear discriminant analysis (LDA), namely the ROCOSD-ORESTE-LDA model. In particular, we improve the performance of the model by embedding a Multilayer Perceptron (MLP) neural network in LDA to address the possible model failure and optimize decision outcomes. In analyzing road safety situations for G20 member countries over the past decade, the proposed model is shown to possess substantial adaptability, stability, and reliability through multiple experiments and multi-level comparisons. This broadly applicable decision framework, which provides Decision-Makers with scientific guidance for future strategic directions and practical actions in road safety and traffic management, systematically supports future road safety development planning to effectively

consolidate road safety in G20 countries. It also demonstrates the feasibility of being extensively applied to solve traffic safety management problems in other parts of the world, as well as other MCDM situations with high complexity and uncertainty.

[SF-TS3-B-1][3599] Safeguarding Autonomous Driving - Preliminary Study on Common Mistakes and Challenges and Proposed UV-Oriented Solutions

Time: 08:30am-08:45am, October 19th, U.S. Eastern Daylight Time
Presenter(s): **Jordon Li**

Abstract*:* While autonomous vehicles continue to garner increasing attention, concerns regarding their potential safety risks have also grown. This paper thoroughly investigates the common errors, challenges, and potential threats that affect autonomous vehicles, including human error and environmental conditions and examine potential factors that lead to system vulnerabilities. Our findings reveals that the leading cause of current accidents involving autonomous vehicles is the failure or misjudgment of the on-board sensors due to weather conditions such as fog and snow as well as complicated driving environments. These on-board sensors and decision-making processors were also subject to malicious attacks and deliberate sabotage that further affected driving safety. Besides, the failure of mutual understanding between autonomous driving systems and surrounding environments poses serious challenges. The paper then explores the current solutions to these emerging issues and studies their advantages and limitations. In this paper, we evaluate, from the UV perspective, the current status of autonomous driving based on a framework of closed feedback control loop: data acquisition, communication, decision making, and action. We propose that an effective system design should take into consideration the interaction between the driving system and other relevant subsystems: smart communities for local drivers, smart medical support, smart energy management, smart road infrastructure, smart environmental protection, smart response system for city emergency, and smart humanity, and also study how the system would be affected by four major impacting factors of smart cities: information flow, material cycle, lifestyle, and community. This systematic study further explores in-depth the complicated dynamic relationship between multiple impacting factors and proposes a UV-oriented, integrated, resilient, inclusive, and sustainable development framework design. Such design considers accurate static and dynamic information matching based on the redundancy in data acquisition, novel communication mechanism based on multidimensional layers of information that ensures the information effectiveness, robustness and self-adaptive methods, and demand response management.

Session [TS4-A]: Renewable Energy and Smart Energy Management

Time: 06:50am - 09:35am, October 22nd, U.S. Eastern Daylight Time
Meeting Room (Microsoft Teams): [TS4-A]IEEE UV2024 Session
Chair(s): Xinyu Tan (China Three Gorges University)
Assistant(s): Chengming Wang, Guangjun Zeng

Meet Our Speakers

Session Overview : The drive for innovations in energy and materials focuses on efficiency, safety, and sustainability. Advanced renewable energy technologies, including new solar energy capture methods and CO_2 conversion, along with breakthroughs in energy storage like sophisticated battery systems and hydrogen fuel production, are transforming urban environmental management. Smart energy management systems optimize these resources, enhancing their effectiveness, while smart materials improve the safety and functionality of energy infrastructures. These innovations collectively promote sustainable resource use and foster cleaner, safer urban environments.

- **Agenda[EDT]**
  1. **[06:50am-06:55am][Oct.22][TS4-A][K-1]** ***Xinyu Tan***, *Session Chair;* **Opening and Speech**
  2. **[06:55am-07:25am][Oct.22][TS4-A][K-2]** ***Xinyu Tan***, *Session Chair & Invited Speaker;* Preparation of hydrophobic radiative cooling film and its effect of light-heat-electric properties on photovoltaic cells
  3. **[07:25am-07:50am][Oct.22][TS4-A][K-3]** ***Liang Chu***, *Invited Speaker;* Stability study of MA perovskite-free photovoltaic modules
  4. **[07:50am-08:05am][Oct.22][TS4-A][K-4]** ***Muhammad Rafique,*** *Invited Speaker;* Advanced Material-based CO_2 Capture and Conversion: Mechanism Insights, Emerging Trends, Future Prospects and Challenges[New]
  5. **[08:05am-08:20am][Oct.22][TS4-A][K-5]** ***Basheer Ahmed Kalwar,*** *Invited Speaker;* Ambient conditions hydrogen storage and release on Ti decorated monolayer BC6N material for fuel cell vehicles. A DFT study[New]
  6. **[08:20am-08:35am][Oct.22][TS4-A][K-6]** ***Huamiao Lin***, *Invited Speaker*; Multiple stimuli-responsive low-molecular-weight organogel with room temperature phosphorescence for dynamic anti-counterfeiting[New]
  7. **[08:35am-08:50am][Oct.22][TS4-A][K-7]** ***Xiwen Chang***, *Invited Speaker,* Tuning Morphology and Electronic Structure of Cobalt Metaphosphate Via Vanadium-Doping for Efficient Water and Urea Splitting[New]
  8. **[08:50am-09:05am][Oct.22][TS4-A][K-8]&[TS4-A-1][8050]** ***Xiuru Li,*** *Invited Speaker,* Investigating the NH4+ pre-intercalation and surface coordination effects on MnO2 for ammonium ion supercapacitor [New]
  9. **[09:20am-09:35am][Oct.22][TS4-A-2][6367]** ***Qiyue Huang, Yapeng Wang, SIO-KEI IM and Xu Yang,*** *Author*; Interpretable Model for Remaining Useful Life Prediction of Batteries

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Student Forum

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10. **[08:45am-09:00am][Oct.19][SF-TS4-A-1][9348]** ***Rebecca Xu,*** Addressing Baltimore County's Landfill

[TS4-A][K-1] Opening and Speech

Time: 06:50am-06:55am, October 22nd, U.S. Eastern Daylight Time
***Invited Speaker(s)*: Xinyu Tan,** *Session Chair*

[TS4-A][K-2] Preparation of hydrophobic radiative cooling film and its effect of light-heat-electric properties on photovoltaic cells

Time: 06:55am-07:25am, October 22nd, U.S. Eastern Daylight Time
***Invited Speaker(s)*: Xinyu Tan,** *Session Chair*

[TS4-A][K-3] Stability study of MA perovskite-free photovoltaic modules

Time: 07:25am-07:50am, October 22nd, U.S. Eastern Daylight Time
***Invited Speaker(s)*: Liang Chu**

[TS4-A][K-4] Advanced Material-based CO_2 Capture and Conversion: Mechanism Insights, Emerging Trends, Future Prospects and Challenges

Time: 07:50am-08:05am, October 22nd, U.S. Eastern Daylight Time
***Invited Speaker(s)*: Muhammad Rafique**

[TS4-A][K-5] Ambient conditions hydrogen storage and release on Ti decorated monolayer BC6N material for fuel cell vehicles. A DFT study

Time: 08:05am-08:20am, October 22nd, U.S. Eastern Daylight Time
Invited Speaker(s): **Basheer Ahmed Kalwar**

[TS4-A][K-6] Multiple stimuli-responsive low-molecular-weight organogel with room temperature phosphorescence for dynamic anti-counterfeiting

Time: 08:20am-08:35am, October 22nd, U.S. Eastern Daylight Time
Invited Speaker(s): **Huamiao Lin**

Abstract: Pure organic luminogens with stimuli-responsive room temperature phosphorescence (RTP) have drawn much attention due to their promising applications in dynamic anti-counterfeiting. In this work, we designed a simple organic molecule with rigid chemical structure (m-FBCM), and all-atom molecular dynamics simulation indicated that it was a potential organogelator. Moreover, the molecule comprises multiple carbonyl units and aromatic rings, which could promote the intersystem crossing process. Our experiments revealed that m-FBCM could form stable gel in DMSO, promoted by balanced intermolecular π-π interactions. Green afterglow was observed at room temperature in the gel state with lifetime 41.6 ms, ascribed to its RTP. The afterglow became invisible at 45 °C and could recover upon cooling to room temperature. Moreover, the N-acylation reaction between m-FBCM xerogel and vapor of volatile primary amine could occur in a few minutes without additional catalyst, providing an orange afterglow. The thermal-responsive and chemical-responsive properties impart the RTP gel promising application in dynamic anti-counterfeiting.

[TS4-A][K-7] Tuning Morphology and Electronic Structure of Cobalt Metaphosphate Via Vanadium-Doping for Efficient Water and Urea Splitting

Time: 08:35am-08:50am, October 22nd, U.S. Eastern Daylight Time
Invited Speaker(s): **Xiwen Chang**

[TS4-A][K-8] & [TS4-A-1][8050] Investigating the NH4+ pre-intercalation and surface coordination effects on MnO2 for ammonium ion supercapacitor

Time: 08:50am-09:05am, October 22nd, U.S. Eastern Daylight Time
Invited Speaker(s): **Xiuru Li**

Abstract: Ion pre-intercalation is an effective method for fine-tuning the electrochemical characteristics of electrode materials, thereby enhancing the performance of aqueous ammonium-ion hybrid supercapacitors (A-HSCs). However, much of the current research on ion pre-intercalation lacks controllability, and the underlying mechanisms remain unclear. In this study, we employ a two-step electrochemical activation approach, involving galvanostatic charge-discharge and cyclic voltammetry, to modulate the pre-intercalation of NH4+ in MnO2. An in-depth analysis of the electrochemical activation mechanism is presented. This two-step electrochemical activation approach endows the final MnO2/AC electrode with a high capacitance of 917.4 F g−1, approximately 2.4 times higher than that of the original MnO2. Furthermore, the MnO2/AC electrode retains approximately 93.4% of its capacitance after 10000 cycles at a current density of 25 mA cm−2. Additionally, the aqueous A-HSC, comprising MnO2/AC and P-MoO3, achieves a

maximum energy density of 87.6 Wh kg−1. This study offers novel insights into the controllable ion pre-intercalation approach via electrochemical activation.

[TS4-A-2][6367] Interpretable Model for Remaining Useful Life Prediction of Batteries

Time: 09:20am-09:35am, October 22nd, U.S. Eastern Daylight Time

Author(s): **Qiyue Huang, Yapeng Wang, SIO-KEI IM and Xu Yang**

Abstract: With the rapid advancement of renewable energy and the widespread adoption of microgrids, there is a growing need to predict the remaining lifespan of microgrid batteries. However, conventional prediction methods based on traditional artificial intelligence models suffer from a lack of interpretability, which hampers their reliability and credibility in practical applications. Addressing this concern, this research paper proposes a method based on interpretable artificial intelligence models for accurately predicting the remaining lifespan of microgrid batteries. To begin with, we collected charging and discharging datasets consisting of lithium batteries and performed preprocessing and feature extraction. In addition to the classic linear prediction model, we incorporated an interpretable module. This module enables the automatic learning of complex battery data features, generating interpretable outputs while maintaining high-precision predictive performance. To validate the effectiveness of our proposed method, multiple sets of simulation experiments were conducted. The results demonstrate that our model can accurately and interpretably predict outcomes, providing valuable insights for the maintenance and management of microgrid batteries.

Keywords—smart microgrids, interpretability, lithium-ion battery, life prediction, neural network.

[SF-TS4-A-1][9348] Addressing Baltimore County's Landfill

Time: 08:45am-09:00am, October 19th, U.S. Eastern Daylight Time
Presenter(s): **Rebecca Xu**

Abstract: Baltimore County in Maryland faces a critical challenge: its 375-acre landfill is rapidly nearing capacity, with projections indicating it will be full by 2027, far earlier than anticipated. This looming issue presents not only logistical and environmental concerns but also exacerbates the county's contribution to climate change. Landfills emit methane, a greenhouse gas with 21 times the warming potential of carbon dioxide, and nitrous oxide, with 310 times the warming potential. Expanding landfill space, either upward or outward, is not a sustainable solution as it will only accelerate greenhouse gas emissions. One viable solution is to increase

recycling rates, which have dropped by a third in Baltimore County over the past decade. To address this, I propose implementing a "pay-as-you-throw" (PAYT) trash collection system. This model incentivizes recycling by requiring residents to purchase special bags for trash disposal, directly tying waste generation to personal cost. Similar programs have proven successful, such as in Carroll County, where waste sent to landfills dropped by 44%, and recycling rates nearly doubled within two months of implementation. The PAYT system has the potential to significantly reduce Baltimore County's landfill burden while also contributing to climate change mitigation. By encouraging responsible waste disposal and recycling, this initiative not only saves county resources but also positions Baltimore County as a leader in sustainable waste management. If successful, this model can be scaled to other regions, amplifying its environmental impact nationwide. By supporting the PAYT system, Baltimore County can take a critical step toward reducing waste, increasing recycling, and combating climate change.

Session [TS4-B]: Smart Materials and Devices

Time: 07:30am - 11:30am, October 22nd, U.S. Eastern Daylight Time
Meeting Room (Microsoft Teams): [TS4-B]IEEE UV2024 Session
Chair(s): Weihua Mu (Wenzhou Institute, Chinese Academy of Sciences)
Assistant(s): Guangjun Zeng

Meet Our Speakers

Session Overview:

- AI-Enhanced Electromagnetic Field Simulations and Design Optimization.
- Mechano-Thermal Properties of Janus TMDs for Energy and Catalytic Applications.
- Real-Time Monocular 3D Pose Tracking for Non-Cooperative Spacecraft.
- The Impact of Trans-Disciplinary Research in Science and Technology.

- **Agenda[EDT]**
  1. **[07:30am-08:00am][Oct.22][TS4-B][K-1]** ***Weihua Mu***, *Session Chair;* Opening and Speech
  2. **[08:00am-08:30am][Oct.22][TS4-B][K-2]** ***Yunpeng Zhang***, *Invited Speaker;* Low-frequency electromagnetic field calculation methods integrating artificial intelligence techniques and their application
  3. **[08:30am-09:00am][Oct.22][TS4-B][K-3]** ***Kai Ren***, *Invited Speaker;* Catalytic and Heat Transfer Properties of Janus TMDs Heterojunctions
  4. **[09:30am-10:00am][Oct.22][TS4-B][K-4]** ***Chang Liu***, *Invited Speaker;* Real-time Monocular 3D Pose Tracking for Non-cooperative Spacecraft in Close Range
  5. **[10:00am-10:30am][Oct.22][TS4-B][K-5]** ***Wentao Kang***, *Invited Speaker;* The Significance of Trans-disciplinary Research Based on Mathematics, Physics, and Computer Science
  6. **[10:30am-11:00am][Oct.22][TS4-B-3][7673]** ***Weihua Mu***, *Author;* Variational Calculations of Helfrich Energy in Material Studies
  7. **[11:00am-11:30am][Oct.22][TS4-B-4][4705]** ***Weihua Mu***, ***Hui Sun***, *Author;* First Threshold Voltage in the Process of Electrostatic Field Induced Reorientation of Diblock Copolymers

[TS4-B][K-1] Opening and Speech

Time: 07:30am-08:00am, October 22nd, U.S. Eastern Daylight Time
Invited Speaker(s): **Weihua Mu**, *Session Chair*

[TS4-B][K-2] Low-frequency electromagnetic field calculation methods integrating artificial intelligence techniques and their application

Time: 08:00am-08:30am, October 22nd, U.S. Eastern Daylight Time
Invited Speaker(s): **Yunpeng Zhang**

Abstract*:* In various stages of the electromagnetic simulation analysis process, such as pre-processing, solvers, and post-processing, artificial neural network models

could be integrated to accelerate the entire analysis process. By using finite element data obtained from electromagnetic simulations, various neural network-based electromagnetic solvers are established to achieve rapid prediction of electromagnetic field distribution, which has been applied to the analysis of various electromagnetic devices. For electromagnetic device design, multi-input/output and multi-operating condition full-performance prediction models are developed, and classifiers are employed to accelerate multi-objective optimization. This enables multi-objective optimization design based on surrogate models, improving the efficiency of electromagnetic design.

[TS4-B][K-3] Catalytic and Heat Transfer Properties of Janus TMDs Heterojunctions

Time: 08:30am-09:00am, October 22nd, U.S. Eastern Daylight Time
Invited Speaker(s): **Kai Ren**

Abstract*:* The recently synthesized two-dimensional Janus transition metal dihalides (TMDs) exhibit unique structural asymmetry, leading to novel thermoelectric, optical, and catalytic properties, which hold great promise for applications in the field of smart energy as next-generation functional materials. Heterostructures based on Janus MoSSe and WSSe show even more intriguing interfacial characteristics. For the Janus MoSSe/WSSe van der Waals heterostructure, the special interfacial stacking can enhance van der Waals interlayer coupling, while the weakened interlayer interaction results in ultra-low phonon shear and breathing mode frequencies. The lattice vibrations under phonon excitations significantly influence the photocatalytic water splitting performance of the MoSSe/WSSe van der Waals heterostructure. Moreover, the Janus MoSSe/WSSe lateral heterostructure spontaneously forms a curved morphology, and this curvature reduces the interfacial thermal resistance and further enhances its hydrogen evolution reaction (HER) properties. Interestingly, under external force, the curved interface can be flattened, requiring the force to first overcome the inherent bending before further pulling the MoSSe/WSSe lateral heterostructure apart. This extraordinary flexibility endows the material with highly efficient self-adaptive catalytic properties during the HER process. Therefore, the unique mechano-thermal and mechano-catalytic properties of Janus MoSSe and WSSe make them promising candidates for smart energy materials.

[TS4-B][K-4] Real-time Monocular 3D Pose Tracking for Non-cooperative Spacecraft in Close Range

Time: 09:30am-10:00am, October 22nd, U.S. Eastern Daylight Time
Invited Speaker(s)**: Chang Liu**

Abstract: This work proposes a new monocular algorithm to track the 3D pose of non-cooperative spacecraft for proximity operations in real time with the 3D boundaries and 3D contour of the spacecraft as features. The 3D boundary segments of the spacecraft are automatically extracted from the 3D spacecraft model a priori. At the start of tracking, the tracking system is initialized by SISnet network together with contour-based matching. Subsequently, with the initial pose and its covariance provided by the extended Kalman filter (EKF), the 3D contour segments are rapidly extracted from the 3D model. The boundary segments and contour segments are taken as 3D features. In the input image, we search the image data corresponding to the 3D features within the range decided by the initial pose and its covariance. Then, the spacecraft pose is determined in real time by minimizing the geometric distances of the 3D features to the backprojection lines of their corresponding image data. The covariance of the pose is estimated via the first-order optimal condition of the minimization. Eventually, the EKF is derived from the second-order autoregression (2nd-AR) to generate the final pose estimate, and the initial pose and its covariance for next time instant. The synthetic trials quantitatively indicate that our method can track the 3D pose of spacecraft in real time with high accuracy and has outstanding robustness to the dark occlusion, cluster background, large image distance, and image noise. The real trial qualitatively validates the effectiveness of our tracking method.

[TS4-B][K-5] The Significance of Trans-disciplinary Research Based on Mathematics, Physics, and Computer Science

Time: 10:00am-10:30am, October 22nd, U.S. Eastern Daylight Time
Invited Speaker(s): **Wentao Kang**

Abstract: Trans-disciplinary research, which integrates mathematics, physics, and computer science, plays a vital role in addressing complex real-world problems and fostering innovation. By combining methodologies and insights from these fields, researchers can develop innovative solutions to multifaceted challenges in areas such as climate science, healthcare, and technology development. This collaboration enhances understanding of complex systems and promotes the advancement of technologies like artificial intelligence and quantum computing. Furthermore, trans-disciplinary approaches enrich educational frameworks by cultivating interdisciplinary skills, preparing students for a dynamic job market. Ultimately, the interplay between these disciplines fosters cross-pollination of ideas, leading to new theoretical insights and significant societal impacts. Emphasizing the importance of breaking down academic silos, this research paradigm contributes to comprehensive problem-solving and drives scientific discovery.

[TS4-B-3][7673] Variational Calculations of Helfrich Energy in Material Studies

Time: 10:30am-11:00am, October 22nd, U.S. Eastern Daylight Time
Invited Speaker(s): **Weihua Mu**, *Session Chair*

Author(s): **Weihua Mu**

Abstract: The Helfrich-type free energy is widely used to study the elastic properties of biological membranes and other soft materials, capturing the interplay between membrane curvature and energy minimization. Despite its broad application, the mathematical derivation of the variation of this free energy often assumes a familiarity with classical geometry theory. This paper provides a self-contained, step-by-step derivation of the variation of the Helfrich-type free energy, specifically focusing on its use in soft materials. By explicitly detailing the mathematical procedures involved, we aim to make the derivation process accessible to readers without prior knowledge of advanced geometry. We emphasize clarity and self-consistency throughout the derivation, ensuring that the reader can follow the reasoning without needing to consult additional references. This work focuses on systematizing derivation procedures to establish standardized pedagogical reference. The work serves as a comprehensive guide for both theoretical and computational studies involving the Helfrich energy.

Keywords—variations, classical differential geometry, Hefrich energy, Ouyang-Helfrich equation

[TS4-B-4][4705] First Threshold Voltage in the Process of Electrostatic Field Induced Reorientation of Diblock Copolymers

Time: 11:00am-11:30am, October 22nd, U.S. Eastern Daylight Time
Invited Speaker(s): **Weihua Mu**, *Session Chair*

Author(s): **Weihua Mu and Hui Sun**

Abstract: In recent advancements in soft-semiconductor manufacturing, a pivotal phenomenon pertinent to nano-lithographic techniques involves the reorientation of parallel lamellae in lamellar diblock copolymers confined between two parallel plates. This reorientation results in a transition to a perpendicular lamellar alignment when an electric field, applied perpendicular to the plates, surpasses a critical threshold value. Such electric field-induced reorientation is of paramount importance for nanolithographic applications. During this structural transition, two distinct characteristic voltages are identified: the first corresponds to the onset of reorientation, where the parallel lamellae begin to tilt toward an upright configuration; and the second marks the completion of reorientation, where the lamellae achieve full perpendicular alignment. Through rigorous stability analysis, we have derived an analytical expression for the first characteristic voltage, providing a theoretical framework that enhances the understanding of the

underlying experimental phenomena and offers valuable insights for industrial applications.

Keywords—diblock copolymer, Ginzburg-Landau energy, stability analysis, electric field effect.

Session [TS5]: Smart Manufacturing

Time: 07:00am - 10:30am, October 22nd, U.S. Eastern Daylight Time
Meeting Room (Microsoft Teams): [TS5]IEEE UV2024 Session
Chair(s): Yuanjun Laili (Beihang University)
Assistant: Yuezhi Luo, Charles Zhang, Zhenqian Huang

Meet Our Speakers

Session Overview: Manufacturing innovations are key to achieving greater efficiency, safety, and sustainability, with a significant focus on optimizing cloud manufacturing scheduling. Addressing the dynamic nature of demands and resource availability, new methodologies are emerging that simplify scheduling into a single, adaptable learning target. These approaches have shown to effectively reduce task completion times and resource utilization variability, marking an improvement over traditional real-time scheduling methods. This shift towards adaptable and efficient manufacturing processes meets technological challenges and aligns with environmental sustainability goals, paving the way for a future where manufacturing is both advanced and responsible.

- **Agenda [EDT]**
  1. **[07:00am-07:05am][Oct.22][TS5][K-1]*Yuanjun Laili*,** *Session Chair;* Welcome speech
  2. **[07:05am-07:25am][Oct.22][TS5][K-2] *Xin Peng*,** *Invited Speaker;* AI-aided unmanned synthesis experiments of molecular sieve catalysts
  3. **[07:25am-07:45am][Oct.22][TS5][K-3] *Yong Cui*,** *Invited Speaker;* Simulation of space radiation model for multilayer electret based low frequency antennas
  4. **[07:45am-08:05am][Oct.22][TS5][K-4] *Chuge Wu*,** *Invited Speaker;* Intelligent Decision Making for the Heterogeneous Scenarios in Discrete Manufacturing of Electronic Products
  5. **[08:05am-8:30am][Oct.22][TS5][K-5] *Bo Fu*,** *Invited Speaker;* Leveraging Large Language Models for Structural Data: Enhancing Text-to-SQL and Knowledge-Based Question Answering
  6. **[08:30am-8:40am][Oct.22][TS5-1][2526] *Dongxiao Tan, Yuanjun Laili, Chengwen Qi, Haiteng Wang, Lin Zhang,*** *Author;* Domain Adaptation Fine-Tuning LLM for Text Error Detection in Industrial Documents
  7. **[08:40am-08:50am][**Oct.22**][TS5-2][0090] *Jiachen Lin, Liya Yao, Xiaoyi Liu, Bo Fu,*** *Author;* Reverse Logistics Network Path Planning Optimization Strategy Based on Greedy Algorithm
  8. **[08:50am-09:00am][Oct.22][SF-TS5-8][7462] *Jinglin Xie, Longfei Zhou, Danjie Cheng, Bingqing Wang, Xiuwen Xu, Runtong Wu,*** *Author;* Layer Printing Time Prediction for Direct Metal Laser Sintering Based on Deep Learning
  9. **[09:00am-09:10am][Oct.22][TS5-4][4433] *Zhuoqun Li, Jinwang Wu, Lin Zhang, Yuanjun Laili,*** *Author;* A Comparative Study of Model Fine-tuning Methods for Multimodal Data Alignment of Electronic Products

10. **[09:10am-09:20am][Oct.22][TS5-5][0586]** ***Anqi Zhao, Rang Li, Bo Fu,*** *Author;* Enhancing ChatBI System Performance in Vertical Business Domains through an Automated Sample Generation Pipeline
11. **[09:30am-09:40am][Oct.22][TS5-7][2352]** ***Donghai Zhang, Shuangtao Yang, Bo Fu,*** *Author;* Multi-Agent Knowledge Graph Question Answering Framework Based on Lightweight Large Language Model
12. **[09:50am-10:00am][Oct.22][TS5-9][7225]** ***Jingqi Wang, Huangkai Xue, Chuge Wu and Yuanqing Xia,*** *Author;* Capacitated Vehicle Routing Problem with 2-dimensional Loading Constraints Study based on Improved Estimation of Distribution Algorithm
13. **[10:10am-10:20am][Oct.22][SF-TS5-5][0240]** ***Yidi Shao, Longfei Zhou, Fangshuo Tang, Xinyi Shi and Dalang Chen,*** *Author;* Comparative Performance of ImageNet Pre-trained Models for Electronic Component Classification
14. **[09:20am-09:30am][Oct.22][SF-TS5-6][6093]** ***Wenqiang Ge, Hao Zhang, Yujie Ren, Liyuan He, Longfei Zhou,*** *Author;* Real-time Defect Detection for Fused Deposition Modeling based on Machine Learning
15. **[09:40am-09:50am][Oct.22][NR-TS5-7][3099]** ***Chang He, Runtong Wu, Xiuwen Xu, Ning Zhang, Longfei Zhou,*** *Author;* Double Deep Q-network Adaption Based Dynamic Task Scheduling in Manufacturing Workshops
16. **[10:20am-10:30am][Oct.22][SF-TS5-9][9782]** ***Tianrun Wu, Xinyun Fang, Zhe Wang, Yi Wu, Naifan Ye, Longfei Zhou,*** *Author;* Automatic Leveling in DMLS Based on Deep Neural Networks

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Student Forum

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17. **[09:15am-09:30am][Oct.19][SF-TS5-1][7539]** ***Enze Dong, Yanyan Li and Ling Chen,*** *Author;* Research on Tool Optimization Evaluation Model Based on Combination Weighting
18. **[09:30am-09:45am][Oct.19][SF-TS5-2][6435]** ***Jiayin Fu, Ling Chen and Zhehao Wang,*** *Author;*Safety Margin Assessment Model for Surface Cracks Based on Path Rate Integral Method
19. **[09:45am-10:00am][Oct.19][SF-TS5-3][3111]** ***Shaojie Zhong, Ling Chen and Fuda Sun,*** *Author;* Optimization Analysis of In-situ Fidelity Coring Drill Bit Structure for Subsea Gas Hydrates
20. **[10:00am-10:15am][Oct.19][SF-TS5-4][2965]** ***Qian Li,*** *Author;* A Mobile Equipment Management System based on Internet of Things Technology

[TS5][K-1] Welcome speech

Time: *0*7:00am-07:05am, October 22nd, U.S. Eastern Daylight Time
Invited Speaker(s): **Yuanjun Laili,** *Session Chair*

[TS5][K-2] AI-aided unmanned synthesis experiments of molecular sieve catalysts

Time: 07:05am-07:25am, October 22nd, U.S. Eastern Daylight Time
Invited Speaker(s): **Xin Peng**

[TS5][K-3] Simulation of space radiation model for multilayer electret based low frequency antennas

Time: 07:25am-07:45am, October 22nd, U.S. Eastern Daylight Time
Invited Speaker(s): **Yong Cui**

[TS5][K-4] Intelligent Decision Making for the Heterogeneous Scenarios in Discrete Manufacturing of Electronic Products

Time: 7:45am-08:05am, October 22nd, U.S. Eastern Daylight Time
Invited Speaker(s): **Chuge Wu**

[TS5][K-5] Leveraging Large Language Models for Structural Data: Enhancing Text-to-SQL and Knowledge-Based Question Answering

Time: 08:05am-08:30am, October 22nd, U.S. Eastern Daylight Time
Invited Speaker(s): **Bo Fu**

[TS5-1][2526] Domain Adaptation Fine-Tuning LLM for Text Error Detection in Industrial Documents

Time: 08:30am-08:40am, October 22nd, U.S. Eastern Daylight Time

Author(s): **Dongxiao Tan, Yuanjun Laili, Chengwen Qi, Haiteng Wang and Lin Zhang**

Abstract: —Complex product manufacturing involves multiple production stages. Since each stage is relatively independent, many documents are needed to assure completeness and improve efficiency. Text errors in industrial documents can reduce the readability of documents. Therefore, text error detection in industrial documents is necessary. Manual detection is not only time-consuming, but also prone to missing some potential errors. Current automatic text error detection strategies primarily focus on specific types of text errors in general corpora, but do not address the need for detecting multiple types of text errors in industrial scenarios. Addressing the above limitations, this paper presents a framework based on domain adaptation fine-tuning, adapting pre-trained Large Language Models (LLMs) to text error detection in industrial documents. Before fine-tuning, we create a text error detection instruction dataset from industrial documents through data preprocessing and prompt design. This dataset serves as the foundation for domain adaptation finetuning of LLMs. To improve fine-tuning efficiency, the model is fine-tuned with Low-Rank Adaptation (LoRA), which reduces training time and lowers memory usage compared to full finetuning. Experimental results show that the assessment score of the domain-adapted LLM for text error detection in industrial documents is significantly improved. Furthermore, the performance of fine-tuned model with fewer parameters can be comparable to, or even exceed, that of larger models on specific tasks. Based on the preceding discussion, we demonstrate the effectiveness of the proposed framework.

Keywords—large language models, text error detection, natural language processing, fine-tuning.

[TS5-2][0090] Reverse Logistics Network Path Planning Optimization Strategy Based on Greedy Algorithm

Time: 08:40am-08:50am, October 22nd, U.S. Eastern Daylight Time

Author(s): **Jiachen Lin, Liya Yao, Xiaoyi Liu and Bo Fu**

Abstract: Significant inefficiencies and high operational costs in reverse logistics route planning are exacerbated by pervasive uncertainties in demand volume and its spatial distribution. While forecasting is recognized as crucial, existing approaches often do not adequately address the coupled spatiotemporal nature of reverse logistics demand or do not proactively integrate these forecasts into vehicle deployment strategies prior to detailed routing. This study confronts these challenges by proposing an optimized reverse logistics network path planning strategy that integrates advanced data-driven demand forecasting with proactive

vehicle deployment. Specifically, we first develop a four-stage spatiotemporal forecasting method, combining a Gate Recurrent Unit model for temporal volume prediction with gravity constraints for spatial distribution across logistics zones. Subsequently, two greedy algorithm-inspired vehicle deployment strategies are introduced to translate these forecasts into optimal initial vehicle positioning, aiming to maximize demand satisfaction and load utilization before detailed route planning. These deployments then inform a mixed-integer multi-objective route planning model, solved using NSGA-II. Applied to waste home appliance collection in Haidian District, Beijing, our approach demonstrates that proactive vehicle deployment driven by forecast significantly reduces transportation costs and improves operational efficiency compared to conventional methods. This work underscores the critical value of integrating granular spatiotemporal demand intelligence into the strategic phase of reverse logistics planning to mitigate uncertainty.

***Keywords*—**logistics engineering, route planning, genetic algorithm, reverse logistics, demand forecasting.

[SF-TS5-8][7462] Layer Printing Time Prediction for Direct Metal Laser Sintering Based on Deep Learning

Time: 08:50am-09:00am, October 22nd, U.S. Eastern Daylight Time

***Author(s)*: Jinglin Xie, Longfei Zhou, Danjie Cheng, Bingqing Wang, Xiuwen Xu, Runtong Wu**

Abstract: Precise prediction of printing duration in Direct Metal Laser Sintering (DMLS), a crucial process in highprecision metal additive manufacturing, is a persistent challenge due to the technology's inherent dynamic multiphysics characteristics. Conventional approaches often struggle to deliver adequate accuracy due to limitations in capturing the influence of dynamic process parameters and exhibiting computational bottlenecks when dealing with intricate geometries. These limitations can lead to notable discrepancies between predicted and realized printing times, especially in the context of complex industrial parts subject to varying process conditions. To address this issue, we present a deep learning (DL)-based framework for DMLS printing time prediction. Our approach utilizes a comprehensive dataset of layer-wise printing images and corresponding process parameters acquired during DMLS fabrication. We trained and evaluated a suite of deep neural network architectures, including ResNeXt, ResNet, SqueezeNet, and Vision Transformer, to improve the fidelity of layer printing time predictions. Empirical evaluations indicate that the optimized ResNeXt model achieves a mean relative error of one point three percent in layer printing time prediction, a substantial improvement compared to a twentyfour points four eight percent relative error observed with a traditional prediction method. This work

demonstrates the considerable promise of DL as a valuable tool for DMLS process monitoring and time estimation, providing a pathway to enhance process visibility without requiring simplified theoretical assumptions. This data-driven methodology has the potential to streamline DMLS process optimization and accelerate the adoption of additive manufacturing in industrial settings.

Keywords—3D printing, DMLS, ResNeXt, printing time prediction, additive manufacturing, deep learning.

[TS5-4][4433] A Comparative Study of Model Fine-tuning Methods for Multimodal Data Alignment of Electronic Products

Time: 09:00am-09:10am, October 22nd, U.S. Eastern Daylight Time

Author(s): **Zhuoqun Li, Jinwang Wu, Lin Zhang, Yuanjun Laili**

Abstract: Currently, after-sales Q&A systems for electronic products have replaced a significant amount of manual services, becoming essential for guiding after-sales maintenance and support. However, the after-sales service process faces challenges due to the diverse graphic and textual data associated with various product categories. Existing Q&A systems often struggle to align these datas effectively, making it difficult to accurately identify the attributes of the products needing service and their specific requirements. While the mainstream multimodal large model, CLIP, can effectively extract features from images and text and align graphical data, it lacks specialized domain knowledge, which hampers its ability to meet specific needs. To address this issue, this paper introduces relevant professional knowledge through model fine-tuning. Four fine-tuning approaches are employed: full parameter fine-tuning, partial parameter finetuning, added parameter fine-tuning, and LoRA (Low-Rank Adaptation) fine-tuning. These methods are trained using three labels: class, brand, and model, with HITS@K and MRR(Mean Reciprocal Rank) serving as performance metrics. Experimental results indicate that while the CLIP model demonstrates strong zero-shot learning capabilities, its performance in recognizing graphics within specialized domains is lacking. However, the four fine-tuning methods significantly enhance graphic alignment, with LoRA fine-tuning yielding the best results—approximately a 475 percent improvement compared to the pre-fine-tuning state. Additionally, ablation experiments on the LoRA method reveal that replacing the encoded part of the image with LoRA can have a substantial impact on the model's performance.

Keywords—electronic products, CLIP model, text alignment, LoRA fine tuning, zero-shot learning.

[TS5-5][0586] Enhancing ChatBI System Performance in Vertical Business

Domains through an Automated Sample Generation Pipeline

Time: 09:10am-09:20am, October 22nd, U.S. Eastern Daylight Time

Author(s): **Anqi Zhao, Rang Li, Bo Fu**

Abstract: Chat Business Intelligence (ChatBI) systems often fail in vertical business domains due to a critical lack of domainspecific training samples, leading to poor query performance and user trust. This paper addresses this challenge by proposing a novel, automated sample generation pipeline. Our core innovation is a dual-path approach that extracts and synergizes structured knowledge from both internal business documents and database schemas. This allows the system to build a deep, contextual understanding of specialized terminology, metrics, and business logic, even in low-data scenarios. The pipeline then uses this knowledge base to automatically generate a diverse set of high-quality, domain-aware question-and-answer samples. Experimental results on real-world business cases demonstrate the effectiveness of our approach, with NL2SQL accuracy improving dramatically from 34.3% to 71.5%. Our work provides a scalable and effective solution for developing reliable and robust ChatBI systems, significantly enhancing their applicability and performance in specialized industries.

Keywords—automated sample generation pipeline, vertical business domains, large language models, few shot learning, domainspecific knowledge extraction.

[TS5-7][2352] Multi-Agent Knowledge Graph Question Answering Framework Based on Lightweight Large Language Model

Time: 09:30am-09:40am, October 22nd, U.S. Eastern Daylight Time

Author(s): **Donghai Zhang, Shuangtao Yang, Bo Fu and Shou Chen**

Abstract: Industrial knowledge graphs pose significant challenges for question answering due to their logical complexity and obscure business knowledge, making it difficult to leverage existing technologies. This paper proposes a unified framework based on lightweight large language model agents to collaboratively process industrial knowledge graphs, enabling knowledge questions-answering in complex scenarios and business logic. The lightweight large language model we released can accurately identify complex entities in industrial data and possesses excellent knowledge-enhanced reasoning capabilities, while meeting the low-resource and high-performance requirements of industrial knowledge graph question answering. Experimental results demonstrate that in a cold-start setting, our proposed framework achieves 73 percent accuracy on industrial knowledge graphs, with an average improvement of 46 percent.

Keywords—industrial knowledge graphs, lightweight large language model, multi-agent

[TS5-9][7225] Capacitated Vehicle Routing Problem with 2-dimensional Loading Constraints Study based on Improved Estimation of Distribution Algorithm

Time: 09:50am-10:00am, October 22nd, U.S. Eastern Daylight Time

Author(s): **Jingqi Wang, Huangkai Xue, Chuge Wu, Yuanqing Xia**

Abstract: The capacitated vehicle routing problem with 2- dimensional loading constraints (2L-CVRP) integrates aspects of both the vehicle routing problem and the two-dimensional bin packing problem. To address this challenge, an Improved Estimation of Distribution Algorithm (IEDA) is proposed in this paper. The IEDA employs a probability model which is designed to characterize the distribution of the solution space. Specifically, for the packing subproblem, a skyline-based bin packing algorithm is utilized to assess the feasibility of packing items for a given route. For the routing subproblem, the probability matrix generated by IEDA guides the global search. Furthermore, to improve local exploitation capabilities, a variable neighborhood search operator is integrated into the IEDA algorithm, enabling a finegrained search. The simulation results indicate that the proposed IEDA outperforms the classic baseline algorithms across different categories of benchmark instances.

Keywords—2D packing problem, capacitated vehicle routing problem, skyline algorithm, estimation of distribution algorithm, variable neighborhood search.

[SF-TS5-5][0240] Comparative Performance of Finetuned ImageNet Pre-trained Models for Electronic Component Classifications

Time: 10:10am-10:20am, October 22nd, U.S. Eastern Daylight Time

Author(s): **Yidi Shao, Longfei Zhou, Fangshuo Tang, Xinyi Shi, Dalang Chen, Shengtao Xia**

Abstract: Electronic component classification and detection are crucial in manufacturing industries, significantly reducing labor costs and promoting technological and industrial development. Pre-trained models, especially those trained on ImageNet, are highly effective in image classification, allowing researchers to achieve excellent results even with limited data. This paper compares the performance of twelve ImageNet pretrained models in classifying electronic components. Our findings show that all models tested delivered respectable accuracies. MobileNet-V2 recorded the highest at 99.95%, while EfficientNetB0 had

the lowest at 92.26%. These results underscore the substantial benefits of using ImageNet pre-trained models in image classification tasks and confirm the practical applicability of these methods in the electronics manufacturing sector.

Keywords—electronic component, machine learning, convolutional neural network, image classification.

[SF-TS5-6][6093] Real-time Defect Detection for Fused Deposition Modeling based on Machine Learning

Time: 09:20am-09:30am, October 22nd, U.S. Eastern Daylight Time

Author(s):**Wenqiang Ge, Longfei Zhou, Hao Zhang, Yujie Ren and Liyuan He**

Abstract: FDM (Fused Deposition Modeling) 3D printing technology, as a type of additive manufacturing technology, is widely used in industrial production and scientific research and education. However, many potential problems in the printing process, such as nozzle clogging and material supply interruption, often lead to printing failure, which seriously affects productivity. In order to solve these problems, this paper proposes an artificial intelligence model RAN based on ResNet_50, which realizes the integration of ResNet_50 and Alex net model for detecting defects in the FDM 3D printing process. By introducing the time window strategy in the RAN model, the prediction level is smoother by modifying the model to improve the accuracy on the one hand and at the same time by introducing the time window strategy in the RAN model. Finally, the classification ability of the two types of images in the data is compared, pointing out the deficiencies in the model, and future models can be more diversified to collect information in order to have better classification ability.

Keywords—FDM 3D printing, defect detection, ResNet 50, AlexNet, additive manufacturing, machine learning, time window.

[NR-TS5-7][3099] Double Deep Q-network Adaption Based Dynamic Task Scheduling in Manufacturing Workshops

Time: 09:40am-09:50am, October 22nd, U.S. Eastern Daylight Time

Author(s):**Chang He, Longfei Zhou, Runtong Wu, Xiuwen Xu and Ning Zhang**

Abstract: Machining workshop computer aided process planning (CAPP) is quite common in general factories crossing various industries, such as automobile, food processing, and textile factories. Current scheduling methods are limited by varying process environments and operations. This paper presents a flexible and demand-

based CAPP using Double Deep Q-network. During robustness testing, the system reveals a workshop containing three kinds of workpieces and five kinds of machines which constitutes three kinds of work operations. Eventually, this research represents an alternative to JSP and the traditional scheduling strategy. It also provides a more flexible system and has the potential to improve workshop scheduling efficiency, and it can be adapted to more application scenarios. To achieve our results, to begin with, we set a background for the CAPP research. We then adapt the Double Deep Q-network (DDQN) to the dispatching rules we produce to obtain a suitable dispatching rule when confronting various process and demands. We eventually conclude a CAPP that can be widely used, and we also present the method regarding adapting the rule to different circumstances. The advantage of our CAPP has been emphasized by comparing the performance of our DDQN and the traditional dispatching rule.

Keywords—job shop scheduling, reinforcement learning, dynamic scheduling, real-time systems, manufacturing, double deep q-network.

[SF-TS5-9][9782] Automatic Leveling in DMLS Based on Deep Neural Networks

Time: 10:20am-10:30am, October 22nd, U.S. Eastern Daylight Time

Author(s):**Xinyue An, Baobao Li, Kewen Shi, Difeng Hou, Yuwei Ni, Jinyu Yan, Shaoxiang Zhu,Xiaoahan Sun, Xinyun Fang,Zhe Wang, Naifan Ye, Yi Wu, Dan Zengloudan, Dawei Qiao,Jiahao Shen, Tiao Qiu and Longfei Zhou**

Abstract: This study aims to explore how deep learning technology can be utilized to achieve automatic leveling in the Direct Metal Laser Sintering (DMLS) process. By transforming the complex task of automatic leveling into an image classification problem, we developed and implemented a priority-based strategy to relabel the training dataset, ensuring the quality and relevance of the data. On this foundation, we evaluated various deep learning architectures, including classic models such as ResNet and VGG, as well as the more recently emerged Vision Transformer (ViT) models.To further enhance the model's performance, we drew on previous research findings and introduced the Convolutional Block Attention Module (CBAM) attention mechanism into the ResNet18 architecture. The addition of CBAM enabled the model to focus more effectively on key features within images, thereby significantly improving its recognition accuracy in the task of automatic leveling. Experimental results demonstrated that the improved model achieved notably higher accuracy in automatic leveling compared to models without the CBAM mechanism, fully validating the tremendous potential of deep learning methods in realizing precise automatic leveling in the DMLS process.The method proposed in this study not only greatly increased the level of automation and reduced the frequency of required human intervention but also significantly enhanced the consistency and reliability of the DMLS process. This provides strong support for

future technological innovations and lays a solid theoretical foundation for practical industrial applications.

***Keywords*—**automatic leveling, ResNet, VGG, ViT, CBAM.

[SF-TS5-1][7539] Research on Tool Optimization Evaluation Model Based on Combination Weighting

Time: 09:15am-09:30am, October 19th, U.S. Eastern Daylight Time

Author(s): **Enze Dong, Bin Xia and Yanyan Li**

Abstract: The decision-making process for tool selection involves numerous indicators and is susceptible to subjective factors. This paper proposes integrating game theory concepts, combining the Analytic Hierarchy Process (AHP) with the entropy weight method for combined weighting to reduce subjective influence. Key evaluation indicators for tool selection are selected, and a game theory combined weighting TOPSIS tool evaluation and selection model is constructed by integrating TOPSIS theory. The model is validated through a practical case: when the workpiece material is TC11, the ideal proximity value of the optimal tool M15 is 0.6006. The results demonstrate that the model possesses rationality and practicality in optimal tool selection.

***Keywords*—**optical components, machining process, tool adaptation.

[SF-TS5-2][6435] Safety Margin Assessment Model for Surface Cracks Based on Path Rate Integral Method

Time: 09:30am-09:45am, October 19th, U.S. Eastern Daylight Time

Author(s): **Jiayin Fu, Yanyan Li, Zhehao Wang, and Ling Chen**

Abstract: Pressure vessel is a common important equipment in industrial production, in the production process by the equipment itself material properties, pressure environment, work in the medium and other complex effects, resulting in the emergence of different defects in the form of surface cracks is a common form of defects in pressure vessels. Although the safety assessment of crack defects has already formed a certain system, most of them are quantitative judgments, and there are fewer studies on the quantitative characterisation of the safety margin or

remaining life of crack defects in pressure equipment. In this paper, an extended study is carried out on the basis of the theory of failure assessment diagram, and the remaining safety margin of surface crack defects in the whole process of fatigue failure is investigated. Using the numerical characterisation calculation method of the failure assessment diagram, the safety margin model of the path rate integral is established by analysing the transient relation equation and differential calculation, and further exploring the safety decay path with the help of practical examples. The results show that the model characterises the safety margin more accurately and is more in line with engineering applications.

Keywords—autoclave, surface crack, safety margin, path rate integral method

[SF-TS5-3][3111] Optimization Analysis of In-situ Fidelity Coring Drill Bit Structure for Subsea Gas Hydrates

Time: 09:45am-10:00am, October 19th, U.S. Eastern Daylight Time

Author(s): **Shaojie Zhong, Tianen Yang, Fuda Sun and Ling Chen**

Abstract: The breakdown of natural gas hydrates in deep-sea environments is significantly influenced by variations in temperature and pressure. It is currently only possible to utilize existing international coring equipment for pressure preservation coring; as such, it is unable to obtain samples in fidelity conditions, preventing the accurate determination of its physical mechanics and other parameters, which in turn limits the effective development and utilization of natural gas hydrate resources. The coring drill bit designed for natural gas hydrate is the critical component of fidelity coring equipment, as it maintains direct and continuous contact with the rock layer throughout the coring process. To facilitate more effective access to deep-sea gas hydrates in their in-situ storage environment, this paper proposes a four-wing composite step coring bit structure, designed to accommodate the unique storage characteristics of hydrates. Additionally, a model for drilling and coring natural gas hydrates has been established to identify the ideal structural parameters for the drill bit. Finally, the impact of the number of steps in the bit on the stress and temperature of hydrates has been analyzed. The findings suggest that increasing the number of drilling steps diminishes the effects of hydrate stress and temperature, which in turn enhances the accuracy of coring. The composite step coring bit experiences maximum compressive and tensile stresses of 144 MPa and a temperature of 5.14 degree celcius, respectively. In contrast, the non-step bit demonstrates higher maximum stress and temperature values of 183 MPa

and 10.19 degree celcius, respectively. The composite stepped bit demonstrated a notable reduction in hydrate stress and temperature, reaching approximately 23 percent and 50 percent lower levels compared to the non-step core bit. This research lays the groundwork for the continued advancement and enhancement of future fidelity coring apparatus.

Keywords—natural gas hydrates, fidelity coring bit, Finite Element Analysis (FEA) simulation, structure.

[SF-TS5-4][2965] A Mobile Equipment Management System based on Internet of Things Technology

Time: 10:00am-10:15am, October 19th, U.S. Eastern Daylight Time

Author(s): **Qian Li**

Abstract: With the widespread adoption of mobile equipment, the scope of the operating environment has expanded and became increasingly diverse, presenting greater challenges for the safe transportation and utilization of mobile equipment. This paper designed a mobile equipment management system with physical level, Internet-of-Things level, data level, service level, and application level. Six key modules are designed and implemented, including the basic data module, the transportation and storage management module, alarm configuration module, the visualization module, the statistics module, and the rights management module. In addition, four safety maintenance rules combined with an electronic fence suite are introduced to maintain the reliable use, transportation, and storage of mobile equipment. The system has been implemented and applied to practical scenarios to show its effectiveness and efficiency.

Keywords—Internet-of-Things system architecture, device transportation and storage, safety maintenance, electronic fence.

Session [TS6]: Smart Agriculture

Time: 08:00am - 11:10am, October 22nd, U.S. Eastern Daylight Time
Meeting Room (Microsoft Teams): [TS6] IEEE UV2024 Session
Chair(s): Yu Zhang (The University of Tokyo)
Assistant: Zhenqian Huang, Yuxuan Chen

Meet Our Speakers

Session Overview: At present, the global food security is extremely arduous. This session believes that the mankind should focus on the global major strategic needs, stabilize the agricultural fundamentals in order to calmly respond to the changes in the century, and then to promote the stable and healthy development of the economy and society. Therefore, we need comprehensively promote rural revitalization and improve the steadily-increased income of farmers, and ensure stable -increased agricultural production by the technologies and production system, namely Smart Agriculture, which farming processes more intelligent and increase the quantity and quality of products while reducing consumption.

- **Agenda [EDT]**
  1. **[08:00am-08:10am][Oct.22][TS6][K-1]** ***Yu Zhang*****,** *Session Chair;* Opening and Speech
  2. **[08:10am-08:40am][Oct.22][TS6][K-2]** ***Wenjiang Huang*****,** *Invited Speaker*; Remote sensing monitoring and early warning of vegetation biosecurity
  3. **[08:40am-09:10am][Oct.22][TS6][K-3]** ***Weiwei Wan*****,** *Invited Speaker*; AI driven robot manipulators for lab automation
  4. **[09:10am-09:40am][Oct.22][TS6][K-4]** ***Zhao Zhang*****,** *Invited Speaker*; AI-Powered Apple Production in China
  5. **[09:40am-10:10am][Oct.22][TS6][K-5]&[SF-TS6-2][1316]** ***Pei Wang*****,** *Invited Speaker; Author;* Weed29: a weed dataset for machine learning
  6. **[10:10am-10:40am][Oct.22][TS6][K-6]** ***Hainie Zha*****,** *Invited Speaker*; Using data-driven models to achieve efficient utilization of crop fertilizers and water
  7. **[10:40am-11:10am][Oct.22][TS6][K-7]** ***Yu Zhang*****,** *Invited Speaker*; Smart Agriculture Production in Japan based on AI, IoT and Big Data

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  8. **[10:15am-10:30am][Oct.19][SI-TS6-1][6712]** ***Takudzwa Tarutira,Israel Alagbe,Jessica Ezemba*****,** ***Ellon Berhanu,Emmanuel Ndashimye*** *Author*; Baboon Detection for Smart Agriculture Using Deep Learning Algorithms

[TS6][K-1] Opening and Speech

Time: 08:00am-08:10am, October 22nd, U.S. Eastern Daylight Time
Invited Speaker(s): **Yu Zhang,** *Session Chair*

[TS6][K-2] Remote sensing monitoring and early warning of vegetation biosecurity

Time: 08:10am-08:40am, October 22nd, U.S. Eastern Daylight Time
Invited Speaker(s): **Wenjiang Huang**

[TS6][K-3] AI driven robot manipulators for lab automation

Time: 08:40am-09:10am, October 22nd, U.S. Eastern Daylight Time
Invited Speaker(s): **Weiwei Wan**

[TS6][K-4] AI-Powered Apple Production in China

Time: 09:10am-09:40am, October 22nd, U.S. Eastern Daylight Time
Invited Speaker(s): **Zhao Zhang**

[TS6][K-5] & [SF-TS6-2][1316] Weed29: A Weed Dataset for Machine Learning

Time: 09:40am-10:10am, October 22nd, U.S. Eastern Daylight Time
Invited Speaker(s): **Pei Wang**

Author(s): **Weiyue Chen, Qi Niu, Hui Li, Lihong Wang, Chengsong Li and Pei Wang**

Abstract: Weeds are a major threat to crop growth, necessitating accurate identification for intelligent weeding methods such as mechanical removal, targeted spraying, and laser-based approaches. However, existing weed datasets are often limited in species diversity and geographic coverage. To address this, we propose Weed29, a large-scale weed image dataset containing 15,204 annotated images across 29 common weed species from cornfields, rapeseed fields, and lawns in southwestern China, captured under diverse environmental conditions and growth stages. Building upon this dataset, we designed an improved detection model, YOLOv7-CA, by integrating Coordinate Attention into the YOLOv7 backbone. The proposed model achieved a mean Average Precision (mAP) of 93.4 percent, outperforming existing benchmarks in both accuracy and inference speed. These results demonstrate the practical potential of Weed29 and YOLOv7- CA in real-time, field-level weed recognition. Limitations remain in detecting small or visually

similar weeds under extreme conditions, which we aim to address in future work. Overall, this study offers a valuable dataset and model for advancing precision agriculture and intelligent weeding systems.

Keywords—Weed29, weed dataset, YOLOv7, weed identification.

[TS6][K-6] Using data-driven models to achieve efficient utilization of crop fertilizers and water

Time: 10:10am-10:40am, October 22nd, U.S. Eastern Daylight Time
Invited Speaker(s): **Hainie Zha**

[TS6][K-7] Smart Agriculture Production in Japan based on AI, IoT and Big Data

Time: 10:40am-11:10am, October 22nd, U.S. Eastern Daylight Time
Invited Speaker(s): **Yu Zhang**

[SI-TS6-1][6712] Baboon Detection for Smart Agriculture Using Deep Learning Algorithms

Time: 10:15am-10:30am, October 19th, U.S. Eastern Daylight Time

Author(s): **Takudzwa Tarutira, Israel Alagbe, Jessica Ezemba, Ellon Berhanu and Emmanuel Ndashimye**

Abstract: Agriculture, contributing 30–40% to Africa's GDP and supporting over 60% of its population, faces severe threats from wildlife foraging, with baboons causing significant crop losses. In Uganda alone, 65% of small-scale farmers report substantial yield reductions due to baboon raids, with losses estimated at $100-$500 per smallholder farmer annually. Traditional deterrent methods, such as fences and sentries, are laborintensive, costly, and often ineffective due to baboons' adaptability. This study presents an approach to mitigate baboon-related crop damage using state-of-the-art deep learning algorithms and the Internet of Things (IoT). We trained and compared multiple iterations of You Only Look Once (YOLO) models: YOLOv8- S, YOLOv9-S and YOLOv10-S for real-time baboon detection, utilizing a custom dataset of images collected from various locations in Rwanda. The best-performing model, YOLOv10- S, achieved the highest accuracy in baboon detection. Our system integrates this deep learning model with edge computing capabilities on a Raspberry Pi 4 Model B, enabling inference with the model even in remote farm fields. Upon detecting baboons, the system activates acoustic deterrents and instantly alerts field guards via the short messaging service (SMS)

through a GSM module. Our results show that this approach can offer an efficient and scalable solution to baboon foraging in agricultural settings in Africa while minimising human-wildlife conflict. This research not only aims to enhance food security and economic stability for African farmers but also to provide a replicable framework to address wildlife-related agricultural challenges globally.

Keywords—baboon detection, deep learning, artificial intelligence, internet of things.

Session [TS7-A]: Smart Ecological and Environmental Systems

Time: 08:30am - 09:30am, October 22nd, U.S. Eastern Daylight Time
Meeting Room (Microsoft Teams): [TS7-A] IEEE UV2024 Session
Chair(s): Pengcheng Fu （Hainan University)
Assistant: Zhongda Wang

Meet Our Speakers

Session Overview:

- Environmental protection: exhaust/ wastewater/ solid waste management; pollution control (air/ water/ soil; light/ noise/ radiation); effective microorganism technology; green roofs
- Challenges and solutions for climate change; restoration and protection of ecosystems; ecological economics and strategies; ecological informatics and acoustics.

- **Agenda [EDT]**
    1. **[08:30am-09:10am][Oct.22][TS7-A][K-1]** ***PengCheng Fu*****,** *Session Chair;* Opening and Speech
    2. **[09:10am-09:30am][Oct.22][TS7-A-1][3313]** ***Wuyang Zhang, Ming Luo, Zibin Chen*****,** *Author;* Hybrid Forecasting: ML Predictions of Lake-Effect Regional Extreme Precipitations

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3. **[10:15pm-10:30pm][Oct.18][SF-TS7-A-1][2217]** ***Samuel Yu*****,** *Presenter;* An investigation into how creating a smart app for fitness will affect dietary health
4. **[09:20pm-09:35pm][Oct.21][SF-TS7-A-2][4026]** ***Cecilia Zhang and Ruiyang Zhang***, *Presenter*; Evaluation of Smart Environmental Protection Systems and UV-Oriented Solution for Integration, Resilience, Inclusiveness and Sustainability

[TS7-A][K-1]Opening and Speech

Time: 08:30am-09:10am, October 22nd, U.S. Eastern Daylight Time

Invited Speaker(s): **PengCheng Fu,** *Session Chair*

[TS7-A-1][3313] Hybrid Forecasting: ML Predictions of Lake-Effect Regional Extreme Precipitations

Time: 09:10am-09:30am, October 22nd, U.S. Eastern Daylight Time

Author(s): **Wuyang Zhang, Ming Luo, Zibin Chen**

Abstract*:* Lake-effect snow events can produce extreme snowfall rates exceeding 5 inches per hour, severely impacting Great Lakes communities. Current forecasting methods face critical limitations: operational NWP models provide only 12–24 hour advance warning with limited accuracy for severe events, while their computational demands often exceed the time available for deployment. We present a hybrid deep learning framework that extends lake-effect precipitation forecasting from 24 to 72 hours while achieving 77.6 percent accuracy for severe events—a 26.9 percentage point improvement over traditional methods. Our approach combines three key innovations: (1) 72-hour observation windows that capture complete atmospheric evolution cycles, (2) multimodal fusion of visible, near-IR, and IR satellite imagery with GAN-based nighttime synthesis for continuous monitoring, and (3) hybrid ConvLSTM architecture with transformer-based feature integration. Evaluated on 11 years of Lake Michigan data (2006–2017), our model achieves 81.3 percent overall accuracy while requiring only 3.5 hours of computation—a 20–60× speedup over NWP methods. This efficiency enables operational deployment on standard GPU hardware, democratizing advanced forecasting for resource-limited weather services. The extended forecast horizon provides emergency managers critical lead time, with potential annual savings of $2.3 million per county based on improved emergency response efficiency and reduced storm-related damages.

Keywords—time series forecasting, machine learning, multimodal machine learning, computer vision.

[SF-TS7-A-1][2217] An investigation into how creating a smart app for fitness will affect dietary health

Time: 10:15pm-10:30pm, October 18th, U.S. Eastern Daylight Time
Presenter(s): **Samuel Yu**

Abstract: The rise in diet-related diseases and the increasing environmental harm caused by human activities, coupled with the abundant food waste resulting from overconsumption and unregulated purchasing habits, highlight the urgent need for innovative solutions. It is imperative to raise public awareness of these issues and innovate our lifestyle accordingly. This paper aims to address this need by proposing the design of a smart system that educates the general public about carbon footprint and macronutrients in their daily diet, while providing personalized guidance to mitigate health concerns such as obesity and related conditions, including cardiovascular disease (CVD) and diabetes. The proposed design seeks to integrate the functionalities of a carbon footprint tracker with those of a calorie counter or recipe generator, offering a comprehensive tool for users. This approach can help reduce users' carbon footprints by recommending recipes that are both low in environmental impact and rich in essential healthy macronutrients, such as protein, while being low in saturated and trans fats. To tailor recommendations to individual users' fitness needs and preferences, the

system will employ information feedback loops and databases to respond effectively to user feedback. Furthermore, the design will include inclusivity features, such as options for dietary restrictions like vegan or vegetarian diets, and will take into account a user's body type to provide more accurate and personalized suggestions. In summary, this preliminary study and proposed framework aim to educate the public on sustainable and healthy consumption habits, contributing to the regulation of diets and the reduction of both environmental and dietary harm.

[SF-TS7-A-2][4026]Evaluation of Smart Environmental Protection Systems and UV-Oriented Solution for Integration, Resilience, Inclusiveness and Sustainability

Time: 09:20pm-09:35pm, October 21st, U.S. Eastern Daylight Time
Presenter(s): **Cecilia Zhang and Ruiyang Zhang**

Session [TS7-B]: Mobility Enabled Material Cycles, the Circular Economy, Trash and Scrap Collection, Processing, Reuse, and Recycling

Time: 09:30am - 11:00am, October 22nd, U.S. Eastern Daylight Time
Meeting Room (Microsoft Teams): [TS7-B] IEEE UV2024 Session
Chair(s): Tian Tan (Doctor Scrap)
Assistant: Zhongda Wang

Meet Our Speakers

Session Overview: Recycling is a very old and way outdated industry. Scrap's unknown and anti-digitize nature is the biggest reason that the recycling industry is almost disconnected from modern technology. Information is so hard to travel in the current recycling system since the common "language" in the industry is photo instead of word. This gives AI+CV an angle to decode scrap photos and turn all hidden scrap information to numbers. Digitization empowered by AI will build a new world for recycling.

- **Agenda [EDT]**
  1. **[09:30am-10:00am][Oct.22][TS7-B][K-1]** ***Tian Tan*****,** *Session Chair; Opening and Speech*
  2. **[10:00am-10:30am][Oct.22][SI-TS7-B-1][0476]** ***Tian Tan, Yuan Zhou, and Mingchao Fang,****Author;* A Fully Automated Scrap Recognition Method Based on Convolutional Neural Networks
  3. **[10:30am-11:00am][Oct.22][TS7-B][K-2]** ***Jane Chen*****,** *Invited Speaker;* How AI will change the Metal recycling industry

[TS7-B][K-1] Opening and Speech

Time: 09:30am-10:00am, October 22nd, U.S. Eastern Daylight Time
Invited Speaker(s): **Tian Tan,** *Session Chair*

[SI-TS7-B-1][0476] A Fully Automated Scrap Recognition Method Based on Convolutional Neural Networks

Time: 10:00am-10:30am, October 22nd, U.S. Eastern Daylight Time
Invited Speaker(s): **Tian Tan,** *Session Chair*

Author(s): **Tian Tan, Yuan Zhou, and Mingchao Fang**

Abstract: As global scrap management challenges intensify, traditional recycling systems encounter inefficiencies and resource loss. The application of artificial intelligence (AI) technologies presents new opportunities to optimize the recycling process. This paper explores the use of AI in recycling, focusing on intelligent scrap classification and metal content detection, thereby enhancing recycling efficiency and reducing environmental impact. Additionally, this paper proposes a fully automated scrap recognition method. Experimental results show that this method was tested on a dataset of 50,0000 images covering 260 types of scrap, achieving a top-1 recognition rate of eighty-five point three percent and a top-3 recognition rate of ninety-seven point three percent.

Keywords—scrap recognition, recycling, object detection, computer vision.

[TS7-B][K-2] How AI will change the Metal recycling industry

Time: 10:30am-11:00am, October 22nd, U.S. Eastern Daylight Time
Invited Speaker(s): **Jane Chen**

Session [TS8-A]: Smart Homes and Community, Virtual Living & Session [TS8-B]: Mobility, Connectivity, and Innovative Lifestyles

Time: 06:00am - 11:35am, November 16th, U.S. Eastern Daylight Time
Meeting Room (Microsoft Teams): [TS8-A & TS8-B] IEEE UV2024 Session
Chair(s): Ji Ma (Dean, Training College, Ihawk Intelligent Health Tech. Co.)
Assistant(s): Yuezhi Luo, Guangjun Zeng, Zhongda Wang

Meet Our Speakers

Session Overview: Population aging is a prominent social problem in the world today, and it is also a comprehensive social phenomenon. To deal with and solve the many challenges and problems of the aging society, there must also be comprehensive countermeasures, the improvement and cooperation of various systems and mechanisms, and the coordination of various forces such as the government, the market, and nonprofit organizations, communities, and families, jointly dealt with. More and more people realize that solving the problem of an aging society requires interdisciplinary collaboration to provide solutions with more innovative wisdom and technical warmth. Through the discussions of experts from different backgrounds in IEEE UV2024, we are more convinced that relying on artificial intelligence products and technologies for smart old-age care, from point. to point, will make the lives of older people easier and happier.

- **Agenda [EST]**
  1. **[06:00am-06:05am][Nov.16][TS8][K-1]** ***Ji Ma*****,** *Session Chair;* Welcome and Introduction
  2. **[06:05am-06:40am][Nov.16][TS8-A][K-2]** ***Qing Li*****,** *Invited Speaker;* From a Feeling to a Science Effects of Forest Bathing/Shinrin-Yoku on Human Health
  3. **[06:40am-07:15am][Nov.16][TS8-A][K-3]** ***Bin Zhu*****,** *Invited Speaker;* Interaction Design for Mindfulness
  4. **[07:15am-07:50am][Nov.16][TS8-A][K-4]** ***Ming Chen*****,** *Invited Speaker;* The effect of Calligraphy in Health Promotion
  5. **[07:50am-08:25am][Nov.16][TS8-A][K-5]** ***Lijun Tang*****,** *Invited Speaker;* The Effects of Tai Chi on Health
  6. **[08:25am-09:00am][Nov.16][TS8-A][K-6]** ***Lin Li*****,** *Invited Speaker;* Sleep and Health: Prevention and management of sleep disorders from an interdisciplinary perspective
  7. **[09:00am-09:35am][Nov.16][TS8-A][K-7]** ***Ji Ma*****,** *Session Chair;* The Role of Sleep in Effective Diabetes Management
  8. **[09:35am-10:10am][Nov.16][TS8-A][K-8]** ***Huihui Wang*****,** *Invited Speaker;* Sleep Quality Matters: Daily Reciprocal Relations between Sleep Quality and Emotional Attention Bias
  9. **[10:10am-10:45am][Nov.16][TS8-B][K-9]&[SI-TS8-B-6][8295]** ***Yan Tang,*** *Presenter;* A Study on the Heart Rate Characteristics and Patterns in Shuttlecock Kicking Sport among Young People
  10. **[10:45am-11:00am]** Discussion
  11. **[11:00am-11:35am][Nov.16][TS8-A][K-10]** ***Abe Abdul*****,** *Invited Speaker;* Smart Dental Care

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12. **[08:05pm-08:20pm][Oct.18][K12-1][SF-TS8-B-5][8240]** ***Jiajun Luo,*** *Presenter; Innovative Low-Cost Bath Chair for Safer Home Care of the Elderly*
13. **[08:20pm-08:35pm][Oct.18][K12-2][SF-TS8-B-6][0431]** ***Jiajun Luo,*** *Presenter; Raspberry Pi and Sensor Tech to Assess Sidewalk Accessibility*
14. **[08:35pm-08:50pm][Oct.18][K12-3][SF-TS8-A-1][8306]** ***Ailun Liu*****,** *Presenter;* Design and Implementation of an Intelligent Fish Tank System
15. **[08:50pm-09:05am][Oct.18][SF-TS8-A][K-1]** ***Zhenyao Liu***, *Invited Presenter*, Towards Intelligent Systems: A Review of Human Activity Recognition Methods and Applications
16. **[09:05pm-09:20pm][Oct.18][SF-TS8-B-1][0273]** ***Lanxin Chen*****,** *Presente*r; Empowering Safety: Smart Technology's Role in Combating Sexual Harassment in Smart City Emergency System
17. **[09:20pm-09:35pm][Oct.18][SF-TS8-B-2][4053]** ***Siying Qu,*** *Presenter;* The Role and Future Prospects of Complementary and Alternative Medicine in the Treatment of Chronic Diseases
18. **[09:35pm-09:50pm][Oct.18][SF-TS8-B-3][7695]** ***Yuezhi Luo and Hongyin An*****,** *Presenter;* Adaptive Health Monitoring and Personalized Care: Intelligent Systems in Disease Management
19. **[09:50pm-10:05pm][Oct.18][SF-TS8-B-7][4448]** ***Yuezhi Luo and Qipei Chen,*** *Presenter;* Smart Healthcare: Sleep Monitoring and Improving

[TS8][K-1] Welcome and Introduction

Time: 06:00am-06:05am, November 16th, U.S. Eastern Daylight Time
Invited Speaker(s): **Ji Ma,** *Session Chair*

[TS8-A][K-2] From a Feeling to a Science Effects of Forest Bathing/Shinrin-Yoku on Human Health

Time: 06:05am-06:40am, November 16th, U.S. Eastern Daylight Time
Invited Speaker(s): **Qing Li**

Abstract: Researchers in Japan have tried to find a new method to reduce stress by visiting forests and have proposed a new concept called “Shinrin-Yoku r Forest Bathing”.
Shinrin in Japanese means ‘forest’, and yoku means ‘bath’. So shinrin-yoku means bathing in the forest atmosphere, or taking in the forest through our senses. This is not exercise, or hiking, or jogging. It is simply being in nature, connecting with it through our sense of sight, hearing, taste, smell and touch. Shinrin-Yoku is like a bridge. By opening our senses, it bridges the gap between us and the natural world.
In Japan, since 2004, serial studies have been conducted to investigate the effects of Forest Bathing/Shinrin-Yoku on human health. We have established a new medical science called Forest Medicine. The Forest Medicine is a new interdisciplinary science, belonging to the categories of alternative medicine, environmental medicine and preventive medicine, which studies the effects of forest environments (Forest Bathing/Shinrin-Yoku/Forest Therapy) on human health. It has been reported that Forest Bathing/Shinrin-Yoku (forest therapy) has the following beneficial effects on human health:
1. Shinrin-Yoku boosts immune function by increasing human natural killer (NK) activity, the number of NK cells, and the intracellular levels of anti-cancer proteins, suggesting a preventive effect on cancers.
2. Shinrin-Yoku reduces stress hormones, such as urinary adrenaline and noradrenaline and salivary/serum cortisol contributing to stress management.
3. Shinrin-Yoku improves sleep.
4. Shinrin-Yoku shows preventive effect on depression by improving positive feelings and serotonin in serum and reducing negative emotions.
5. Shinrin-Yoku reduces blood pressure and heart rate showing preventive effect on hypertension.
6. Shinrin-Yoku may apply to rehabilitation medicine.
7. Shinrin-Yoku in city parks also has benefits on human health.
8. Shinrin-Yoku has preventive effect on lifestyle related diseases by reducing stress.
9. Shinrin-Yoku shows preventive effect on COVID-19 by reducing stress and boosting immune function.
10. Phytoncides (aroma from trees) play an important role in Shinrin-Yoku.

[TS8-A][K-3] Interaction Design for Mindfulness

Time: 06:40am-07:15am, November 16th, U.S. Eastern Daylight Time
InvitedSpeaker(s): **Bin Zhu**

Abstract: Mindfulness is becoming a buzzword in lifestyle and health, but what if we could take it further—blending it with technology and design? In this talk, I'll dive into how we can integrate mindfulness and Chinese aesthetics to create more meaningful interactions with biodata. Imagine using biodata not to judge our bodies, but to experience them with awareness and calm. I’ll share our design projects that apply Eastern aesthetics, leading to mindful interaction. This approach focuses on

non-judgmental, rhythmic engagement and aesthetic representation, helping even beginners anchor their attention and experience their bodies without pressure. We explore how these innovative designs might just change the way we approach mindfulness in everyday life.

[TS8-A][K-4]The effect of Calligraphy in Health Promotion

Time: 07:15am-07:50am, November 16th, U.S. Eastern Daylight Time
Invited Speaker(s): **Ming Chen**

Abstract: Based on the theory proposed in my book "Modern Calligraphy Theory (Four Volumes)" and decades of personal experience in calligraphy study, this paper adopts a systematic and scientific multidisciplinary analysis method that compares contemporary Chinese and Western styles and combines them to propose a theory on the efficacy of calligraphy in promoting physical health and longevity. Analyzing the mechanism of calligraphy's effects on health and longevity from various aspects such as the organic structure of the integration of subject and object in Chinese characters, the operation of the Tai Chi system in calligraphy, and the aesthetic characteristics of calligraphy, especially my personal theoretical proposal to introduce static qigong into calligraphy, the combination of dantian luck, the combination of internal and external body movements, the combination of up and down movements, and the movement of the whole body, has new value worth developing. Analyzed the main role of calligraphy in promoting health and longevity: (1) calming breath. (2) Helps with sleep. (3) Gentle body (4) strengthens legs and feet. (5) Promote metabolism. 6. Protect your facial features. (7) Skincare nail (8) enhances sexiness. (9) Thin body shape (10) with strong awareness.

[TS8-A][K-5] The Effects of Tai Chi on Health

Time: 07:50am-08:25am, November 16th, U.S. Eastern Daylight Time
Invited Speaker(s): **Lijun Tang**

[TS8-A][K-6] Sleep and Health: Prevention and management of sleep disorders from an interdisciplinary perspective

Time: 08:25am-09:00am, November 16th, U.S. Eastern Daylight Time
Invited Speaker(s): **Lin Li**

[TS8-A][K-7] The Role of Sleep in Effective Diabetes Management

Time: 09:00am-09:35am, November 16th, U.S. Eastern Daylight Time
Invited Speaker(s): **Ji Ma,** *Session Chair*

[TS8-A][K-8] Sleep Quality Matters: Daily Reciprocal Relations between Sleep Quality and Emotional Attention Bias

Time: 09:35am-10:10am, November 16th, U.S. Eastern Daylight Time
Invited Speaker(s): **Huihui Wang**

[TS8-B][K-9] & [SI-TS8-B-6][8295] A Study on the Heart Rate Characteristics and Patterns in Shuttlecock Kicking Sport among Young People

Time: 10:10am-10:45am, November 16th, U.S. Eastern Daylight Time
Invited Speaker(s): **Yan Tang**

Author(s): **Yan Tang, Jingxin Nie, Yan Fang, Zhanjia Zhang and Junwei Qian**

Abstract: The inheritance and development of shuttlecock sport needs the integration of modern science and technology. In this paper, the heart rate characteristics of college students during shuttlecock kicking and its evolution process of heart rate during 10 weeks were studied by Polar heart rate testing watch. The subjects were 90 male and female college students in three classes in a semester. In each week, the total number of shuttlecock kicking in three minutes and the maximum number of one time consecutive shuttlecock kicking, as well as the change of heart rate of students who kicking shuttlecock for three minutes were counted and analyzed. The results showed that the average maximum heart rate of shuttlecock kicking for three minutes was 159.7 times/min, which corresponded to moderate-to-vigorous intensity aerobic exercise. The subjects' heart rates gradually increased in the first 3-4 weeks of the course, and then gradually decreased. The maximum heart rate in the first 3 weeks was less than that in the last 3 weeks. The total number of 3-minute shuttlecock kicking ($P = 0.000 < 0.01$) and the number of one time continuous shuttlecock kicking ($P = 0.027 < 0.02$) increased significantly. It indicated the body function economization after long-term shuttlecock kicking. The last minute average heart rates of the students with poor foundation and good foundation of shuttlecock kicking decreased significantly, while the ones of the students with normal foundation increased. Heart rate can reflect the different training levels of shuttlecock kicking. The heart rate increases in the initial adaptation and the intermediate advanced processes. Then, after reaching a certain level, the phenomenon of functional saving happens.

Keywords—college student；kicking shuttlecock；polar watch；heart rate

[TS8-A][K-10] Smart Dental Care

Time: 11:00am-11:35am, November 16th, U.S. Eastern Daylight Time
Invited Speaker(s): **Abe Abdul**

[SF-TS8-B-5][8240] Innovative Low-Cost Bath Chair for Safer Home Care of the Elderly

Time: 08:05pm-08:20pm, October 18th, U.S. Eastern Daylight Time
Presenter(s): **Jiajun Luo**

Abstract: Developed an innovative bath chair specifically designed for elderly individuals who require assistance from caregivers during bathing. This bath chair is engineered to simplify the bathing process, making it safer and more manageable for both the caregiver and the elderly person. After conducting a thorough review of existing literature and market products, I found that there are no similar products that cater to home use while also being cost-effective. My design fills this gap, offering an affordable and practical solution that enhances safety and convenience in home care settings.

[SF-TS8-B-6][0431] Raspberry Pi and Sensor Tech to Assess Sidewalk Accessibility

Time: 08:20pm-08:35pm, October 18th, U.S. Eastern Daylight Time
Presenter(s): **Jiajun Luo**

Abstract: This study was motivated by personal experience during a summer program in Cambridge, Massachusetts, where suboptimal road conditions in the Allston area posed notable challenges for cycling. This experience highlighted broader accessibility concerns, particularly for individuals with mobility impairments who often lack reliable data on surface-level sidewalk conditions. A review of existing accessibility mapping tools, such as Wheelmap, OpenSidewalks, and AccessMap, revealed ongoing efforts to document infrastructure features relevant to wheelchair users. However, a critical gap remains in capturing fine-grained surface condition data. To address this need, this paper proposes a data collection system utilizing a Raspberry Pi integrated with GPS and gyroscopic sensors to assess sidewalk surface quality. The system is designed for use during cycling to generate spatially resolved condition metrics. The collected data can

inform accessibility planning, enrich existing mapping platforms, and ultimately support more inclusive urban navigation for individuals with disabilities.

Keywords—data aggregation, data rate reduction, sensor data processing, real-time data collection.

[K12-3][SF-TS8-A-1][8306] Design and Implementation of an Intelligent Fish Tank System

Time: 08:35pm-08:50pm, October 18th, U.S. Eastern Daylight Time
Presenter(s): **Ailun Liu**

Abstract: The rapid development of the Internet of Things (IoT) is fundamentally reshaping the smart home ecosystem, providing unprecedented levels of automation, monitoring, and control. In this field, smart fish tanks are a key application that solves the persistent challenge in aquarium farming: maintaining optimal water parameters to prevent fish mortality. Traditional manual management methods are notoriously unreliable, which highlights a significant problem demanding technological solutions. This paper presents the comprehensive design, implementation, and rigorous evaluation of an IoT-based Intelligent Fish Tank System. The system integrates multi-sensor arrays for continuous water quality monitoring (pH, conductivity, turbidity, temperature, dissolved oxygen), coupled with automated controllers (LED lighting, pump, aerator) and a remote mobile application interface. Leveraging the MQTT protocol for robust communication and featuring a custom 3D-printed enclosure, the system aims to provide a stable aquatic habitat while significantly reducing manual intervention and the risk of environmental failure. Also, this paper details the hardware architecture centered on an Xtensa LX6 dual-core processor, the modular software design, presents empirical stability assessment data, identifies potential failure modes, and proposes future enhancements, including AI-driven analytics and sustainable design integration.

Keywords—intelligent fish tank, Internet of Things (IoT), water quality monitoring, aquarium automation, sensor networks, realtime control, MQTT, smart homes, system stability, failure analysis.

[SF-TS8-A][K-1] Towards Intelligent Systems: A Review of Human Activity Recognition Methods and Applications

Time: 08:50pm-09:05pm, October 18th, U.S. Eastern Daylight Time
Invited Presenter(s): **Zhenyao Liu**

[SF-TS8-B-1][0273] Empowering Safety: Smart Technology's Role in Combating Sexual Harassment in Smart City Emergency System

Time: 09:05pm-09:20pm, October 18th, U.S. Eastern Daylight Time
Presenter(s): **Lanxin Chen**

Abstract: The study explores the current landscape of sexual harassment and examines potential solutions through the application of advanced technologies. This abstract summarizes the key discussions, focusing on the prevalence of sexual harassment, its impact, and the innovative technological approaches proposed to address these issues. Sexual harassment is a widespread global issue, occurring in various environments such as workplaces, educational institutions, and public spaces. The presentation begins by defining sexual harassment according to the United Nations as "unwelcome sexual advances, requests for sexual favors, and other verbal or physical harassment of a sexual nature." It categorizes harassment into verbal, non-verbal, cyber, and physical forms, emphasizing the diverse contexts in which these acts occur. The presentation highlights alarming statistics, including that nearly one in three women worldwide has experienced physical and/or sexual violence, often by intimate partners. In the U.S., the Equal Employment Opportunity Commission (EEOC) recorded nearly 98,411 harassment charges from 2018 to 2021, with 27,291 cases specifically involving sexual harassment. These figures underscore the pervasive nature of the problem and the significant challenges in combating it. Beyond the immediate physical harm, sexual harassment leads to severe psychological and emotional consequences. The presentation details the distress experienced by victims, including increased stress, diminished self-worth, and long-term conditions such as anxiety and post-traumatic stress disorder (PTSD). Economic impacts are also significant, with gender-based violence costing the European Union approximately EUR 366 billion annually, a substantial portion of which is attributed to sexual harassment. Despite existing regulations, such as India's Sexual Harassment of Women at Workplace (Prevention, Prohibition, and Redressal) Act, 2013, the presentation acknowledges the limitations in current measures and the persistent challenges in enforcement. This highlights the need for more effective and proactive strategies. The presentation introduces smart technology as a key solution to preventing and responding to sexual harassment. Proposed innovations include wearable devices, IoT (Internet of Things) technologies, and systems like Early Sexual Predator Detection (eSPD). These technologies aim to enhance safety through real-time monitoring, immediate alerts, and preventive actions. For instance, wearable devices such as smart bras and watches are equipped with sensors and GPS modules that detect assaults and send emergency signals to authorities or trusted contacts. The integration of AI and machine learning is emphasized to improve the accuracy and responsiveness of these systems. Additionally, the presentation discusses the role of large language models (LLMs) and federated learning in creating secure, trustworthy AI systems that can protect user privacy while effectively detecting and preventing harassment. However, the presentation also addresses the limitations and risks associated with

implementing these technologies, such as data privacy concerns, security breaches, and the need for robust data acquisition processes. It calls for ongoing research and development to refine these technologies and ensure their effective deployment. This paper advocates for a combined approach of legal frameworks, public awareness, and technological innovation to address sexual harassment. It highlights the potential of smart technologies to provide real-time protection and support to potential victims, ultimately contributing to the reduction of sexual harassment incidents. However, careful consideration of ethical and practical challenges is necessary to ensure these solutions' effectiveness and sustainability.

[SF-TS8-B-2][4053] The Role and Future Prospects of Complementary and Alternative Medicine in the Treatment of Chronic Diseases

Time: 09:20pm-09:35pm, October 18th, U.S. Eastern Daylight Time
Presenter(s): **Siying Qu**

Abstract: Complementary and Alternative Medicine (CAM) refers to therapies used to promote health that are not part of the mainstream clinical medical practices. These therapies are often employed as complementary and alternatives to conventional medical treatments. In recent years, as population structures have evolved and healthcare needs have increased, the number of individuals turning to CAM for treatment has been steadily rising worldwide. Additionally, the aging population and the growing prevalence of chronic diseases have further driven the use of CAM in managing chronic conditions. This paper aims to review the application and effectiveness of CAM in the treatment of chronic diseases such as cancer and diabetes, examining its role in improving the health and well-being of patients. Furthermore, it will explore the future prospects of CAM, particularly in its potential to contribute to chronic disease management on a global scale.

[SF-TS8-B-3][7695] Adaptive Health Monitoring and Personalized Care: Intelligent Systems in Disease Management

Time: 09:35pm-09:50pm, October 18th, U.S. Eastern Daylight Time
Presenter(s): **Yuezhi Luo and Hongyin An**

Abstract: Chronic diseases, like obesity, diabetes, and hypertension are becoming a major worldwide public health issue, with profound effects on socioeconomic outcomes, healthcare systems, and individual health. Current methods for solving these diseases have different shortcomings, such as the lack of preventive measures, the uneven distribution of treatment resources, and patients' insufficient ability to self-manage, so comprehensive and innovative solutions are required to address this global health crisis. This article uses the method of literature review, systematically analyzes the application and effect of the current lifestyle system, like

web and app platforms, to facilitate daily management tasks, including weight and glucose monitoring. These applications show great potential in disease control. Therefore, we proposed a method based on Universal Village (UV) system's framework in sensing, communication, decision-making, and action. The integration of these components allows for real-time monitoring and personalized interventions from blood pressure, weight, diet, and sleeping, thereby enhancing the effectiveness of health management strategies and improving patient outcomes. Future study should focus on improving the system's usability, ensuring data security, and investigating how to integrate these tools more broadly into existing healthcare systems.

[SF-TS8-B-7][4448] Smart Healthcare: Sleep Monitoring and Improving

Time: 09:50pm-10:05pm, October 18th, U.S. Eastern Daylight Time
Presenter(s): **Yuezhi Luo and Qipei Chen**

Abstract: Enough sleep and a wonderful sleep quality can support your brain performance and mood while decreasing your risk for many diseases and disorders, like type 2 diabetes, heart disease, stroke, obesity, and dementia. It impacts alertness, attention, cognitive performance, mood, resiliency, voc abulary acquisition, learning, memory, boosts immunity, supports growth, quicker reactions, effective learning, problem-solving, restoring and recovering body systems, brain development, and mental health.

Session [TS9-A] AI-assisted Healthcare Monitoring

Time: 08:00am-08:41am, October 19th, U.S. Eastern Daylight Time
Meeting Room (Microsoft Teams): [TS9-A & TS9-B] IEEE UV2024 Session
Chair(s): Viksit Kumar (Massachusetts General Hospital); Lin Zhang (University of Buffalo)
Assistant: Yuezhi Luo, Guangjun Zeng, Zhongyu Liu

Meet Our Speakers

Session Overview: Due to its unique benefits, including safety, affordability, and convenience, ultrasound technology is widely used in the field of biomedical engineering from diagnostic imaging, stimulation, power transfer, to tissue mechanics and therapies. Several fascinating topics about ultrasound technologies for biomedical applications will be covered in this session, such as the design and manufacture of ultrasound transducers, ultrasound shear wave elastography, acoustic radiation force in tissue engineering, and ultrasound imaging analysis and improvement. The challenges and future vision of this topic will be also discussed.

- **Agenda [EDT]**
  1. **[08:00am-08:05am][Oct.19]** ***Viksit Kumar and Lin Zhang,*** *Session Chairs;* Opening and Speech
  2. **[08:05am-08:23am][Oct.19][SF-TS9-A-1][2296]** ***Qiaoru Li, Yujie Ren, Hao Zhang, Wenqiang Ge, Jiacheng Huang, Jinglin Xie, Danjie Cheng, Tinghe Zhang, Yitong Huang, Naidan Xu, Yuliang Gai and Longfei Zhou,*** *Author*; PWT: Advancing Alzheimer's PET Synthesis from MRI with Enhanced Pathological Feature Preservation
  3. **[08:23am-08:41am][Oct.19][SI-TS9-A-2][4412]** ***Yicheng Xu, Yuxiang Zhou, Bingqing Wang, Yiming Zhou, Jiarong Liu, Liyuan He, Jichen Yao, Mingyuan Shao and Longfei Zhou,*** *Author;* Performance Evaluation of Deep Learning Models in Lumbar Spine MRI Segmentation

[TS9-A] Opening and Speech

Time: 08:00am-08:05am, October 19th, U.S. Eastern Daylight Time
Invited Speaker(s): Viksit Kumar and Lin Zhang, *Session Chairs*

[SF-TS9-A-1][2296] PWT: Advancing Alzheimer's PET Synthesis from MRI with Enhanced Pathological Feature Preservation

Time: 08:05am-08:23am, October 19th, U.S. Eastern Daylight Time

Author(s): **Qiaoru Li, Yujie Ren, Hao Zhang, Wenqiang Ge, Jiacheng Huang, Jinglin Xie, Danjie Cheng, Tinghe Zhang, Yitong Huang, Naidan Xu, Yuliang Gai and Longfei Zhou**

Abstract: Alzheimer's disease (AD) is a neurodegenerative condition that significantly impairs cognitive function. Early and accurate diagnosis is critical for effective intervention. While MRI provides detailed structural information, it lacks the functional insights that PET scans offer, particularly in detecting metabolic

changes associated with AD. However, PET imaging is costly and involves radiation exposure, limiting its frequent use. In this work, we propose an enhanced framework, PWT (PASTA With TransUNet), to generate synthetic PET images from MRI data, integrating transformer-based attention mechanisms to improve the preservation of pathological features. By replacing the UNet architecture in the original PASTA model, our approach captures both local and global features more effectively, resulting in higher-quality synthetic PET images. Evaluation on a dataset of MRI and PET images shows that PWT with an embedding dimension of 512 outperforms the original PASTA model in metrics such as FID, SSIM, and PSNR, offering a promising tool for improving AD diagnosis while reducing the need for direct PET scans.

Keywords—medical image, magnetic resonance imaging, mri, positron emission tomography, pet, alzheimer's disease, machine learning, deep learning

[SI-TS9-A-2][4412] Performance Evaluation of Deep Learning Models in Lumbar Spine MRI Segmentation

Time: 08:23am-08:41am, October 19th, U.S. Eastern Daylight Time

Author(s): **Yicheng Xu, Yuxiang Zhou, Bingqing Wang, Yiming Zhou, Jiarong Liu, Liyuan He, Jichen Yao, Mingyuan Shao and Longfei Zhou**

Abstract: Spinal disorders have become a prevalent health problem around the world today, with far-reaching impacts on patients' quality of life and ability to work. Spine segmentation is an effective tool for accurately identifying spinal disorders and is important in medical image processing and computer-aided diagnosis. Efficient and automated spine segmentation is essential to help doctors better identify spinal lesions and perform preoperative simulation and preparation. In recent years, the development of deep learning techniques has greatly contributed to the advancement of this field. However, there is a lack of studies comparing and evaluating the latest medical image segmentation models. In this paper, we evaluate the performance of state-of-the-art models proposed in recent years for spine MRI image segmentation, including U-Net, U-Net++, Attention-U-Net, MiniSeg, SENet, TransUNet, SwinUNet, Deeplabv3-ResNet 50, Deeplabv3-ResNet 101, Deeplabv3-MobileNet, Deeplabv3-Xception, Deeplabv3+- ResNet 50, Deeplabv3+-ResNet 101, Deeplabv3+-MobileNet and Deeplabv3 +-Xception. In this paper, each model is trained on the spine MRI dataset and a PCA-Driven Dynamically Weighted Hybrid Subjective-Objective Evaluation Algorithm for Comprehensive Model Performance (PCA-DHSEA) is proposed. The table selection of each model on each index is evaluated with this algorithm, and the results show that the Deeplab class model outperforms the U-Net class with other models, with the Deeplabv3+ model embedded in ResNet101 performing best. This study systematically summarizes deep learning models based on spine image segmentation, and the insights gained

from it can provide a reference for the selection and development of models for medical image processing applications, thus promoting the development of computer-aided diagnosis in the management of spinal diseases.

Keywords—medical segmentation, Deeplabv3+, ResNet101

Session [TS9-B]: Smart Medicine and Smart Healthcare

Time: 09:00am-12:05am, October 19th, U.S. Eastern Daylight Time
Meeting Room (Microsoft Teams): [TS9-A & TS9-B] IEEE UV2024 Session
Chair(s): Tongyu Zhu (Fudan University Shanghai Medical College)
Assistant: Hanxia Li, Yuling Chen, Guangjun Zeng

Meet Our Speakers

Session Overview: We aim to provide an interdisciplinary platform for researchers, students, paratheatrical industrial scientists to present and discuss the most recent trends, innovations, challenges, and novel solutions adopted in biomedicine using novel computational modeling, machine learning, artificial intelligence, sequence and imaging analysis, bio-informatics tools, and biophysical techniques.

- **Agenda [EDT]**
  1. **[09:00am-09:05am][Oct.19][TS9-B][K-1]** ***Tongyu Zhu,*** *Session Chair,* Opening and Speech
  2. **[09:05am-09:45am][Oct.19][TS9-B][K-2]** ***Tongyu Zhu,*** *Session Chair & Invited Speaker,* Smart Medicine and Smart Healthcare
  3. **[09:45am-10:30am][Oct.19][TS9-B][K-3]** ***Jintai Yu*****,** *Invited Speaker;* Smart Medicine and Smart Healthcare
  4. **[10:35am-11:05am][Oct.19][TS9-B][K-4]** ***Yanwen Huang,*** *Invited Speaker****;*** The Path to Real AIDD: Rethinking AI and Human Collaboration in Drug Design
  5. **[11:05-11:35am][Oct.19][TS9-B][K-5]** ***Bo Qiang,*** *Invited Speaker****;*** Leveraging Medicinal Chemistry Insights to Enhance Generative Models
  6. **[11:35am-12:05pm][Oct.19][TS9-B-1][7704]** ***Shiroh Itai, Soma Anzai, Tomoko Nariai and Toshihiko Yoneoka,*** *Author***;** Analysis of near-miss data at the aged care facility and suggestions for improvement

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Student Forum

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  7. **[2:55am-3:10am][Oct.19][SF-TS9-B-2][0795]** ***Yuling Chen,*** *Presenter***;** Medical Deepfakes: Innovation and Ethical Challenges
  8. **[3:10am-3:25am][Oct.19][SF-TS9-B-3][1814] Siying Qu,** *Author***; Five Small Molecule Compounds Targeting Aβ in Alzheimer's Disease**

[TS9-B][K-1] Opening and Speech

Time: 09:00am-09:05am, October 19th, U.S. Eastern Daylight Time
Invited Speaker(s): **Tongyu Zhu*,*** *Session Chair*

[TS9-B][K-2] Smart Medicine and Smart Healthcare

Time: 09:05am-09:45am, October 19th, U.S. Eastern Daylight Time
Invited Speaker(s): **Tongyu Zhu*,*** *Session Chair*

[TS9-B][K-3] Smart Medicine and Smart Healthcare

Time: 09:45am-10:30am, October 19th, U.S. Eastern Daylight Time
Invited Speaker(s): **Jintai Yu**

[TS9-B][K-4] The Path to Real AIDD: Rethinking AI and Human Collaboration in Drug Design

Time: 10:35am-11:05am, October 19th, U.S. Eastern Daylight Time
Invited Speaker(s): **Yanwen Huang**

[TS9-B][K-5] Leveraging Medicinal Chemistry Insights to Enhance Generative Models

Time: 11:05am-11:35am, October 19th, U.S. Eastern Daylight Time
Invited Speaker(s): **Bo Qiang**

[TS9-B-1][7704] Analysis of near-miss data at the aged care facility and suggestions for improvement

Time: 11:35am-12:05pm, October 19th, U.S. Eastern Daylight Time

Author(s): **Shiroh Itai, Soma Anzai, Tomoko Nariai, and Toshihiko Yoneoka**

Abstract: Facing a super-aged society, Japan experiences increasing demand for efficient senior care. This study addresses the underutilization of near-miss reports, valuable for accident prevention, in aged care facilities. Researchers conducted interviews at a care facility in Japan and identified key issues in recordkeeping, particularly that internal reports are rarely used for feedback or improvement. Focusing on 407 near-miss cases over six months, the study applied text mining, clustering, decision tree learning, and co-occurrence network analysis. Key findings include that “going to the toilet alone” and incidents in the dining room were major factors to near-misses, often involving specific individuals. Seasonal and individual fluctuations were also observed. The results were shared with care staff, leading to actionable measures such as targeted monitoring and consideration of automated alerts for fall risks. The study concludes that data-driven approaches can significantly improve safety and efficiency in elder care.

Keywords—scientific care, data mining, near-misses, nursing, co-occurrence network.

[SF-TS9-B-2][0795] Medical Deepfakes: Innovation and Ethical Challenges

Time: 2:55am-3:10am, October 19th , U.S. Eastern Daylight Time
Presenter(s): **Yuling Chen**

Abstract: Medical deepfakes, a subset of synthetic media generated through AI techniques like generative adversarial networks (GANs), are emerging as a transformative tool in healthcare. These AI-generated simulations have the potential to revolutionize medical training, diagnostic simulations, and data augmentation by creating highly realistic medical images, videos, and patient interactions. While their applications promise enhanced training for healthcare professionals and improved AI-based diagnostics, deepfakes also pose significant challenges. These include the risks of misinformation, diagnostic errors, and breaches of patient privacy. Ethical concerns surrounding patient consent, data ownership, and regulatory oversight further complicate their integration into healthcare systems. As the use of deepfakes grows, it is essential to balance their potential benefits with careful regulation to mitigate risks, ensuring they are used responsibly and effectively in advancing medical practice.

[SF-TS9-B-3][1814] Five Small Molecule Compounds Targeting Aβ in Alzheimer's Disease

Time: 3:10am-3:25am, October 19th , U.S. Eastern Daylight Time
Presenter(s): **Siying Qu**

Author(s): **Siying Qu**

Abstract: Alzheimer's disease (AD) is a complex neurodegenerative disorder characterized by cognitive decline, with amyloid-beta (Aβ) accumulation playing a central role in its pathogenesis. Despite numerous efforts in drug development, effective treatments targeting Aβ have faced significant challenges, including inadequate target engagement, poor clinical efficacy, and toxicity concerns. This review explores the relationship between Aβ and AD pathogenesis, discussing the amyloid cascade hypothesis and the hypothesis of Aβ oligomer pathogenicity. In addition, five representative drugs targeted for Aβ are summarized, highlighting their mechanisms of action, preclinical and clinical data, and the challenges faced in development. We also address the need for multitarget approaches, early intervention, and improved drug delivery methods, such as overcoming the bloodbrain barrier. Despite the setbacks in clinical trials, ongoing research in Aβ-targeted therapies offers hope for more effective treatment strategies. This review

underscores the need for further research and development to overcome the current obstacles in treating Alzheimer's disease.

Keywords—amyloid-beta, alzheimer's disease, small molecule component.

Session [TS10-A][TS10-B]: Urbanization and Smart Communities & Smart Government and Social Services

Time: 09:00am-10:50am, October 22nd, U.S. Eastern Daylight Time
Meeting Room (Microsoft Teams): [TS10-A & TS10-B] IEEE UV2024 Session
Chair(s): Zhiyong Lan (Tsinghua University)
Assistant: Zhongda Wang，Chengming Wang

Meet Our Speakers

Session Overview: Human-centered social innovations are essential in promoting diversity and inclusive-ness as cities become more digitized and urbanized. By integrating smart technologies into urban planning and government services, these initiatives enhance accessibility and quality of life while preserving cultural heritage. Streamlined services and sustainable development ensure that modernization respects historical identities and meets diverse community needs effectively. This approach ensures that the benefits of urban growth and technological advancements are equitably distributed, fostering sustainable and harmonious urban futures.

- **Agenda [EDT]**
  1. **[09:00am-09:10am][Oct.22][TS10-A&B][K-1]** ***Zhiyong Lan,*** *Session Chair;* Opening and Speech
  2. **[09:10am-09:30am][Oct.22][TS10-A&B][K-2]&[SI-TS10-A-1][5140]** ***Dongquan Li,*** *Invited Speaker***; *Mengyuan Li, Dongquan Li,* *Author*;** How does Digital Technologies Enhance Resilience in Rural Communities?
  3. **[09:30am-09:50am][Oct.22][SI-TS10-A-2][4631]** ***Chenyang Yu, Moyan Li and Hongyu Long,*** *Author;* Can Developing Big Data Improve Urban Energy Efficiency? A Double Machine Learning Based Approach.
  4. **[09:50am-10:10am][Oct.22][SI-TS10-A-3][5427]** ***Hongyu Long, Moyan Li and Chenyang Yu,*** *Author;* How Does Regional Integration Drive Energy Efficiency in Vertically Connected Industries?
  5. **[10:10am-10:30am][Oct.22][SI-TS10-A-4][1023]** ***Xihan Dong,*** *Author;* Dynamic Analysis of Platform Worker Protection Policies in China: An Institutional Analysis and Development (IAD) Framework Approach.
  6. **[10:30am-10:50am][Oct.22][SI-TS10-B-1][8787]** ***William Aboucaya, Rafael Angarita and Valerie Issarny,*** *Author;* The Future of e-Democracy: Analyzing and Optimizing Citizen Participation Platforms

[TS10-A&B][[K-1] Opening and Speech

Time: 09:00am-09:10am, October 22nd, U.S. Eastern Daylight Time
Invited Speaker(s): **Zhiyong Lan,** *Session Chair*

[TS10-A&B][K-2]&[SI-TS10-A-1][5140] How does Digital Technologies Enhance Resilience in Rural Communities?

Time: 09:10am-09:30am, October 22nd, U.S. Eastern Daylight Time
Invited Speaker(s): **Dongquan Li**

Author(s): **Mengyuan Li, Dongquan Li**

Abstract: Currently, there remains an imbalance in development between urban and rural areas globally. Rural areas are relatively disadvantaged in risk response. Digital technology holds the potential to become a crucial tool in enhancing the resilience of rural communities. However, existing researches present conflicting views regarding the impact of digitalization on rural resilience, particularly around the debate between digital empowerment and the digital divide. This research provides case evidence from China for this debate, identifies key factors, and unpacks the process mechanisms involved. Through fieldwork and in-depth interviews, this research collects case data on the digital transformation of Zhanghe Village, Chengdu, Sichuan Province. Some of the data also came from official statistical yearbooks. The case analysis reveals that digitalization has brought significant positive changes to Zhanghe Village. We explored the mechanisms and influencing factors of digital technologies on rural resilience from four dimensions: economic, infrastructural, social, and institutional. The following is the ranking of factor importance in each dimension. (1) Economic resilience: digital IP >enterprise resources >rural resources. (2) infrastructure resilience: physical assets >human assets = political assets = cultural assets = social capital. (3) social resilience: bonding social capital = bridging social capital. (4) institutional resilience: formal institutions >degree of participant diversity >informal institutions. This study responds to ongoing debates in the literature on rural digitalization. It also establishes a framework of influencing factors and clarifies the mechanisms through which digitalization affects rural resilience. It has positive implications for the further digitization of rural areas and their sustainable development in the future.

Keywords—rural resilience, digital technology, zhanghe village.

[SI-TS10-A-2][4631] Can Developing Big Data Improve Urban Energy Efficiency? A Double Machine Learning Based Approach

Time: 09:30am-09:50am, October 22nd, U.S. Eastern Daylight Time

Author(s): **Chenyang Yu, Moyan Li and Hongyu Long**

Abstract: This paper examines the causal impact of big data development on urban energy efficiency using China Big Data Integrated Pilot Zone policy as a quasi natural experiment. Through double machine learning and spatial econometric models applied to panel data from 238 Chinese cities during 2008 to 2019, we identify a critical paradox. Implementation of the policy significantly reduces local energy efficiency by 10 percent after controlling for variables and fixed effects while generating positive spatial spillover effects that improve efficiency in neighboring areas by 8.4 percent. Mechanism analysis demonstrates that the policy induces clustering of computer and software industries, increasing local energy

consumption and lowering local energy efficiency. Simultaneously, it attracts enterprise relocation from peripheral regions to pilot zones, reducing energy burdens in surrounding areas and improving their efficiency. Heterogeneity analysis reveals stronger negative local effects in eastern and central regions compared to western regions, and more pronounced impacts in non-ordinary prefecture level cities. Robustness tests including extended SFA modeling confirm these findings. These results challenge conventional assumptions about uniform benefits of big data and highlight the necessity for spatially coordinated policies to balance efficiency gains across regions.

Keywords—big data, energy efficiency, double machine learning, spillover effects.

[SI-TS10-A-3][5427]How Does Regional Integration Drive Energy Efficiency in Vertically Connected Industries?

Time: 09:50am - 10:10am, October 22nd, U.S. Eastern Daylight Time

***Author(s)*: Hongyu Long, Moyan Li and Chenyang Yu**

Abstract: This study examines the impact of regional integration on energy efficiency through the perspective of vertically linked industries. Our theoretical model incorporates energy inputs into a new economic geography framework, offering robust support for the empirical analysis. Based on a unique dataset that combines the industrial enterprise database with the enterprise pollution database, our empirical results reveal that a 1 percent increase in regional integration leads to a 4 percent improvement in energy efficiency in upstream industries and a 5 percent improvement in downstream industries. Further, the heterogeneity analysis shows that regional integration has a stronger impact on high-energy-consuming sectors, developed urban agglomerations and peripheral cities. Mechanism analysis suggests that regional integration enhances energy efficiency by fostering both competition and cooperation among vertically linked industries. Lastly, our policy recommendations include promoting regional integration through targeted policies that encourage industrial competition and collaboration, optimizing urban development strategies to balance energy efficiency gains across regions, and supporting coordinated collaboration within vertical industry chains to drive energy efficiency improvements across sectors.

Keywords—regional integration, energy efficiency, vertical industry linkages, industrial competition and cooperation.

[SI-TS10-A-4][1023] Dynamic Analysis of Platform Worker Protection Policies in China: An Institutional Analysis and Development (IAD) Framework Approach

Time: 10:10am-10:30am, October 22nd, U.S. Eastern Daylight Time

Author(s)*: *Xihan Dong

Abstract: This paper develops a modified Institutional Analysis and Development (IAD) framework to analyze the dynamic evolution of China's platform worker protection policies from 2015 to 2023, revealing underlying institutional mechanisms driving policy transformation and predicting future development trajectories. Unlike traditional static IAD applications, this study introduces three methodological innovations: temporal policy evolution analysis across distinct development stages, multi-level governance integration, and outcome-response feedback mechanisms that trace how policy implementation outcomes directly influence subsequent institutional responses. Through systematic analysis of two phases—Initial Development (2015–2018) and Maturation and Regulation (2019–2023)—the research demonstrates how institutional learning processes transformed China's approach from growth-prioritizing policies with minimal worker protections to sophisticated regulatory frameworks featuring the innovative "incomplete labor relationship" classification. The modified framework reveals that effective platform worker protection emerges through iterative cycles where policy outcomes generate feedback that reshapes subsequent institutional arrangements, with local policy experimentation serving as testing grounds for national measures. Key findings show that institutional responses evolved from reactive gap-filling to proactive protection design, driven by external pressures, stakeholder interactions, and systematic policy learning. The study's theoretical contribution lies in demonstrating how the IAD framework can capture institutional dynamism and predict policy trajectories through outcome-feedback analysis. Empirically, the research reveals that China's regulatory evolution follows predictable patterns of institutional learning, suggesting future development toward differentiated protection frameworks that balance innovation with worker rights. This modified analytical approach provides a replicable methodology for understanding platform economy governance evolution and offers practical insights for policymakers designing adaptive regulatory frameworks in rapidly evolving digital economies.

Keywords—modified IAD framework, platform economy worker protection, institutional learning, policy evolution dynamics, China labor policy, regulatory innovation, temporal institutional analysis

[SI-TS10-B-1][8787] The Future of e-Democracy: Analyzing and Optimizing Citizen Participation Platforms

Time: 10:30am-10:50am, October 22nd, U.S. Eastern Daylight Time

***Author(s)*: William Aboucaya, Rafael Angarita and Valerie Issarny**

Abstract: As e-democracy evolves, online participatory platforms are revolutionizing citizen engagement in public decisionmaking, enabling unprecedented scale and geographic reach. This study delves into the diverse landscape of these platforms, uncovering their unique objectives and challenges through semistructured interviews with platform administrators. Our analysis reveals critical areas for improvement, particularly in managing large-scale participation and fostering collaborative citizen contributions. We propose innovative solutions, including leveraging machine learning for efficient processing of voluminous inputs and implementing collaborative editing tools to enhance collective decision-making. These advancements promise to transform edemocracy, making it more inclusive, efficient, and impactful. Our findings offer valuable guidance for platform administrators and designers, paving the way for the next generation of digital civic engagement tools.

Keywords—E-government, collaborative systems, social computing

Session [TS10-C][TS10-D]: Integrated Solutions for Smart Humanity & Smart Design and Design Ethics

Time: 08:30pm-04:20am, October 19th, U.S. Eastern Daylight Time
Meeting Room (Microsoft Teams): [TS10-C & TS10-D] IEEE UV2024 Session
Chair(s): Shengsheng Cao (Tsinghua University)
Assistant: Zhicheng Zhang, Zhongyu Liu, Zhenqian Huang

Meet Our Speakers

Session Overview: Human-Centered Social Innovations drive diversity, inclusiveness, and cultural heritage preservation by prioritizing equitable, accessible solutions. Emphasizing interdisciplinary approaches, these innovations leverage technology for human well-being, ensuring progress respects cultural diversity. Ethical design principles guide the creation of sustainable, accessible technologies, while acknowledging linguistic and cultural diversity enhances educational tools' inclusive-ness. This commitment fosters a more inclusive, culturally rich society.

- **Agenda [EDT]**

1. **[08:30pm-08:40pm][Oct.19][TS10-C&D][K-1]** ***Shengsheng Cao,*** *Session Chair;* Opening and Speech
2. **[08:45pm-08:55pm][Oct.19][TS10-C&D][K-2]** ***Yajun Fang,*** *Invited Speaker;* Opening Remarks
3. **[09:00pm-09:40pm][Oct.19][TS10-C&D][K-3]** ***Kaixi Fan,*** *Invited Speaker;* The Humanistic Value and Technical Ethics of Generative Design （GDAI） Artificial Intelligence Applications
4. **[09:45pm-10:15pm][Oct.19][TS10-C&D][K-4]** ***Zhentao Jiao,*** *Invited Speaker;* The Evolution of Information Concepts and Value Transfer in the Age of Digital Intelligence
5. **[10:20pm-10:50pm][Oct.19][TS10-C&D][K-5]** ***Zeyuan Shi,*** *Invited Speaker;* Reflections on digital technology in cultural and tourism scene
6. **[10:55pm-11:25pm][Oct.19][TS10-C&D][K-6]** ***Sicheng Li,*** *Invited Speaker;* Innovation and Tradition: Bridging Design Thinking and AIGC Tools
7. **[01:30am-02:10am][Oct.20][TS10-C&D][K-7]** ***Lie Zhang,*** *Invited Speaker;* Diversified interpretation and living display of cultural heritage
8. **[02:15am-02:45am][Oct.20][TS10-C&D][K-8]** ***Yanying Fan,*** *Invited Speaker;* AI-Empowered Immersive Classrooms: Revolutionizing Education with Digital Content and Smart Spaces
9. **[02:50am-03:20am][Oct.20][TS10-C&D][K-9]** ***Changwang He,*** *Invited Speaker;* The Ethical Crisis and Responses to ChatGPT-Like Generative AI in Education
10. **[03:25am-03:50am][Oct.20][TS10-C&D][K-10]** ***Siyuan Yang,*** *Invited Speaker;* Tracing the origins:Digital technology and art dance together
11. **[03:55am-04:20am][Oct.20][TS10-C&D][K-11]** ***Shurong Chen,*** *Invited Speaker;* Application and value proposition of AI in tourism travel service design

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Student Forum

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12. **[10:45am-11:00am][Oct.19][SF-TS10-D-1][3138]** ***Zizhan Chen, Xinyu Tong and Kai Yu,*** *Author;* Digital Creation, Representation, and Parametric Style Editing of Chinese Calligraphy

[TS10-C&D][K-1] Opening and Speech

Time: 08:30pm-08:40pm, October 19th, U.S. Eastern Daylight Time
Invited Speaker(s): **Shengsheng Cao,** *Session Chair*

[TS10-C&D][K-2] Opening Remarks

Time: 08:45pm-08:55pm, October 19th, U.S. Eastern Daylight Time
Invited Speaker(s): **Yajun Fang**

[TS10-C&D][K-3]The Humanistic Value and Technical Ethics of Generative Design（GDAI）Artificial Intelligence Applications

Time: 09:00pm-09:40pm, October 19th, U.S. Eastern Daylight Time
Invited Speaker(s): **Kaixi Fan**

[TS10-C&D][K-4]The Evolution of Information Concepts and Value Transfer in the Age of Digital Intelligence

Time: 09:45pm-10:15pm, October 19th, U.S. Eastern Daylight Time
Invited Speaker(s): **Zhentao Jiao**

[TS10-C&D][K-5]Reflections on digital technology in cultural and tourism scene

Time: 10:20pm-10:50pm, October 19th, U.S. Eastern Daylight Time
Invited Speaker(s): **Zeyuan Shi**

[TS10-C&D][K-6] Innovation and Tradition: Bridging Design Thinking and AIGC Tools

Time: 10:55pm-11:25pm, October 19th, U.S. Eastern Daylight Time
Invited Speaker(s): **Sicheng Li**

[TS10-C&D][K-7]Diversified interpretation and living display of cultural heritage

Time: 01:30am-02:10am, October 20th, U.S. Eastern Daylight Time
Invited Speaker(s): **Lie Zhang**

[TS10-C&D][K-8]AI-Empowered Immersive Classrooms: Revolutionizing Education with Digital Content and Smart Spaces

Time: 02:15am-02:45am, October 20th, U.S. Eastern Daylight Time
Invited Speaker(s): **Yanying Fan**

[TS10-C&D][K-9]The Ethical Crisis and Responses to ChatGPT-Like Generative AI in Education

Time: 02:50am-03:20am, October 20th, U.S. Eastern Daylight Time
Invited Speaker(s): **Changwang He**

[TS10-C&D][K-10]Tracing the origins: Digital technology and art dance together

Time: 03:25am-03:50am, October 20th, U.S. Eastern Daylight Time
Invited Speaker(s): Siyuan Yang

[TS10-C&D][K-11]Application and value proposition of AI in tourism travel service design

Time: 03:55am-04:20am, October 20th, U.S. Eastern Daylight Time
Invited Speaker(s):**Shurong Chen**

[SF-TS10-D-1][3138] Digital Creation, Representation, and Parametric Style Editing of Chinese Calligraphy

Time: 10:45am-11:00am, October 19th, U.S. Eastern Daylight Time

Author(s): **Zizhan Chen, Xinyu Tong and Kai Yu**

Abstract: The digitization of Chinese calligraphy is hindered by a prevailing focus on static images, which neglects the art's essential dynamic brush motion. Mainstream

neural network approaches therefore lack the parametric control and interpretability required for practical applications and fail to integrate with process-based brush modeling studies. To resolve these challenges, we introduce a holistic system that represents calligraphy through its dynamic creation process. Our framework unifies a virtual brush model with a structured format that records calligraphy motion data. This process-centric foundation enables our key contribution: parametric calligraphy style editing methods based on motion data that are interactive, explicit, and interpretable. Experimental results validate our system's ability to faithfully represent and manipulate calligraphy, offering a powerful alternative to static methods. This work establishes a more effective and practical foundation for cultural preservation, interactive education, and artistic expression.

Keywords—calligraphy digitization, computational art, parametric modeling.

Session [TS11-A]: Responsible and Ethical Data Management and Processing
Session [TS11-B]: Learning Algorithm Development, Analysis and Interpretability:

Time: 08:00am-10:45am, October 20th, U.S. Eastern Daylight Time
Meeting Room (Microsoft Teams): [TS11-A][PE]IEEE UV2024 Session
Chair(s): Yong Xu (Build-it-Yourself)
Assistant: Zhenqian Huang, Zhicheng Zhang

Meet Our Speakers

Session Overview: Learning algorithms play a vital role in Artificial Intelligence and offer efficient solutions to numerous real-world problems. In this era of bigdata, scientists and engineers are facing the issues of how to use these data more efficiently, both retrospectively and prospectively, with the aim to mine useful knowledges from them. In order to achieve these, new algorithms have to be developed to discover some novel methods for the optimized treatment of these data and to attain reliable predictive results with confidence. In this Section of the conference, you will find exciting opportunities to explore the amazing real-world algorithms for the treatment of data ranging from text massages, time series data, images and photos to online videos, etc.

- **Agenda [EDT]**

1. **[08:00am-08:25am][Oct.20][TS11-A&B-1][K-1]*Yong Xu*,** *Session Chair*, **Opening and Speech**
2. **[08:25am-09:05am][Oct.20][TS11-A&B][K-2]*Vipula Rawte,*** *Invited Speaker;* Hallucination in Large Foundation Models'
3. **[09:05am-09:45am][Oct.20][TS11-A-1][5476] *Ali Hassan and Shonda Bernadin,*** *Author;* Investigating Threat of Deepfake Voice Manipulation on Psychological Security
4. **[10:05am-10:25am][Oct.20][TS11-A-3][2485] *Maria Anurag Reddy Basani,*** *Author;* Optimizing ETL Pipelines with AI: A Framework for Intelligent Data Integration
5. **[10:25am-10:45am][Oct.20][SF-TS11-B-1][3625] *Zehan Zhao and Shujun Fang,*** *Author;* Toward Out-of-Domain Binding Affinity Prediction

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Student Forum

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6. **[11:20pm-11:25pm][Oct.18] Jieren Kou*,*** *Session Chair*; Opening and Speech
7. **[11:25pm-11:40pm][Oct.18][SF-TS11-A-1][9294] *Muxi Chen***, *Presenter*; Safeguarding Privacy in Big Data Management: Solutions and Risk Mitigation Strategies
8. **[11:40pm-11:55pm][Oct.18][SF-TS11-B][K-1] *Hanxia Li*,** *Invited Presenter;* Ethical Challenges in AI Across Multiple Domains: Insights from Real-World Case Studies
9. **[11:55pm-12:10am][Oct.18][SF-TS11-B][K-2] *Mingyuan Hu*,** *Invited Presenter;* A Review of Large Language Model
10. **[12:10am-12:25am][Oct.19][SF-TS11-B][K-3] *Jieren Kou*,** *Invited Presenter;* Federated Learning

11. **[12:25am-12:40am][Oct.19][SF-TS11-B][K-4]** ***Zhongyu Liu*****,** *Invited Presenter;* An Introduction to Speculative Sampling
12. **[12:40am-12:55am][Oct.19][SF-TS11-B-2][7837]** ***Zhongda Wang*****,** *Presenter;* Multimodal Learning
13. **[12:55am-1:10am][Oct.19][SF-TS11-B-3][5414]** ***Jieren Kou, Xiuyuan Lu, Aobing Yin, Wuyang Zhang, Xinyi Fang, Youzhang Li, Tengyue Pan, Lijia Zhang, Ge Cheng, Hao Yuan, Xiaoman Duan and Yajun Fang,*** *Presenter;* Beyond Isolated Fixes: A Comprehensive Survey on Hallucination Mitigation with a Three-Dimensional Taxonomy and Integrative Framework
14. **[1:10am-1:25am][Oct.19][SF-TS11-B-4][8924]** ***Zhenqian Huang*****,** *Presenter;* A Review of Adversarial Attacks on AI-Powered Systems
15. **[1:25am-1:40am][Oct.19][SF-TS11-B-5][8499]** ***Guoxin Huang*****,** *Presenter*; AI in E-Discovery: An In-Depth Exploration of Predictive Coding
16. **[1:40am-1:55am][Oct.19][SF-TS11-B-6][9132]** ***Guangjun Zeng,*** *Presenter*; Active Learning as a Catalyst for Human-Centric AI: Enhancing Explainability, Intent Understanding, and Societal Resilience
17. **[1:55am-2:10am][Oct.19][SF-TS11-B-7][3993]** ***Wuyang Zhang, Chenkai Zhang, Chuqiao Gu, Jieren Kou, Hao Yuan, Xinyi Fang, Xiaoman Duan and Yajun Fang*****,** *Author(s);* Hallucination in Large Language Models: From Mechanistic Understanding to Novel Control Frameworks
18. **[2:10am-2:25am][Oct.19][SF-TS11-B-8][6666]** ***Xinyi Fang, Hao Yuan, Hanxia Li, Jieren Kou, Chuqiao Gu, Wuyang Zhang, Xiaoman Duan and Yajun Fang,*** *Author(s);* Reframing Hallucination in Large Language Models: A Lifecycle-Based, Mechanism-Aligned, and Phenomenon-Consistent Definition
19. **[2:25am-2:40am][Oct.19][SF-TS11-B-9][9066]** ***Chuqiao Gu, Wuyang Zhang, Zhengqian Huang, Jieren Kou, Zhenyao Liu, Chenjun Zhao, Chang Liu, Lifeng Zhang, Wenjie Lin, Guoxin Huang, Charles Zhang, Zhongda Wang, Jianwei Deng, Yuhuan Xie, Chengming Wang, Hao Yuan, Xiaoman Duan and Yajun Fang,*** *Author(s);* LENS: Layers of Evaluation of hallucinatioN in GenAI Systems
20. **[2:40am-2:55am][Oct.19][SF-TS11-B-10][8007]** ***Zhenyao Liu, Jieren Kou, Wuyang Zhang, Chuqiao Gu, Xinyi Fang, Zhenqian Huang, Hao Yuan, Hanxia Li, Xiuyuan Lu, Aobing Yin, Chang Liu, Zhongda Wang, Haoyang Huang, Xiaoman Duan and Yajun Fang,*** *Author(s);* Comprehensive Evaluation of AI Hallucination and Novel UV-Oriented Framework toward Safe and Trustworthy AI

[TS11-A&B-1][K-1] Opening and Speech

Time: 08:00am-08:25am, October 20th, U.S. Eastern Daylight Time
Invited Speaker(s): **Yong Xu,** Session Chair

[TS11-A&B][K-2] Hallucination in Large Foundation Models'

Time: 08:25am-09:05am, October 20th, U.S. Eastern Daylight Time
Invited Speaker(s): **Vipula Rawte**

[TS11-A-1][5476] Investigating Threat of Deepfake Voice Manipulation on Psychological Security

Time: 09:05am-09:45am, October 20th, U.S. Eastern Daylight Time

Author(s): **Ali Hassan and Shonda Bernadin**

Abstract: Major Clinical Depression impacts social and economic aspects significantly, manifesting as an increased number of leave days, costs associated with invalidity pensions, monthly disability payments, etc. To gain invalidation benefits or for various other reasons, individuals may fake or malinger these symptoms approximately 20 percent to 40 percent of the time in forensic settings. In today's world, with advancements in voice cloning and the reliance on telemedicine, there is a significant possibility that individuals can generate fake depressed voices in real time to feign depression. Deepfakes can erode trust, enable malingering through fabricated symptoms, and hinder accurate diagnoses. This research emphasizes the importance of preserving voice integrity and discusses the need for heightened awareness about the risks associated with manipulated voices. This research developed an audio-based fake depression detection system by integrating fake audio detection with our proposed depression detection model. To facilitate better training and detect deepfakes, we present a new dataset extracted from the DAIC-WOZ collection. Our approach uses a two-step procedure: first, it employs SpecRNet to identify deepfakes, After confirming the authenticity of the audio, the system employs an integration of CNNs (Convolutional Neural Networks) and GRUs (Gated Recurrent Units) to analyze speech patterns to detect depression. SpecRNet achieved an AUC score of 99.9941 and an EER score of 0.1549, slightly worse than LCNN but better than RawNet2, with 409,127 trainable parameters. Despite LCNN achieving higher accuracy, SpecRNet was selected due to its

significantly lower parameter count and reduced inference time, making it more suitable for real-time deployment in resource-constrained or mobile health settings. The system operates efficiently with lower resource consumption and faster inference times. The proposed depression detection model achieved 95.27 percent accuracy, 93.36 percent precision, 93.18 percent recall, and 95.23 percent F1-score, surpassing existing benchmarks like MS2-GNN (89.13 percent accuracy, 80.0 percent precision, 85.71 percent recall, 82.76 percent F1-score).

Keywords—online invention, vocal Integrity, deep learning, vulnerabilities, depression, mental health.

[TS11-A-3][2485] Optimizing ETL Pipelines with AI: A Framework for Intelligent Data Integration

Time: 10:05am-10:25am, October 20th, U.S. Eastern Daylight Time

Author(s): **Maria Anurag Reddy Basani**

Abstract: This paper presents a comprehensive framework for optimizing Extract, Transform, Load (ETL) pipelines using arti-ficial intelligence (AI) techniques such as reinforcement learning and incremental learning. The proposed AI-driven ETL pipeline dynamically adjusts data extraction, transformation, and loading processes, leading to improved performance in data integration. Experiments conducted using a financial transactions dataset demonstrated significant improvements in key metrics, including a 48 percent reduction in latency, a 78 percent increase in throughput, and a five to six percent improvement in accuracy compared to a traditional ETL system. These results highlight AI's capability to provide scalable, efficient, and accurate data integration solutions for modern big data environments While the individual techniques used in this work—reinforcement learning and incremental learning—are well-established, their unified application within a dynamic, real-time ETL optimization frame-work presents a novel contribution. The system redefines pipeline execution as a sequential decision-making problem, enabling adaptive data integration in latency-sensitive environments.

Keywords—AI-driven, reinforcement learning, incremental learning, data transformation, latency reduction.

[SF-TS11-A-1][9294] Safeguarding Privacy in Big Data Management: Solutions and Risk Mitigation Strategies

Time: 11:25pm-11:40pm, October 18th, U.S. Eastern Daylight Time
Presenter(s): **Muxi Chen**

Abstract: With the continuous growth of big data, future big data management will place increasing emphasis on data security and privacy protection. At the same time, greater attention will be given to data governance and data quality issues. By establishing a comprehensive data governance framework and a data quality evaluation system, we can improve the reliability and credibility of data. Although automated data processing technologies have brought great convenience in data processing, the application of artificial intelligence, machine learning, and edge computing has helped us enhance our ability to analyze, store, and process data through technology, enabling more precise, efficient data management, analysis, and prediction. However, as the volume of data continues to grow and the complexities and diversity of data processing present various challenges, responsible and ethical data management and processing have become particularly critical to ensuring the security and privacy of personal and sensitive data.

[SF-TS11-B][K-1] Ethical Challenges in AI Across Multiple Domains: Insights from Real-World Case Studies

Time: 11:40pm-11:55pm, October 18th, U.S. Eastern Daylight Time
Invited Presenter(s): **Hanxia Li**

[SF-TS11-B][K-2] A Review of Large Language Model

Time: *11:55pm, October 18th -12:10am, October 19th, U.S. Eastern Daylight Time*
Invited Presenter(s): **Mingyuan Hu**

[SF-TS11-B][K-3] Federated Learning

Time: 12:10am-12:25am, October 19th, U.S. Eastern Daylight Time
Presenter(s): **Jieren Kou**

Abstract: Federated Learning (FL) is a decentralized machine learning approach where multiple clients collaboratively train a shared model under the coordination of a central server while keeping their data localized. Originating in 2016, FL was introduced to address privacy concerns and the challenges of unbalanced, non-IID data across distributed devices. This concept has since evolved, gaining traction in various fields such as smart cities, healthcare, and finance. As FL continues to develop, key focus areas include enhancing communication efficiency, addressing data heterogeneity, and optimizing resource-constrained devices. Future research will likely explore innovative solutions to these challenges, fostering broader adoption and practical implementation across diverse applications.

[SF-TS11-B][K-4] An Introduction to Speculative Sampling

Time: 12:25am-12:40am, October 19th, U.S. Eastern Daylight Time
Invited Presenter(s): **Zhongyu Liu**

[SF-TS11-B-1][3625] Toward Out-of-Domain Binding Affinity Prediction

Time: 10:25am-10:45am, October 20th, U.S. Eastern Daylight Time

Author(s): **Zehan Zhao and Shujun Fang**

Abstract: Predicting binding affinity takes a central role in modern drug design by clarifying how ligands interact with protein targets and supporting more efficient candidate selection. However, many existing methods rely on training and evaluation data drawn from closely aligned domains, which does not adequately capture the diversity observed in real biomedical research settings. In practice, predictive models are frequently challenged by distributional shifts arising from novel chemical scaffolds, previously unseen protein families, differences in experimental conditions and emerging drug resistance, all of which can greatly reduce accuracy. These challenges, known as out-of-domain (OOD) scenarios, increase the risk of overlooking potential compounds or selecting unsuitable substitutes. Although several benchmarks have been proposed to evaluate OOD generalization, many lack accessible and flexible codebases for robust and balanced evaluation. To address this gap, we present a benchmark built upon the DrugOOD dataset, crafted to systematically examine how binding affinity prediction models respond to realistic distributional variations. We also introduce BIOW2D, a new approach that outperforms previous baselines by retaining chemically meaningful substructures as key features, enhancing both accuracy and interpretability. We aim for this study to promote applied research on OOD generalization and aid in advancing reliable binding affinity prediction techniques, especially in contexts where domain shifts cannot be avoided, ultimately supporting more informed compound selection.

Keywords**—**machine learning, out-of-distribution, binding affinity prediction, drug design.

[SF-TS11-B-2][7837] Multimodal Learning

Time: 12:40am-12:55am, October 19th, U.S. Eastern Daylight Time
Presenter(s): **Zhongda Wang**

Abstract: What is multimodal learning, what challenges it faces, and what applications in fields such as healthcare, autonomous vehicles, and content creation?

[SF-TS11-B-3][5414] Beyond Isolated Fixes: A Comprehensive Survey on Hallucination Mitigation with a Three-Dimensional Taxonomy and Integrative Framework

Time: 12:55am-1:10am, October 19th, U.S. Eastern Daylight Time
Presenter(s): **Jieren Kou**, *Student Forum Chair*

Author(s): **Jieren Kou, Xiuyuan Lu, Aobing Yin, Wuyang Zhang, Xinyi Fang, Youzhang Li, Tengyue Pan, Lijia Zhang, Ge Cheng, Hao Yuan, Xiaoman Duan and Yajun Fang**

Abstract: Hallucinations in large language and vision–language models constitute a persistent and systemic failure mode that fundamentally undermines their reliability in high-stakes applications. Rather than framing hallucination as a localized generation error, this paper reconceptualizes it as a lifecycle phenomenon—emerging from upstream deficiencies in data collection, reinforced by training-time biases, and exacerbated by inference-time decoding pathologies. To address this challenge, we propose a unified framework for hallucination mitigation grounded in a structured three-dimensional taxonomy that spans mechanism-based strategies, phase-specific interventions, and cross-phase integrative approaches. This taxonomy elucidates how technical solutions, knowledge-enhanced methods, and framework-level designs can be systematically orchestrated across pre-, in-, and post-generation stages to support more robust, interpretable, and auditable model behavior. Within this paradigm, detection is positioned not as a terminal task, but as a diagnostic backbone that enables adaptive and multi-stage mitigation workflows. Building on this foundation, we introduce an integrative hybrid framework that consolidates previously fragmented techniques into coherent pipelines, demonstrating how cross-phase synergy and iterative refinement can enhance reliability in real-world deployment. This framework further reveals latent connections across diverse strands of research, facilitating the identification of underexplored intersections and the development of synergistic method combinations. By reframing hallucination mitigation as a system-level challenge rather than a set of isolated fixes, this work offers both a theoretical lens and a practical roadmap for advancing the trustworthiness of generative AI systems.

[SF-TS11-B-4][8924] A Review of Adversarial Attacks on AI-Powered Systems

Time: 1:10am-1:25am, October 19th, U.S. Eastern Daylight Time
Presenter(s): **Zhenqian Huang**

Abstract: The rapid advancement of artificial intelligence (AI) has brought immense benefits across multiple domains, but has also exposed these systems to significant vulnerabilities, particularly through adversarial attacks. This review explores the landscape of adversarial attacks on AI-powered systems, focusing on their implications for critical applications such as power grids, IoT networks, and image recognition systems. Recent studies have revealed how subtle, human-imperceptible perturbations can drastically mislead AI models, from convolutional neural networks (CNNs) used in power quality recognition to semantic segmentation in aerial image analysis. Various attack vectors, including fast gradient sign methods, black-box attacks, and universal perturbations, have been identified as major threats, capable of bypassing security layers and degrading system performance. Additionally, these attacks not only influence machine perception but also bias human decisions, further amplifying their potential harm. To counter these threats, defense mechanisms such as adversarial training, feature attention networks, and blockchain-integrated machine learning have been proposed. However, the arms race between attack sophistication and defense robustness continues, underscoring the need for further research into more resilient AI systems. This review consolidates knowledge on adversarial attacks and defense strategies, offering insights into the current state of the field and highlighting directions for future work.

[SF-TS11-B-5][8499] AI in E-Discovery: An In-Depth Exploration of Predictive Coding

Time: 1:25am-1:40am, October 19th, U.S. Eastern Daylight Time

Presenter(s): **Guoxin Huang**

Abstract: This presentation explores the application of Artificial Intelligence (AI) in the domain of Electronic Discovery (E-Discovery), particularly focusing on Predictive Coding. E-Discovery involves locating, securing, and analyzing electronic data to be used as evidence in legal proceedings. With the rising volume and complexity of data, AI provides essential tools to address critical challenges, such as document classification and analysis, by automating processes that were once labor-intensive. The presentation delves deeply into Predictive Coding, a machine learning-based technique used to classify documents as relevant, non-relevant, or privileged. Key topics covered include feature extraction through natural language processing (NLP), model selection (Logistic Regression, Support Vector Machines), and the evaluation metrics used (precision, recall, and F1 score). Special attention is given to Active Learning (AL) and Continuous Active Learning (CAL), strategies where the machine learning model actively selects the most informative data for training. The challenges of balancing batch sizes during retraining are highlighted, as well as the implementation of Incremental Gradient Descent (IGD) to optimize model updates. The technical details provided make this presentation valuable for researchers interested in the intersection of AI, law, and data management,

emphasizing AI's role in improving the efficiency and accuracy of E-Discovery processes

[SF-TS11-B-6][9132] Active Learning as a Catalyst for Human-Centric AI: Enhancing Explainability, Intent Understanding, and Societal Resilience

Time: 1:40am-1:55am, October 19th, U.S. Eastern Daylight Time
Presenter(s): **Guangjun Zeng**

Abstract: The presentation titled "Active Learning as a Catalyst for Human-Centric AI: Enhancing Explainability, Intent Understanding, and Societal Resilience" explores active learning's role in creating more adaptive, efficient, and ethically aligned AI systems. Key points include:

- Human-AI Relationship Transformation: Active learning addresses challenges in human-AI interaction by enhancing system transparency and trustworthiness.
- Active Learning Techniques: Three core approaches—Membership Query Synthesis, Stream-Based Sampling, and Pool-Based Sampling—optimize model learning efficiency by selectively querying the most informative data.
- Applications Across Fields: In healthcare, robotics, smart homes, and finance, active learning supports tasks like anomaly detection, personalized adaptation, and real-time decision-making, focusing on reducing annotation costs and improving scalability.
- Challenges and Future Directions: Privacy, annotation quality, and model interpretability remain key concerns. Integration with federated learning, real-time model updates, and adherence to regulatory standards represent forward-looking goals for responsible AI.

[SF-TS11-B-7][3993] Hallucination in Large Language Models: From Mechanistic Understanding to Novel Control Frameworks

Time: 1:55am-2:10am, October 19th, U.S. Eastern Daylight Time
Presenter(s): **Wuyang Zhang**

Author(s): **Wuyang Zhang, Chenkai Zhang, Chuqiao Gu, Jieren Kou, Hao Yuan, Xinyi Fang, Xiaoman Duan and Yajun Fang**

Abstract: Hallucination in large language models (LLMs) represents a fundamental challenge that extends beyond technical failure to reveal the mathematical inevitability of uncertainty in probabilistic language generation. This comprehensive survey presents the first unified mechanistic framework that systematically maps causal pathways from internal mechanisms to observable

manifestations. We introduce a hierarchical taxonomy organizing hallucinations into four manifestation categories (P1: factuality errors, P2: faithfulness violations, P3: logical inconsistencies, P4: emergent behaviors) and trace their origins to three mechanistic sources (C1: data artifacts, C2: training biases, C3: inference failures). Our analysis reveals the dual nature of hallucination, simultaneously representing creative potential and factual unreliability, which challenges assumptions about complete elimination. We present seven novel frameworks for mechanism-aware hallucination management: HALO-M for layer-wise diagnostic analysis, KOQF for quantifying knowledge overshadowing effects, MIT for targeted mechanistic interventions, DPHCS for dual-process adaptive generation, HABS for comprehensive benchmarking, NSHPA for neuro-symbolic verification, and HACHMS for human-AI collaborative management. Through systematic task decomposition and compositional verification, these frameworks enable precise identification and mitigation of hallucination at its source. By establishing hallucination as an emergent property to be understood and managed rather than suppressed, we provide both theoretical foundations and practical tools for developing AI systems that balance creative capability with factual reliability, ultimately reframing the hallucination challenge from an obstacle to an opportunity for advancing artificial intelligence aligned with human values.

[SF-TS11-B-8][6666] Reframing Hallucination in Large Language Models: A Lifecycle-Based, Mechanism-Aligned, and Phenomenon-Consistent Definition

Time: 2:10am-2:25am, October 19th, U.S. Eastern Daylight Time
Presenter(s): **Xinyi Fang**

Author(s): **Xinyi Fang, Hao Yuan, Hanxia Li, Jieren Kou, Chuqiao Gu, Wuyang Zhang, Xiaoman Duan and Yajun Fang**

Abstract: While recent advances in Large Language Models' reasoning capabilities have improved their performance across many tasks, the fundamental challenge of hallucination, a form of unexpected generation, persists. Researchers are already attempting to develop methods to detect and mitigate hallucination, even though the term itself lacks a unified definition and is applied inconsistently across the literature. This incongruity underscores the need for a clear and conceptually grounded definition, which is the prerequisite for pursuing effective solutions. We reviewed 76 definitions of hallucination from AI-related literature published between 2023 and 2025. Our analysis revealed substantial overlaps and ambiguities in the definitional boundaries between hallucination and other related concepts, leading to inconsistent usage across the literature. The current definitional vocabulary also remains largely focused on observable properties, such as factuality and faithfulness, rather than the underlying mechanisms that give rise to these outputs. To address these limitations, we propose a Lifecycle-Based, Mechanism-Aligned, and Phenomenon-Consistent definition of hallucination that integrates both

the generative mechanisms and their observable manifestations across the stages of data collection, processing, and quality assurance, through model development, to deployment. This reframed definition provides a conceptually coherent foundation for hallucination evaluation and mitigation, offering future guidance for developing benchmarks, designing diagnostic tools, and implementing mitigation strategies.

[SF-TS11-B-9][9066] LENS: Layers of Evaluation of hallucination in GenAI Systems

Time: 2:25am-2:40am, October 19th, U.S. Eastern Daylight Time
Presenter(s): **Chuqiao Gu**

Author(s): **Chuqiao Gu, Wuyang Zhang, Zhengqian Huang, Jieren Kou, Zhenyao Liu, Chenjun Zhao, Chang Liu, Lifeng Zhang, Wenjie Lin, Guoxin Huang, Charles Zhang, Zhongda Wang, Jianwei Deng, Yuhuan Xie, Chengming Wang, Hao Yuan, Xiaoman Duan and Yajun Fang**

Abstract: Large Language Models (LLMs) and Vision – Language Models (VLMs) demonstrate remarkable capabilities but remain vulnerable to hallucinations — producing plausible yet factually incorrect content—with error rates ranging from as low as 1.47% in clinical applications to as high as 75\% in domain-specific queries.

Despite growing attention, existing hallucination evaluation frameworks remain insufficient to meet critical needs. Through a comprehensive survey of over 100 evaluation methods spanning six methodological paradigms (probe-based, adversarial testing, causal intervention, uncertainty-guided, internal state analysis, and online evaluation), we identify fundamental limitations: current approaches fall short of enabling objective model comparison, providing diagnostic insights into failure modes, supporting domain-evolving benchmark construction, and guiding targeted mitigation strategies.

Our analysis reveals that evaluations remain fragmented, operating either horizontally—comparing models across tasks and domains—or vertically—probing reasoning chains within single outputs. This fragmentation limits holistic assessment: horizontal evaluations provide breadth but risk superficiality, while vertical assessments deliver depth but lack generalizability. Moreover, we identify five critical gaps: (1) dimensional poverty reducing hallucinations to binary metrics, (2) failure to integrate horizontal breadth with vertical depth, (3) metacognitive blind spots overlooking when models should seek external verification, (4) adaptability crisis from static benchmarks, and (5) transparency deficits providing scores without actionable insights.

Beyond surveying the landscape, this paper articulates eight fundamental challenges confronting comprehensive evaluation — from epistemological difficulties in defining ground truth and computational complexity of scaling assessment, to attribution opacity obscuring causal mechanisms and dynamic knowledge evolution

rendering benchmarks obsolete. These challenges span multimodal complexity, scale and diversity requirements, adversarial robustness, and human alignment considerations.

We present LENS (Layers of Evaluation of Hallucination in GenAI Systems), a unified framework addressing these gaps through hierarchical, tree-based query decomposition. LENS transforms complex evaluation tasks into multi-layered assessment structures via a six-stage pipeline (task formulation, decomposition, tool-augmented execution, structured generation, multi-dimensional scoring, and trace analysis), enabling MRI-like scanning of inference processes to reveal where and why hallucinations originate.

The framework introduces four key innovations:

(1) Tool Necessity Detection and Selection (TND/TSA) – explicitly evaluating when models should consult external sources versus relying on parametric memory, addressing a fundamental hallucination source. (2) Multi-Dimensional Metrics – assessing degree (accuracy, faithfulness, tool appropriateness), quantity (coverage, completeness), stability (consistency, robustness), and risk (uncertainty quantification) beyond binary detection. (3) User-Centric Benchmark Construction – empowering organizations to design custom evaluations from their evolving knowledge bases while maintaining methodological rigor. (4) Actionable Error Attribution – providing hierarchical decomposition traces with causal attribution, evidence chains, and OpenTelemetry-based reproducibility for transparent auditing.

Our systematic taxonomy unifies previously fragmented approaches across evaluation targets (task-specific, modality-based, hallucination-type, domain-specific), dimensions (factuality, faithfulness, consistency, robustness, causal reasoning, interpretability), and methodologies. We introduce unified metrics transcending individual dimensions and present mitigation-aware evaluation strategies integrating RAG, parameter-efficient fine-tuning, knowledge distillation, preference optimization, and temporal intervention approaches.

By combining horizontal breadth (across domains and architectures) with vertical depth (into reasoning processes), LENS advances hallucination evaluation from post-hoc error detection to proactive risk assessment. Case studies in medical diagnosis, legal analysis, and financial reasoning demonstrate the framework's transformative impact, enabling objective model comparison, informed selection, diagnostic insights, domain-evolving benchmarks, and targeted mitigation development—fostering calibrated trust in AI systems deployed in safety-critical applications where accuracy, interpretability, and accountability are indispensable.

[SF-TS11-B-10][8007] Comprehensive Evaluation of AI Hallucination and Novel UV-Oriented Framework toward Safe and Trustworthy AI

Time: 2:40am-2:55am, October 19th, U.S. Eastern Daylight Time
Presenter(s): **Zhenyao Liu**

Author(s): **Zhenyao Liu, Jieren Kou, Wuyang Zhang, Chuqiao Gu, Xinyi Fang, Zhenqian Huang, Hao Yuan, Hanxia Li, Xiuyuan Lu, Aobing Yin, Chang Liu, Zhongda Wang, Haoyang Huang, Xiaoman Duan and Yajun Fang**

Abstract: this work, we present a comprehensive evaluation of hallucination phenomena in LLMs and multimodal systems. First, we propose a structured taxonomy encompassing factuality-based, faithfulness-based, logical-based, and emergent hybrid forms, extending to multimodal-specific risks such as cross-modal inconsistencies, visual overinterpretation, and modality dominance effects. Second, we conduct a mechanistic analysis that traces hallucinations across the full model lifecycle — data-level origins (knowledge gaps, misinformation, annotation noise), training-induced mechanisms (distributional mimicry, reward bias, alignment forgetting), and inference-time vulnerabilities (confidence miscalibration, decoding failures, prompt-induced errors). This perspective reveals how independent mechanisms interact to produce cascade effects, amplifying initial flaws into elaborate but unreliable narratives. Third, we critically assess existing detection and evaluation approaches, highlighting limitations of current benchmarks, taxonomic ambiguities, and the lack of mechanism-aware evaluation protocols. We argue that future evaluation must integrate both surface-level manifestations and their generative causes to achieve more robust measurement.

Beyond evaluation, we survey mitigation strategies organized into mechanism-based, phase-based, and hybrid approaches. These range from lightweight prompt engineering and decoding constraints to resource-augmented methods such as retrieval-augmented generation and knowledge graph integration, as well as higher-level frameworks for controllability and uncertainty calibration. We analyze the trade-offs among effectiveness, scalability, interpretability, and creative freedom, emphasizing the importance of context-specific tolerances: hallucinations that are unacceptable in medicine or finance may be tolerable, or even beneficial, in creative applications.

Building on these insights, we propose a novel UV-oriented framework for safe and trustworthy AI, inspired by the Universal Village vision of harmonizing human, technological, and environmental systems. In this framework, hallucination is conceptualized not only as an isolated model error but as a systemic vulnerability in information flow and decision-making loops. We design a multi-level dynamic system integrating sensing, communication, decision-making, action, and evaluation, supported by closed feedback loops and user-specific hallucination tolerance levels. This architecture enables adaptive mitigation through mechanism-informed strategies, retrieval and verification integration, and consensus mechanisms, ensuring resilience across diverse application contexts.

Our contributions are threefold: (1) we present the most comprehensive taxonomy of hallucination to date, linking manifestations with mechanistic drivers; (2) we unify detection, evaluation, and mitigation strategies into a coherent survey that highlights both current progress and pressing gaps; and (3) we introduce a UV-oriented framework that reframes hallucination control as part of a broader,

feedback-driven ecosystem for reliable AI. We conclude by outlining open challenges, including classification ambiguities, multimodal alignment risks, deployment-specific vulnerabilities, and the need to reconcile reliability with creativity. Addressing these challenges is essential to advancing from powerful yet fallible generative models toward AI systems that are not only safe and responsible but also aligned with human values and societal needs.

Session [TS12-A] : New results in low carbon and zero carbon technology

Time: 09:00am-10:45am, October 20th , U.S. Eastern Daylight Time
Meeting Room (Microsoft Teams): [TS12-A] IEEE UV2024 Session
Chair(s): Ting He (Jinan University)
Assistant(s): Yuezhi Luo

Meet Our Speakers

Session Overview: China maps path to the carbon peak, carbon neutrality goals under new development philosophy. Using renewable energy is one of the obvious ways to reduce carbon dioxide emissions. However, China like other large countries such as India, Japan, still use fossil fuels as the main source of the electricity generation. Low carbon or zero carbon technology is an important alternatives to fossil fuel combustion for industrial applications. Oxy - fuel combustion, ammonia/hydrogen - fuel combustion, aluminum powder combustion for propulsion, co - combustion of different fuels such as coal, biomass, solid waste are being explored. By adopting a range of technologies, it is possible to reduce CO_2 emission and move toward to more sustainable energy future.

- **Agenda[EDT]**

1. **[09:00am-09:05am][Oct.20][TS12-A][K-1]** ***Ting He,*** *Session Chair*; Opening and Speech
2. **[09:05am-09:25am][Oct.20][TS12-A][K-2]** ***Xinjian Chen*****,** *Invited Speaker*; High-resolution dynamic characteristics of thermal wave in porous media burners with low-concentration methane
3. **[09:25am-09:40am][Oct.20][TS12-A][K-3]** ***Wei Dong*****,** *Invited speaker;* Experimental Study on Long-term Self-sustained Combustion of High-concentration Aluminum Particles in a Swirl Combustor
4. **[09:40am-09:55am][Oct.20][TS12-A-1][4720]** ***Mengqi Yi and Ting He,*** *Author;* Dynamic Characteristics Analysis and Active Disturbance Rejection Control of Hydrogen Blended Gas Turbine

   <9:55-10:00am> Break

5. **[10:00am-10:15am][Oct.20][TS12-A][K-4]** ***Cheng Zhong,*** *Invited speaker;* Application of multi-source heat pump coupled with phase change heat storage technology in crude
6. **[10:15am-10:30am][Oct.20][TS12-A-2][4401]** ***Jiayu Chu ,*** *Author;* Highly Efficient Photocatalytic Hydrogen Evolution Activity over CdS/NiS Nanocomposites under Visible Light
7. **[10:30am-10:45am][Oct.20][TS12-A-3][0951]** ***Jiacheng Gao,*** *Author;* Study on Control and Optimization of DataCenter Refrigeration System Based on Phase Change Cold Storage

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Student Forum

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8. **[09:05pm-09:20pm][Oct.21][SF-TS12-A-1][9721]** ***Yuxuan Chen,*** *Presenter;* The Role of Co-Firing Technology with Multiple Fuels in Carbon Emission Reduction

[TS12-A][K-1] Opening and Speech

Time: 09:00am-09:05am, October 20th, U.S. Eastern Daylight Time
Invited Speaker(s): **Ting He,** *Session Chair*

[TS12-A][K-2] High-resolution dynamic characteristics of thermal wave in porous media burners with low-concentration methane

Time: 09:05am-09:25am, October 20th, U.S. Eastern Daylight Time
Invited Speaker(s): **Xinjian Chen**

[TS12-A][K-3] Experimental Study on Long-term Self-sustained Combustion of High-concentration Aluminum Particles in a Swirl Combustor

Time: 09:25am-09:40am, October 20th, U.S. Eastern Daylight Time
Invited Speaker(s): **Wei Dong**

[TS12-A-1][4720] Dynamic Characteristics Analysis and Active Disturbance Rejection Control of Hydrogen Blended Gas Turbine

Time: 09:40am-09:55am, October 20th, U.S. Eastern Daylight Time
Invited Speaker(s): **Mengqi Yi**

Author(s): **Mengqi Yi and Ting He**

Abstract: Under the background of carbon peaking and carbon neutrality, hydrogen blending combustion technology for gas turbines has attracted significant attention. The dynamic characteristics and control strategies of hydrogen-blended gas turbines are crucial for improving combustion efficiency. This paper employs a modular modeling approach to establish a dynamic simulation model for hydrogen-blended gas turbines on a simulation platform. It investigates the dynamic characteristics and control strategies of hydrogen-blended gas turbines, analyzing the trends of key parameters under different operating conditions and hydrogen blending ratios. The control effects of PID and ADRC strategies on hydrogen-blended gas turbines are compared. The results indicate that as the hydrogen blending ratio increases, the fuel ffow required to maintain the same operating conditions decreases, while the turbine inlet pressure and exhaust temperature also decrease. At the same time, the emissions of CO2 and NOx also decrease. Higher blending ratios lead to more pronounced temperature variations. Both ADRC and PID control strategies can maintain the rotor speed and exhaust temperature near the set values, with ADRC achieving better control performance under varying operating

conditions.

Keywords—dynamic characteristics gas turbine, hydrogen blending, ADRC.

<09:55am-10:00am> Break

[TS12-A][K-4] Application of multi-source heat pump coupled with phase change heat storage technology in crude

Time: 10:00am-10:15am, October 20th, U.S. Eastern Daylight Time
Presenter(s): **Cheng Zhong**

[TS12-A-2][4401] Highly Efficient Photocatalytic Hydrogen Evolution Activity over CdS/NiS Nanocomposites under Visible Light

Time: 10:15am-10:30am, October 20th, U.S. Eastern Daylight Time

***Author(s)*:** **Jiayu Chu, Tielei Xu, Wenfu Tan, Weiyue Wu, Kunrong Huang, Min Qiu and Yanchun Jiang**

Abstract: The development of efficient and stable non-precious metal-based photocatalytic materials is an important way to achieve hydrogen production through water cracking, which is of great significance for alleviating the energy crisis and environmental pollution. Our research indicates that a breakthrough has been made in the field of structurally uniform CdS/NiS nanocomposites synthesized by the hydrothermal method. Facile hydrothermal synthesis of CdS/NiS nanocomposites achieves exceptional visible-light-driven hydrogen evolution (5.6 mmol·g-1·h-1), showcasing a 31-fold enhancement over pure CdS. This work highlights both the remarkable efficiency and straightforward preparation of non-precious metal photocatalysts for sustainable hydrogen production.

Keywords—CdS, NiS, visible-light, photocatalytic hydrogen evolution evolution.

[SF-TS12-A-3][0951]Study on Control and Optimization of DataCenter Refrigeration System Based on Phase Change Cold Storage

Time: 10:30am-10:45am, October 20th, U.S. Eastern Daylight Time

Author(s):**Jiacheng Gao, Lejun Feng, Jun Sui, Weiyue Wu, Tielei Xu, Kunrong Huang and Wenfu Tan**

***Abstract*:** This study addresses the inefficiency of cooling systems in data centers by developing an air conditioning chilled water system incorporating phase change thermal energy storage. A comprehensive control framework is established through the construction of energy consumption models for pumps, chillers, and cooling towers, as well as a dynamic cooling capacity output model for the phase change storage unit. To navigate the complexity of multi-variable optimization, a hybrid algorithm combining Simulated Annealing and Particle Swarm Optimization is proposed, enhancing convergence and mitigating the risk of local optima. Experimental outcomes indicate that the optimized system reduces operational costs by approximately 30 percent and decreases the Power Usage Effectiveness from 1.5 to 1.38, significantly enhancing the energy efficiency of data centers.

***Keywords*—**date center, phase change thermal storage device, SA-PSO hybrid algorithm.

[SF-TS12-A-1][9721] The Role of Co-Firing Technology with Multiple Fuels in Carbon Emission Reduction

Time: 09:05pm-09:20pm, October 21st, U.S. Eastern Daylight Time
Presenter(s): **Yuxuan Chen**

Abstract: A technique that involves the combustion of multiple fuels together, such as coal, biomass, and solid waste.

Session [TS12-B] : UV Underground: Underground Infrastructure & Future

Time: 10:20am - 12:30pm, October 20th , U.S. Eastern Daylight Time
Meeting Room (Microsoft Teams):[TS12-B] IEEE UV2024 Session
Chair(s): Zili Li
Assistant(s): Zhongda Wang, Zhicheng Zhang, Guangjun Zeng

Meet Our Speakers

Session Overview:

- AI and digital tools revolutionize civil engineering underground.
- Sustainable subsurface engineering via renewable energy, emission reduction.
- Data analytics enhance underground structures, Universal Village insights.
- Innovative socioeconomics and architecture for underground living spaces.

- **Agenda [EDT]**
  1. **[10:20am-10:30am][Oct.20][TS12-B][K-1]** ***Zili Li,*** *Session Chair*; Opening and Speech
  2. **[10:30am-11:30am][Oct.20][TS12-B][K-2]** ***Bingyu Zhao,*** *Invited Speaker*; Burrowing Robotics: bioinspirations, mechanisms and prototypes
  3. **[11:30am-12:30pm][Oct.20][TS12-B][K-3]** ***Julian Tao,*** *Invited Speaker*; City-scale Traffic Simulations and Applications in Resilience and Sustainability

[TS12-B][K-1] Opening and Speech

Time: 10:20am-10:30am, October 20th, U.S. Eastern Daylight Time
Invited Speaker(s): **Zili Li,** *Session Chair*

[TS12-B][K-2] Burrowing Robotics: bioinspirations, mechanisms and prototypes

Time: 10:30am-11:30am, October 20th, U.S. Eastern Daylight Time
Invited Speaker(s): **Bingyu Zhao**

[TS12-B][K-3] City-scale Traffic Simulations and Applications in Resilience and Sustainability

Time: 11:30am-12:30pm, October 20th, U.S. Eastern Daylight Time
Invited Speaker(s): **Julian Tao**

Session [TS12-C] : The Fusion of Traditional Chinese Medicine and Modern Science

Time: 11:00am - 12:35pm, October 20th, U.S. Eastern Daylight Time
Meeting Room (Microsoft Teams): [TS12-C] IEEE UV2024 Session
Chair(s): Yun Li (Beijing University of Chemical Technology)
Assistant(s): Zhongda Wang, Zhicheng Zhang, Chengming Wang, Haohsiang Hsu

Meet Our Speakers

Session Overview: The integration of Traditional Chinese Medicine (TCM) and modern science is gaining popularity in recent years. TCM, based on the balance within the body, mind, and spirit, uses herbal medicine, acupuncture, cupping, and massage to address the root causes of health issues. Modern science, with its evidence-based approach, treats diseases through pharmaceuticals and surgeries. Combining these approaches offers holistic, personalized healthcare that addresses root causes and promotes overall well-being.

- **Agenda[EDT]**
  1. **[11:00am-11:05am][Oct.20][TS12-C][K-1]** ***Yun Li,*** *Session Chair;* Opening and Speech
  2. **[11:05am-11:35am][Oct.20][TS12-C][K-2]** ***Ka-Kit Hui*** **,** *Invited Speaker*; The Potential of Integrative Medicine in Improving Health Care
  3. **[11:35am-12:05pm][Oct.20][TS12-C][K-3]** ***Jimmy Wang*****,** *Invited Speaker*; A Summary of a Modern Pulse Diagnosis using Harmonics Analysis
  4. **[12:05pm-12:35pm][Oct.20][TS12-C][K-4]** ***Keda Li*****,** *Invited Speaker*; The TCM Sclera Diagnosis System
  5. **[07:45am-08:00am][Oct.19][NR-TS12-C-1][4464]** ***Yan Tang***, ***Weibo Zhang and Ligong Xue,*** *Author*; Assessing the Relevance of Fancy Shuttlecock Kicking to the Electrical Impedance Measurements of Meridians

[TS12-C][K-1]Opening and Speech

Time: 11:00am-11:05am, October 20th, U.S. Eastern Daylight Time
Invited Speaker(s): **Yun Li,** *Session Chair*

[TS12-C][K-2]The Potential of Integrative Medicine in Improving Health Care

Time: 11:05am-11:35am, October 20th, U.S. Eastern Daylight Time
Invited Speaker(s): **Ka-Kit Hui**

[TS12-C][K-3]A Summary of a Modern Pulse Diagnosis using Harmonics Analysis

Time: 11:35am-12:05pm, October 20th, U.S. Eastern Daylight Time
Invited Speaker(s): **Jimmy Wang**

[TS12-C][K-4]The TCM Sclera Diagnosis System

Time: 12:05pm-12:35pm, October 20th, U.S. Eastern Daylight Time
Invited Speaker(s)*:* **Keda Li**

[NR-TS12-C-1][4464]:Assessing the Relevance of Fancy Shuttlecock Kicking to the Electrical Impedance Measurements of Meridians

Time: 07:45am-08:00am, October 19th, U.S. Eastern Daylight Time

Author(s): **Yan Tang, Weibo Zhang and Ligong Xue**
Abstract: Fancy shuttlecock kicking is a long-standing traditional Chinese sport that adheres to the fundamental principles of Traditional Chinese Medicine (TCM). Research indicates that shuttlecock kicking is closely related to the oldest medical classics of China, the Lingshu (Spiritual Pivot) of Huang Di Nei Jing (Yellow Emperor's Inner Canon). In ancient China, there were the Foot Three Yin and Foot Three Yang Meridian-tendons, which were muscle groups and associated tissues discovered by the ancients. These Meridian-tendons represent patterns in muscular injuries, with 'Jing' denoting longitudinal lines. Ancient Chinese divided the body's muscles longitudinally into 24 muscle chains. The leg movements in traditional fancy shuttlecock kicking overlap in muscle activation with some of these muscle chains. Muscle activity generates heat, which theoretically, like heat therapy, disperses contusions. The meridians close to these muscle chains also aid in clearing blockages. Tests have shown that exercise can alter the values obtained from meridian electrical impedance testing, with electrical impedance varying between individuals. The variability in human body impedance is subject to patterns discernible after numerous extensive tests, and theoretically, this hypothesis stands, requiring extensive empirical validation.

Keywords—fancy shuttlecock kicking, meridians, meridian electrical impedance, traditional chinese medicine, muscle chains.

Session [TS12-D] : AI-Driven Sports Training, Exercise, and Fitness

Time: 08:00am-11:10am, October 22nd , U.S. Eastern Daylight Time
Meeting Room (Microsoft Teams): [TS12-D] IEEE UV2024 Session
Chair(s): Zhixiong Zhou (Capital University of Physical Education and Sports)
Assistant(s): Zhongda Wang, Zhongyu Liu

Meet Our Speakers

Session Overview: The integration of artificial intelligence (AI) in sports health is transforming how people train, recover, and prevent injuries. AI technologies analyze vast amounts of data from devices, motion sensors, and medical records to provide personalized insights and recommendations. Additionally, AI aids in injury prevention by identifying patterns and potential risks, allowing for early intervention. The fusion of AI with sports health practices offers a forward-looking, data-driven method to enhance overall performance.

- **Agenda[EDT]**
  1. **[08:00am-08:10am][Oct.22][TS12-D][K-1]** ***Zhixiong Zhou***, *Session Chair*; **Opening and Speech**
  2. **[08:10am-08:40am][Oct.22][TS12-D][K-2]** ***Liucheng Guo***, *Invited Speaker*; An AI-Driven Sensing Material for Sports Training, Exercise, and Fitness
  3. **[08:40am-09:10am][Oct.22][TS12-D][K-3]** ***Jian Liu***, *Invited Speaker*; The Potential of AI in Virtual Sports: Shaping the Future of Training and Interaction
  4. **[09:10am-09:40am][Oct.22][TS12-D][K-4]** ***Yu Chen***, *Invited Speaker*; Application of Green Flexible Conductive Materials and Intelligent Sensors in Sports Health Monitoring
  5. **[09:40am-10:10am][Oct.22][TS12-D][K-5]** ***Zhize Zhou,*** *Invited Speaker*; Development of Markerless Motion Capture and its Application in Sports
  6. **[10:10am-10:25am][Oct.22][TS12-D-1][5874]** ***Jiale Xu, Wei Wang, Zheng Yu, Lei Sun, Junchao Zhu,*** *Author*; Estimating Steady-State Metabolic Energy Cost From Wearable Sensors Using LSTM Neural Networks During Level and Inclined Walking
  7. **[10:25am-10:40am][Oct.22][SI-TS12-D-2][4645]** ***Keying Zhang, Yaxue Wang, Chunmei Cao and Dong Zhang,*** *Author*; SVM Classification of Endurance Athletes and Controls: A Model with Practical Implications for Athletic Performance
  8. **[10:40am-10:55am][Oct.22][SI-TS12-D-3][0684]** ***Hanbai Zhang, and Yuebai Zhang,*** *Author*; Research and Development of Health Qigong Teaching Aids and Movement Correction Equipment
  9. **[10:55am-11:10am][Oct.22][SI-TS12-D-4][4798]** ***Min Lu, Jun Xiang, Shenglian Lu, Zhiliang Qiu, Yanyan Su, Haoping Qin,*** *Author*; The Application of Computer Vision Technology in the Evaluation of Athletic Teaching in Sports Majors: A Case Study of the Hang Style in Long Jump

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Student Forum

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10. **[10:30pm-10:45pm][Oct.18][SF-TS12-D-1][0009]** ***Dong Wang and Yuebai Zhang,*** *Author*; Integrating Somatosensory Technology with Wu Qin Xi: A Novel Teaching Model Exploration
11. **[10:45pm-11:00pm][Oct.18][SF-TS12-D-2][8117]** ***Tao Xu and Chenxi Xu,*** *Author*; The Application of AI Physical Fitness in the Physical Training of High-level Table Tennis Athletes
12. **[11:00pm-11:15pm][Oct.18][SF-TS12-D-4][1245]** ***Sihan Chen and Zihan Zhou*****,** *Presenter***;** Computer Vision-Based Physical Activity Intensity Measurement

[TS12-D][K-1] Opening and Speech

Time: 08:00am-08:10am, October 22nd, U.S. Eastern Daylight Time
Invited Speaker(s): **Zhixiong Zhou*****,*** *Session Chair*

[TS12-D][K-2] An AI-Driven Sensing Material for Sports Training, Exercise, and Fitness

Time: 08:10am-08:40am, October 22nd, U.S. Eastern Daylight Time
Invited Speaker(s): **Liucheng Guo**

[TS12-D][K-3] The Potential of AI in Virtual Sports: Shaping the Future of Training and Interaction

Time: 08:40am-09:10am, October 22nd, U.S. Eastern Daylight Time
Invited Speaker(s): **Jian Liu**

[TS12-D][K-4] Application of Green Flexible Conductive Materials and Intelligent Sensors in Sports Health Monitoring

Time: 09:10am-09:40am, October 22nd, U.S. Eastern Daylight Time
Invited Speaker(s): **Yu Chen**

[TS12-D][K-5] Development of Markerless Motion Capture and its Application in Sports

Time: 09:40am-10:10am, October 22nd, U.S. Eastern Daylight Time
Invited Speaker(s): **Zhize Zhou**

[TS12-D-1][5874] Estimating Steady-State Metabolic Energy Cost From Wearable Sensors Using LSTM Neural Networks During Level and Inclined Walking

Time: 10:10am-10:25am, October 22nd, U.S. Eastern Daylight Time

Author(s): **Jiale Xu, Wei Wang, Zheng Yu, Lei Sun and Junchao Zhu**

Abstract*:* To reduce the physical effort of walking, lower limb exoskeletons have been developed to assist with human movement. Recent studies on human-in-the-loop optimization have greatly improved exoskeleton performance, allowing for personalized assistance strategies for wearers. Currently, metabolic cost is widely employed as the primary physiological objective in optimization processes. However, estimating metabolic cost typically involves noisy, sparsely sampled data and requires extended experimental durations, which can result in participant fatigue and cardiopulmonary drift. This study aimed to predict energy expenditure based on physiological data collected from wearable sensors, offering improved temporal resolution and reduced variability compared to traditional respiratory measurements. Physiological data, including heart rate, electromyography (EMG), and limb accelerations, were collected from subjects walking at various treadmill speeds and slopes. Energy expenditure was estimated using various machine learning models, including multiple linear regression (MLR), BP neural networks (BPNN), and long short-term memory (LSTM) networks. The results indicated that heart rate muscle activities have a strong correlation with metabolic cost. Among the three models, the LSTM model demonstrated the highest accuracy in predicting energy expenditure. Our results offer valuable insights for developing personalized exoskeleton assistance strategies.

Keywords—steady-state metabolic energy cost, wearable sensors, LSTM, walking.

[SI-TS12-D-2][4645] SVM Classification of Endurance Athletes and Controls: A Model with Practical Implications for Athletic Performance

Time: 10:25am-10:40am, October 22nd, U.S. Eastern Daylight Time

Author(s): **Keying Zhang, Yaxue Wang, Chunmei Cao and Dong Zhang**

Abstract*:* The gray matter plasticity in athletes is crucial for understanding the neural mechanisms of sports. However, traditional MRI data processing methods face limitations due to the large volume of data from voxel - based analyses. Support vector machine (SVM) may offer advantages and could serve as a potential solution. MRI scans were performed to obtain gray matter volume data for each voxel from

20 endurance athletes and 20 control subjects. We applied a SVM classification algorithm with leave-one-out cross-validation to construct the classification model and calculate accuracy. Brain regions with significant contribution weights during classification were identified as regions of interest (ROI). We then extracted their gray matter volume signals and conducted a correlation analysis with endurance capacity (maximum oxygen uptake) to evaluate the relationship between plasticity of these brain regions and athletic performance. The SVM classification algorithm using gray matter volume (GMV) as a feature achieved excellent performance in distinguishing between endurance athletes and control subjects, with a total accuracy and balanced accuracy of percent of 82.5. The differing brain regions were located in extensive cortical and subcortical areas. Specifically, the left precuneus, the left superior frontal orbital gyrus, the left thalamus, as well as the right thalamus exhibited a positive correlation with maximal oxygen uptake (V O2 max), while the right hippocampus and right parahippocampal showed a negative correlation. This study shows that SVM classification can distinguish endurance athletes from controls using GMV as feature. Key brain regions correlate with maximum oxygen uptake, suggesting that GMV plasticity may correlate with endurance capacity. These findings provide insights for future research and training strategies.

Keywords—pattern recognition, support vector machine, athletes, magnetic resonance imaging, gray matter, aerobic endurance.

[SI-TS12-D-3][0684] Research and Development of Health Qigong Teaching Aids and Movement Correction Equipment

Time: 10:40am-10:55am, October 22nd, U.S. Eastern Daylight Time

Author(s)*:* **Hanbai Zhang and Yuebai Zhang**

Abstract: Health Qigong, a cornerstone of traditional Chinese wellness practice, faces a critical barrier to wider adoption: the inherent difficulty in mastering its complex movements. Conventional teaching, hampered by the lack of real-time, objective feedback and standardized guidance, often leads to inefficient learning and potential errors. To overcome this fundamental challenge, this study pioneers an intelligent mechanical-assisted learning system. Our breakthrough solution seamlessly integrates high-precision 3D motion tracking, biomechanical analysis, and AI-driven correction. The system captures user movement in realtime, rigorously compares it against gold-standard models, and delivers instantaneous, multi-modal feedback (haptic and visual) to the learner. Crucially, the integrated AI module autonomously identifies deviations (e.g., posture angles, joint misalignment) and dynamically adjusts mechanical resistance to actively guide users towards correct form. Rigorous experimental validation with 50 participants (novices and instructors) demonstrated a remarkable 42% acceleration in skill acquisition compared to traditional methods. This innovative human-machine interaction not

only dramatically enhances learning efficiency and accuracy but also significantly reduces reliance on scarce instructor resources, enabling scalable, high-fidelity self-training – a transformative advancement for traditional mind-body exercise pedagogy.

Keywords—health Qigong, teaching aids, movement correction.

[SI-TS12-D-4][4798] The Application of Computer Vision Technology in the Evaluation of Athletic Teaching in Sports Majors: A Case Study of the Hang Style in Long Jump

Time: 10:55am-11:10am, October 22nd, U.S. Eastern Daylight Time

Author(s)*:* **Min Lu, Jun Xiang, Shenglian Lu, Zhiliang Qiu, Yanyan Su, Haoping Qin**

Abstract*:* This study presents the development and validation of an intelligent evaluation system based on computer vision for assessing the "Hang Style" technique in long jump. Traditional methods of evaluating sports techniques often rely on subjective observation and scoring by instructors, which can lead to inconsistencies and inaccuracies. To address these challenges, this system integrates artificial intelligence technologies, specifically utilizing HRNet and ResNet models within the MMPose framework for human pose estimation. The system automates the analysis of key technical movements, including approach speed, in-air posture, and landing mechanics. It employs Euclidean distance and cosine similarity methods for pose matching and scoring, while a Long Short-Term Memory (LSTM) network is used to predict movement quality. Experimental results demonstrate that the proposed system provides more objective and accurate evaluations compared to traditional approaches, thereby enhancing the quality of instruction and the technical proficiency of students. This intelligent and visualized solution offers a novel approach to sports technique assessment, furthering the application of artificial intelligence in higher education for physical training.

Keywords—hang style in long jump, computer vision, pose estimation, motion analysis.

[SF-TS12-D-1][0009] Integrating Somatosensory Technology with Wu Qin Xi: A Novel Teaching Model Exploration

Time: 10:30pm-10:45pm, October 18th, U.S. Eastern Daylight Time
Presenter(s): **Dong Wang**

Author(s): **Yuebai Zhang and Dong Wang**

Abstract: This paper examines the integration of somatosensory technology into Wu Qin Xi teaching. Unlike sports relying on innate talent, Wu Qin Xi requires detailed instruction and correction. Somatosensory technology captures human skeletons to identify and correct improper movements, reducing teachers' repetitive correction work and allowing them to focus on imparting deeper knowledge. It also transforms online classes into an interactive game-like environment, enhancing students' participation and engagement. Grounded in game theory, the virtual simulation teaching platform uses somatosensory games to guide students through learning tasks, reducing learning pressure and aligning with Wu Qin Xi's holistic principles. However, this technology cannot fully recognize all subtle human movements, leading to potential distortions in motion recognition. Future implementation should adopt a phased integration approach, combining somatosensory technology with traditional instruction to maintain Wu Qin Xi's holistic nature while optimizing learning outcomes.

Keywords—wu qin xi, motion sensing, teaching method.

[SF-TS12-D-2][8117] The Application of AI Physical Fitness in the Physical Training of High-level Table Tennis Athletes

Time: 10:45pm-11:00pm, October 18th, U.S. Eastern Daylight Time

Author(s): **Tao Xu and Chenxi Xu**

Abstract: The integration of artificial intelligence (AI) into physical fitness training has emerged as a transformative approach to enhancing the performance of high-level table tennis athletes. This study investigates the application of AI-driven systems in optimizing both health-related (e.g., cardiorespiratory endurance, body composition, flexibility) and skill-related (e.g., speed, reaction time, agility) physical fitness components. By leveraging advanced technologies such as wearable sensors, machine learning algorithms, and virtual reality (VR), AI enables real-time monitoring, personalized training program adjustments, and predictive injury prevention. For instance, AI-optimized high-intensity interval training (HIIT) improved athletes' VO2 max by 14.3%, while machine learning-driven agility training enhanced directional transition efficiency by 24.5%. Case studies from national teams in China, Japan, and Germany demonstrated the efficacy of AI in identifying biomechanical deficiencies and reducing injury risks by up to 34%. Despite challenges such as data privacy concerns and technical complexity, the study highlights AI's potential to revolutionize traditional training paradigms through precision, adaptability, and scientific rigor. The findings underscore the critical role of AI in advancing athletic performance, extending career longevity, and promoting interdisciplinary innovation in sports science.

Keywords—AI physical fitness, high-level table tennis athletes, personalized training, machine learning in sports science.

[SF-TS12-D-4][1245] Computer Vision-Based Physical Activity Intensity Measurement

Time: 11:00pm-11:15pm, October 18th, U.S. Eastern Daylight Time
Presenter(s): **Sihan Chen and Zihan Zhou**

Abstract: This paper describes a novel non-contact intensity estimation using a computer vision system. Given the prevalent obese conditions and health problems related to obesity in most parts of the world, there is a dire need for accurate monitoring of physical activities without overexertion that causes injury and provides personalized exercise programs accordingly. The existing wearable systems often require an invasive or uncomfortable type of usage that results in inconsistent application. Our approach leverages keypoint detection algorithms and LSTM models to estimate energy expenditure from real-time joint movements captured through camera systems. The system was tested on 50 college students and walking/running exercises were monitored at several speeds and for different activities. Preliminary results indicate that the model can sufficiently estimate VO2 max and energy consumption with promising accuracy. The strategy represents a scalable, low-cost intervention that could be widely deployed in public settings to both reduce injury and improve fitness outcomes. Future efforts will focus on enhancing the model's generalization to increasingly larger and more varied populations in real-world outdoor settings.

Session [TS12-E]: Equitable AI for the Voiceless and Vulnerable Groups

Time: 09:00am - 11:30am, October 20th, U.S. Eastern Daylight Time
Meeting Room (Microsoft Teams): [TS12-E] IEEE UV2024 Session
Chair(s): Juntao Jiang (Zhejiang University), Junyi Yu (Columbia University)
Assistant: Zhongyu Liu, Guangjun Zeng

Meet Our Speakers

Session Overview: As AI reshapes industries and societies, its potential to address global challenges is undeniable. This session will focus on the role of AI in promoting fairness and social impact, particularly for voiceless and vulnerable populations. Experts will discuss how AI can be leveraged to bridge gaps in healthcare, education, and economic opportunities, with a special emphasis on empowering developing countries and reducing poverty. The session will explore ways to design AI systems that promote inclusion, eliminate biases, and create lasting positive change, ensuring that technological progress uplifts those who need it most.

- **Agenda[EDT]**
  1. **[09:00am-09:20 am][Oct.20][TS12-E][K-1]** ***Juntao Jiang, Junyi Yu,*** *Session Chair;* Opening and Speech
  2. **[09:20am-09:50am][Oct.20][TS12-E][K-2]** ***Jia'an Liu*****,** *Invited Speaker*; Inclusive AI for Social Impact: Bridging Gaps with AI Voice and Agent-based ModelingAI
  3. **[09:50am-10:15am][Oct.20][TS12-E][K-3]** ***Zikang Xu*****,** *Invited Speaker*; FairMedFM: Fairness Benchmarking for Medical Imaging Foundation Models
  4. **[10:20am-10:45am][Oct.20][TS12-E][K-4]** ***Jessica Li*** **,** *Invited Speaker*; Empowering African American Organizations with Census Data: enhancing data literacy through accessible solution
  5. **[10:45am-11:15am][Oct.20][TS12-E][K-5]** ***Andy Liu*** **,** *Invited Speaker*; Gender Difference in Innovation Recognition
  6. **[11:15am-11:30am][Oct.20][TS12-E][K-6]** ***Discussion & Summary***

[TS12-E][K-1] Opening and Speech

Time: 09:00am-09:20 am, October 20th, U.S. Eastern Daylight Time
Invited Speaker(s): **Juntao Jiang, Junyi Yu,** *Session Chair*

[TS12-E][K-2] Inclusive AI for Social Impact: Bridging Gaps with AI Voice and Agent-based ModelingAI

Time: 09:20am-09:50am, October 20th, U.S. Eastern Daylight Time
Invited Speaker(s): **Jia'an Liu**

[TS12-E][K-3] FairMedFM: Fairness Benchmarking for Medical Imaging Foundation Models

Time: 09:50am-10:15am, October 20th, U.S. Eastern Daylight Time
Invited Speaker(s): **Zikang Xu**

[TS12-E][K-4] Empowering African American Organizations with Census Data: enhancing data literacy through accessible solution

Time: 10:20am-10:45am, October 20th, U.S. Eastern Daylight Time
Invited Speaker(s): **Jessica Li**

[TS12-E][K-5] Gender Difference in Innovation Recognition

Time: 10:45am-11:15am, October 20th, U.S. Eastern Daylight Time
Invited Speaker(s): **Andy Liu**

[TS12-E][K-6] Discussion & Summary
Time: 11:15am-11:30am, October 20th, U.S. Eastern Daylight Time

Session [PE]: Rethinking Education

Time: 08:00pm-08:40pm, October 20th, U.S. Eastern Daylight Time
Meeting Room (Microsoft Teams): [PE] IEEE UV2024 Session
Chair(s): John Galinato, Jing Yu
Assistant: Hao-Hsiang Hsu, Zhongyu Liu

Meet Our Speakers

Session Overview: According to Mitchel Resnick in Lifelong Kindergarten, "To thrive in today's fast - changing world, people of all ages must learn to think and act creatively". But how can creativity be obtained? how efficient is our education system in getting us ready for tomorrow's needs? Over the past 50 years, the cost of education has risen 24 times. Tuition at Cornell University was $2,500 in 1970 and $59,000 in 2020. This is more than 3 times the rate of inflation. While the average Cornell engineering graduate salary in 1970 was $12,000, but $94,000 in 2020. If the quality of education can be measured by what society is willing to pay for a college graduate, which Forbes does when it ranks colleges, then we can conclude that the quality of education has barely kept up with the inflation rate, let alone tuition increase. If Resnick is right with future education - "the best way ...is by focusing more on imagining, creating, playing, sharing, and reflecting, just as children do in traditional kindergartens" - then maybe to rethink and redesign an education system that's both accessible and relevant to future has become more urgent than ever. In our panel discussion, we will try to discuss the possibility of a new way of learning that integrates creativity, technology, and real - world problem - solving, which has been practiced and constantly evolved for 2 decades.

- **Agenda [EDT]**
  1. **[08:00pm-08:05pm][Oct.20][PE][K-1]** ***John Galinato, Jing Yu,*** *Session Chair*; Opening and Speech
  2. **[08:05pm-08:15pm][Oct.20][PE][K-2]** ***Wen Yu,*** *Invited Speaker,* Teaching AI to kids
  3. **[08:15pm-08:40pm][Oct.20][PE-1][5916]** ***Rodrigo Kai, Cindy Lin,*** *Author,* Rethinking Education

[PE][K-1] Opening and Speech

Time: 08:00pm-08:05pm, October 20th, U.S. Eastern Daylight Time
Invited Speaker(s): **John Galinato, Jing Yu,** *Session Chair*

[PE][K-2] Teaching AI to kids

Time: 08:05pm-08:15pm, October 20th, U.S. Eastern Daylight Time
Invited Speaker(s): **Wen Yu**

[PE-1] Rethinking Education

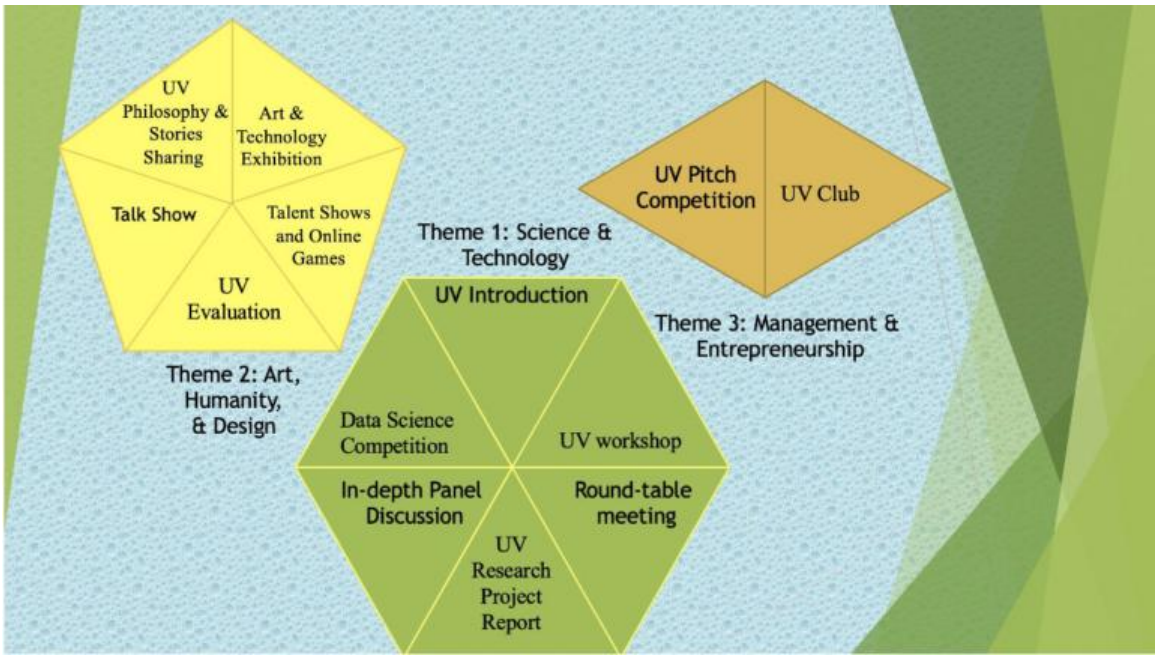
Time: 08:15pm-08:40pm, October 20th, U.S. Eastern Daylight Time

***Presenter*(s): John Galinato, Jing Yu, Wen Yu, Cindy Lin, and Rodrigo Kai**

Abstract: According to Professor Mitchel Resnick, Director of MIT's Lifelong Kindergarten Media Lab group, “To thrive in today's fast-changing world, people of all ages must learn to think and act creatively”. To echo his study, this paper proposes a vision to develop a metaverse classroom of the future that teaches students creativity and technical skills efficiently and effectively. The Build-It-Yourself strategy is to develop an online, global laboratory environment with interactive, dynamic content delivered by a network of art and engineering students from well-known universities. Professor Mitchel Resnick's quote guides the Build-It-Yourself strategy: “The best way …is by focusing more on imagining, creating, playing, sharing, and reflecting, just as children do in traditional kindergartens.”

[SF] Student Forum - Pitch Competition & Workshop

[SF] Student Forum - Pitch Competition & Workshop
Time: 08:00pm, October 18th - 11:15pm, October 18th, U.S. Eastern Daylight Time
11:20pm, October 18th - 3:25am, October 19th, U.S. Eastern Daylight Time
Meeting Room (Microsoft Teams): Team Channel: [SF] IEEE UV2024 Student Forum
Student Forum Chair(s): Zhenyao Liu, Hanxia Li, Jieren Kou



- **Part I: Pitch Competition for Lifestyle Innovation <Student Forum / K12 >**
  - **[K12-Pitch][K12][SF-TS7-A][SF-TS8-A][SF-TS8-B][SF-TS12-D]**
  - **[SF-TS7-A] Smart Environmental Protection; Smart Ecological Systems**
  - **[SF-TS8-A] Smart Homes and Community, Virtual Living**
  - **[SF-TS8-B] Mobility, Connectivity, and Innovative Lifestyles**
  - **[SF-TS12-D] AI-powered Sports, Exercise, and Fitness**
- **Agenda [08:00pm, October 18th - 11:15pm, October 18th] (EDT)**
  1. **[08:00pm-08:05pm][Oct.18]** ***Hanxia Li,*** *Student Forum Chair*; Opening and Speech
  2. **[08:05pm-08:20pm][Oct.18][K12-1][SF-TS8-B-5][8240]** ***Jiajun Luo,*** *Presenter; Innovative Low-Cost Bath Chair for Safer Home Care of the Elderly*
  3. **[08:20pm-08:35pm][Oct.18][K12-2][SF-TS8-B-6][0431]** ***Jiajun Luo,*** *Presenter; Raspberry Pi and Sensor Tech to Assess Sidewalk Accessibility*

4. **[08:35pm-08:50pm][Oct.18][K12-3][SF-TS8-A-1][8306]** ***Ailun Liu*****,** *Presenter;* Design and Implementation of an Intelligent Fish Tank System
5. **[08:50pm-09:05am][Oct.18][SF-TS8-A][K-1]** ***Zhenyao Liu***, *Invited Presenter*, Towards Intelligent Systems: A Review of Human Activity Recognition Methods and Applications
6. **[09:05pm-09:20pm][Oct.18][SF-TS8-B-1][0273]** ***Lanxin Chen,*** *Presenter;* Empowering Safety: Smart Technology's Role in Combating Sexual Harassment in Smart City Emergency System
7. **[09:20pm-09:35pm][Oct.18][SF-TS8-B-2][4053]** ***Siying Qu,*** *Presenter;* The Role and Future Prospects of Complementary and Alternative Medicine in the Treatment of Chronic Diseases
8. **[09:35pm-09:50pm][Oct.18][SF-TS8-B-3][7695]** ***Yuezhi Luo and Hongyin An*****,** *Presenter;* Adaptive Health Monitoring and Personalized Care: Intelligent Systems in Disease Management
9. **[09:50pm-10:05pm][Oct.18][SF-TS8-B-7][4448]** ***Yuezhi Luo and Qipei Chen,*** *Presenter;* Smart Healthcare: Sleep Monitoring and Improving
10. **[10:05pm-10:15pm][Oct.18]** <Break>
11. **[10:15pm-10:30pm][Oct.18][SF-TS7-A-1][2217]** ***Samuel Yu*****,** *Presenter;* An investigation into how creating a smart app for fitness will affect dietary health
12. **[10:30pm-10:45pm][Oct.18][SF-TS12-D-1][0009]** ***Dong Wang and Yuebai*** **Zhang,** *Author***;** Integrating Somatosensory Technology with Wu Qin Xi: A Novel Teaching Model Exploration
13. **[10:45pm-11:00pm][Oct.18][SF-TS12-D-2][8117]** ***Tao Xu and Chenxi Xu*****,** *Presenter***;** The Application of AI Physical Fitness in the Physical Training of High-level Table Tennis Athletes
14. **[11:00pm-11:15pm][Oct.18][SF-TS12-D-4][1245]** ***Sihan Chen and Zihan Zhou*****,** *Presenter***;** Computer Vision-Based Physical Activity Intensity Measurement

- **Part II: [UV Theme Workshop] [SF-TS11-A][SF-TS11-B][Session SF-TS9-B]**
  - **[Session SF-TS11-A] Responsible and Ethical Data Management and Processing**
  - **[Session SF-TS11-B] Learning Algorithm Development, Analysis and Interpretability**
  - **[Session SF-TS9-B] Smart Medicine and Smart Healthcare**
- **Agenda [11:20pm, October 18th - 3:25am, October 19th] (EDT)**

1. **[11:20pm-11:25pm][Oct.18] Jieren Kou,** *Student Forum Chair*; Opening and Speech
2. **[11:25pm-11:40pm][Oct.18][SF-TS11-A-1][9294] *Muxi Chen***, *Presenter*; Safeguarding Privacy in Big Data Management: Solutions and Risk Mitigation Strategies
3. **[11:40pm-11:55pm][Oct.18][SF-TS11-B][K-1] *Hanxia Li*,** *Invited Presenter;* Ethical Challenges in AI Across Multiple Domains: Insights from Real-World Case Studies
4. **[11:55pm-12:10am][Oct.18][SF-TS11-B][K-2] *Mingyuan Hu*,** *Invited Presenter;* A Review of Large Language Model
5. **[12:10am-12:25am][Oct.19][SF-TS11-B][K-3] *Jieren Kou*,** *Invited Presenter;* Federated Learning
6. **[12:25am-12:40am][Oct.19][SF-TS11-B][K-4] *Zhongyu Liu*,** *Invited Presenter;* An Introduction to Speculative Sampling
7. **[12:40am-12:55am][Oct.19][SF-TS11-B-2][7837] *Zhongda Wang*,** *Presenter;* Multimodal Learning
8. **[12:55am-1:10am][Oct.19][SF-TS11-B-3][5414] *Jieren Kou, Xiuyuan Lu, Aobing Yin, Wuyang Zhang, Xinyi Fang, Youzhang Li, Tengyue Pan, Lijia Zhang, Ge Cheng, Hao Yuan, Xiaoman Duan and Yajun Fang,*** *Presenter;* Beyond Isolated Fixes: A Comprehensive Survey on Hallucination Mitigation with a Three-Dimensional Taxonomy and Integrative Framework
9. **[1:10am-1:25am][Oct.19][SF-TS11-B-4][8924] *Zhenqian Huang*,** *Presenter;* A Review of Adversarial Attacks on AI-Powered Systems
10. **[1:25am-1:40am][Oct.19][SF-TS11-B-5][8499] *Guoxin Huang*,** *Presenter*; AI in E-Discovery: An In-Depth Exploration of Predictive Coding
11. **[1:40am-1:55am][Oct.19][SF-TS11-B-6][9132] *Guangjun Zeng,*** *Presenter*; Active Learning as a Catalyst for Human-Centric AI: Enhancing Explainability, Intent Understanding, and Societal Resilience
12. **[1:55am-2:10am][Oct.19][SF-TS11-B-7][3993] *Wuyang Zhang, Chenkai Zhang, Chuqiao Gu, Jieren Kou, Hao Yuan, Xinyi Fang, Xiaoman Duan and Yajun Fang*,** *Author(s);* Hallucination in Large Language Models: From Mechanistic Understanding to Novel Control Frameworks
13. **[2:10am-2:25am][Oct.19][SF-TS11-B-8][6666] *Xinyi Fang, Hao Yuan, Hanxia Li, Jieren Kou, Chuqiao Gu, Wuyang Zhang, Xiaoman Duan and Yajun Fang*,** *Author(s);* Reframing Hallucination in Large Language Models: A Lifecycle-Based, Mechanism-Aligned, and Phenomenon-Consistent Definition

14. **[2:25am-2:40am][Oct.19][SF-TS11-B-9][9066]** ***Chuqiao Gu, Wuyang Zhang, Zhengqian Huang, Jieren Kou, Zhenyao Liu, Chenjun Zhao, Chang Liu, Lifeng Zhang, Wenjie Lin, Guoxin Huang, Charles Zhang, Zhongda Wang, Jianwei Deng, Yuhuan Xie, Chengming Wang, Hao Yuan, Xiaoman Duan and Yajun Fang,*** *Author(s);* LENS: Layers of Evaluation of hallucinatioN in GenAI Systems
15. **[2:40am-2:55am][Oct.19][SF-TS11-B-10][8007]** ***Zhenyao Liu, Jieren Kou, Wuyang Zhang, Chuqiao Gu, Xinyi Fang, Zhenqian Huang, Hao Yuan, Hanxia Li, Xiuyuan Lu, Aobing Yin, Chang Liu, Zhongda Wang, Haoyang Huang, Xiaoman Duan and Yajun Fang,*** *Author(s);* Comprehensive Evaluation of AI Hallucination and Novel UV-Oriented Framework toward Safe and Trustworthy AI
16. **[2:55am-3:10am][Oct.19][SF-TS9-B-2][0795]** ***Yuling Chen,*** *Presenter***;** Medical Deepfakes: Innovation and Ethical Challenges
17. **[3:10am-3:25am][Oct.19][SF-TS9-B-3][1814] Siying Qu,** *Author***; Five Small Molecule Compounds Targeting Aβ in Alzheimer's Disease**

[SF] Student Forum - Research Presentation
Time: 07:40am, October 19th -11:00am, October 19th, U.S. Eastern Daylight Time
09:00pm, October 21st -10:05pm, October 21st, U.S. Eastern Daylight Time
Meeting Room (Microsoft Teams): Team Channel: [SF] IEEE UV2024 Student Forum
Student Chair(s): Zhenyao Liu, Hanxia Li, Jieren Kou, Yuezhi Luo

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- **Part III: Research Presentation**
  - **[SF-TS2-B] Intelligent Modeling, Simulation, and System Analysis**
  - **[SF-TS3-A] Intelligent Transportation, Urban Planning, and Smart City Infrastructure**
  - **[SF-TS3-B] Intelligent Vehicles, Mobility Support for Vulnerable Groups**
  - **[SF-TS4-A] Renewable Energy and Smart Energy Management**
  - **[SF-TS5] Manufacturing Innovations for Efficiency, Safety, and Sustainability**
  - **[SF-TS6] Agriculture Innovations for Efficiency, Safety, and Sustainability**
  - **[SF-TS9-B] Smart Medicine and Smart Healthcare**
  - **[SF-TS10-D] Smart Design and Design Ethics**
  - **[NR-TS12-C] The Fusion of Traditional Chinese Medicine and Modern Science**

- **[SF-CF] Vision for Universal Village and UV Indices**

- **Agenda [7:40am, October 19th -11am, October 19th] (EDT)**

1. **[07:40am-07:45am] Zhenyao Liu,** *Student Forum Chair*; Opening and Speech
2. **[07:45am-08:00am][Oct.19][NR-TS12-C-1][4464]** ***Yan Tang, Weibo Zhang and Ligong Xue,*** *Presenter;* Assessing the Relevance of Fancy Shuttlecock Kicking to the Electrical Impedance Measurements of Meridians
3. **[08:00am-08:15am][Oct.19][SF-TS2-B-1][3256]** ***Yue Zhong, Ling Chen and Zexiang Chen,*** *Presenter,* Research and Development of Digital Twin System for Deep In-situ Fidelity Coring
4. **[08:15am-08:30am][Oct.19][SF-TS3-A-1][4165]** ***Xiaoyuan Wang,*** *Presenter;* Analyzing road safety development for G20 countries through a reformative ROCOSD-ORESTE-LDA model with MLP to enhance decision reliability
5. **[08:30am-08:45am][Oct.19][SF-TS3-B-1][3599]** ***Jordon Li***, *Presenter*, Safeguarding Autonomous Driving - Preliminary Study on Common Mistakes and Challenges and Proposed UV-Oriented Solutions
6. **[08:45am-09:00am][Oct.19][SF-TS4-A-1][9348]** ***Rebecca Xu,*** Addressing Baltimore County's Landfill
7. **[09:00am-09:15am]**<Break>
8. **[09:15am-09:30am][Oct.19][SF-TS5-1][7539]** ***Enze Dong, Yanyan Li and Ling Chen,*** *Author;* Research on Tool Optimization Evaluation Model Based on Combination Weighting
9. **[09:30am-09:45am][Oct.19][SF-TS5-2][6435]** ***Jiayin Fu, Ling Chen and Zhehao Wang,*** *Author;*Safety Margin Assessment Model for Surface Cracks Based on Path Rate Integral Method
10. **[09:45am-10:00am][Oct.19][SF-TS5-3][3111]** ***Shaojie Zhong, Ling Chen and Fuda Sun,*** *Author;* Optimization Analysis of In-situ Fidelity Coring Drill Bit Structure for Subsea Gas Hydrates
11. **[10:00am-10:15am][Oct.19][SF-TS5-4][2965]** ***Qian Li,*** *Author;* A Mobile Equipment Management System based on Internet of Things Technology
12. **[10:15am-10:30am][Oct.19][SI-TS6-1][6712]** ***Takudzwa Tarutira, Israel Alagbe, Jessica Ezemba, Ellon Berhanu and Emmanuel Ndashimye*****,** *Presenter***;** Baboon Detection for Smart Agriculture Using Deep Learning Algorithms

13. **[10:30am-10:45am][Oct.19][SF-TS6-2][1316]** ***Weiyue Chen, Qi Niu, Hui Li, Lihong Wang, Chengsong Li and Pei Wang*****,** *Author;* Weed29: a weed database for machine learning
14. **[10:45am-11:00am][Oct.19][SF-TS10-D-1][3138]** ***Zizhan Chen, Xinyu Tong and Kai Yu,*** *Presenter;* Digital Creation, Representation, and Parametric Style Editing of Chinese Calligraphy

- **Part IV: Research Presentation**
  - **[SF-TS1-C]: Digital Analytics, Digital Transformations and UV index Evaluation**
  - **[SF-TS7-A]: Smart Ecological and Environmental Systems**
  - **[SF-TS9-B]: Smart Medicine and Smart Healthcare**
  - **[SF-TS12-A] : New results in low carbon and zero carbon technology**
- **Agenda [09:00pm, October 21st -10:05pm, October 21st] (EDT)**
  1. **[09:00pm-09:05pm]** ***Hanxia Li,*** *Student Forum Chair*; Opening and Speech
  2. **[09:05pm-09:20pm][Oct.21][SF-TS12-A-1][9721]** ***Yuxuan Chen,*** *Presenter;* The Role of Co-Firing Technology with Multiple Fuels in Carbon Emission Reduction
  3. **[09:20pm-09:35pm][Oct.21][SF-TS7-A-2][4026] Cecilia Zhang and Ruiyang Zhang,** *Presenter;* Evaluation of Smart Environmental Protection Systems and UV-Oriented Solution for Integration, Resilience, Inclusiveness and Sustainability
  4. **[09:35pm-09:50pm][Oct.21][SF-TS1-C-1][5197]** ***Hongyang Hua,*** *Presenter;* Preliminary Study on Evaluation of Smart-Cities Technologies and Proposed UV Lifestyles
  5. **[09:50pm-10:05pm][Oct.21][SF-TS1-C-2][8970]** ***Beifeng Wang,*** *Presenter*; Preliminary Study on Evaluation of UV Smart Systems

Part I: Pitch Competition for Lifestyle Innovation <Student Forum / K12 >

[K12-Pitch][SF-TS7-A][SF-TS8-A][SF-TS8-B][SF-TS12-D]

[SF] Student Forum - Pitch Competition
Time: 08:00pm, October 18th - 11:15pm, October 18th, U.S. Eastern Daylight Time
Meeting Room (Microsoft Teams): Team Channel: [SF] IEEE UV2024 Student Forum
Student Forum Chair(s): Zhenyao Liu, Hanxia Li, Jieren Kou

[SF] Student Forum - Pitch Competition & Workshop: Opening and Speech

Time: 08:00pm-08:05pm, October 18th, U.S. Eastern Daylight Time
Invited Presenter(s): **Hanxia Li,** *Student Forum Chair*

[K12-1][SF-TS8-B-5][8240] Innovative Low-Cost Bath Chair for Safer Home Care of the Elderly

Time**:** 08:05pm-08:20pm, October 18th, U.S. Eastern Daylight Time
Presenter(s)**: Jiajun Luo**

[K12-2][SF-TS8-B-6][0431] Leveraging Raspberry Pi and Sensor Technology to Assess Sidewalk Accessibility: Enhancing Travel Experiences for Handicapped Individuals

Time: 08:20pm-08:35pm, October 18th, U.S. Eastern Daylight Time
Presenter(s): **Jiajun Luo**
Author(s): **Jiajun Luo**

[K12-3][SF-TS8-A-1][8306] Design and Implementation of an Intelligent Fish Tank System

Time: 08:35pm-08:50pm, October 18th, U.S. Eastern Daylight Time
Presenter(s): **Ailun Liu**
Author(s): **Ailun Liu**

[SF-TS8-A][K-1] Towards Intelligent Systems: A Review of Human Activity Recognition Methods and Applications

Time: 08:50pm-09:05pm, October 19th, U.S. Eastern Daylight Time

Invited Presenter(s): **Zhenyao Liu,** *Student Forum Chair*

[SF-TS8-B-1][0273] Empowering Safety: Smart Technology's Role in Combating Sexual Harassment in Smart City Emergency System

Time: 09:05pm-09:20pm, October 18th, U.S. Eastern Daylight Time
Presenter(s): **Lanxin Chen**

[SF-TS8-B-2][4053] The Role and Future Prospects of Complementary and Alternative Medicine in the Treatment of Chronic Diseases

Time: 09:20pm-09:35pm, October 18th, U.S. Eastern Daylight Time
Presenter(s): **Siying Qu**

[SF-TS8-B-3][7695] Adaptive Health Monitoring and Personalized Care: Intelligent Systems in Disease Management

Time: 09:35pm-09:50pm, October 18th, U.S. Eastern Daylight Time
Presenter(s): **Yuezhi Luo and Hongyin An**

[SF-TS8-B-7][4448] Smart Healthcare: Sleep Monitoring and Improving

Time: 09:50pm-10:05pm, October 19th, U.S. Eastern Daylight Time
Presenter(s): **Yuezhi Luo, Qipei Chen**

[SF-TS7-A-1][2217] An investigation into how creating a smart app for fitness will affect dietary health

Time: 10:15pm-10:30pm, October 18th, U.S. Eastern Daylight Time
Presenter(s): **Samuel Yu**

[SF-TS12-D-1][0009] Integrating Somatosensory Technology with Wu Qin Xi: A Novel Teaching Model Exploration

Time: 10:30pm-10:45pm, October 18th, U.S. Eastern Daylight Time
Presenter(s): **Dong Wang**
Author(s): **Dong Wang and Yuebai Zhang**

[SF-TS12-D-2][8117] The Application of AI Physical Fitness in the Physical Training of High-level Table Tennis Athletes

Time: 10:45pm-11:00pm, October 18th, U.S. Eastern Daylight Time
Presenter(s): **Tao Xu**
Author(s): **Tao Xu and Chenxi Xu**

[SF-TS12-D-4][1245] Computer Vision-Based Physical Activity Intensity Measurement

Time: 11:00pm-11:15pm, October 18th, U.S. Eastern Daylight Time
Presenter(s): **Sihan Chen and Zihan Zhou**

Part II: [UV Theme Workshop]

[SF-TS11-A][SF-TS11-B][SF-TS9-B]

Time: 11:20pm, October 18th - 2:10am, October 19th, U.S. Eastern Daylight Time
Meeting Room (Microsoft Teams): Team Channel: [SF] IEEE UV2024 Student Forum
Student Forum Chair(s): Zhenyao Liu, Hanxia Li, Jieren Kou

[SF-WS] Opening and Speech

Time: 11:20pm-11:25pm, October 18th, U.S. Eastern Daylight Time
Invited Speaker(s): **Jieren Kou,** *Student Forum Chair*

[SF-TS11-A-1][9294] Safeguarding Privacy in Big Data Management: Solutions and Risk Mitigation Strategies

Time: 11:25pm-11:40pm, October 18th, U.S. Eastern Daylight Time
Presenter(s): **Muxi Chen**

[SF-TS11-B][K-1] Ethical Challenges in AI Across Multiple Domains: Insights from Real-World Case Studies

Time: 11:40pm-11:55pm, October 18th, U.S. Eastern Daylight Time
Invited Presenter(s): **Hanxia Li,** *Student Forum Chair*

[SF-TS11-B][K-2] A Review of Large Language Model

Time: 11:55pm, October 18th -12:10am, October 19th, U.S. Eastern Daylight Time
Invited Presenter(s): **Mingyuan Hu**

[SF-TS11-B][K-3] Federated Learning

Time: 12:10am-12:25am, October 19th, U.S. Eastern Daylight Time
Invited Presenter(s): **Jieren Kou,** *Student Forum Chair*

[SF-TS11-B][K-4] An Introduction to Speculative Sampling

Time: 12:25am-12:40am, October 19th, U.S. Eastern Daylight Time
Presenter(s): Zhongyu Liu

[SF-TS11-B-2][7837] Multimodal Learning

Time: 12:40am-12:55am, October 19th, U.S. Eastern Daylight Time
Presenter(s)**: Zhongda Wang**

[SF-TS11-B-3][5414] Beyond Isolated Fixes: A Comprehensive Survey on Hallucination Mitigation with a Three-Dimensional Taxonomy and Integrative Framework

Time: 12:55am-1:10am, October 19th, U.S. Eastern Daylight Time
Presenter(s): **Jieren Kou,** *Student Forum Chair*

Author(s)**: Jieren Kou, Xiuyuan Lu, Aobing Yin, Wuyang Zhang, Xinyi Fang, Youzhang Li, Tengyue Pan, Lijia Zhang, Ge Cheng, Hao Yuan, Xiaoman Duan and Yajun Fang**

[SF-TS11-B-4][8924] A Review of Adversarial Attacks on AI-Powered Systems

Time: 1:10am-1:25am, October 19th, U.S. Eastern Daylight Time
Invited Presenter(s): **Zhenqian Huang**

[SF-TS11-B-5][8499] AI in E-Discovery: An In-Depth Exploration of Predictive Coding

Time: 1:25am-1:40am, October 19th, U.S. Eastern Daylight Time
Invited Presenter(s): **Guoxin Huang**

[SF-TS11-B-6][9132] Active Learning as a Catalyst for Human-Centric AI: Enhancing Explainability, Intent Understanding, and Societal Resilience

Time: 1:40am-1:55am, October 19th, U.S. Eastern Daylight Time
Presenter(s): **Guangjun Zeng**

[SF-TS11-B-7][3993] Hallucination in Large Language Models: From Mechanistic Understanding to Novel Control Frameworks

Time: 1:55am-2:10am, October 19th, U.S. Eastern Daylight Time
Presenter(s): **Wuyang Zhang**

Author(s): **Wuyang Zhang, Chenkai Zhang, Chuqiao Gu, Jieren Kou, Hao Yuan, Xinyi Fang, Xiaoman Duan and Yajun Fang**

[SF-TS11-B-8][6666] Reframing Hallucination in Large Language Models: A Lifecycle-Based, Mechanism-Aligned, and Phenomenon-Consistent Definition

Time: 2:10am-2:25am, October 19th, U.S. Eastern Daylight Time
Presenter(s): **Xinyi Fang**

Author(s): **Xinyi Fang, Hao Yuan, Hanxia Li, Jieren Kou, Chuqiao Gu, Wuyang Zhang, Xiaoman Duan and Yajun Fang**

[SF-TS11-B-9][9066] LENS: Layers of Evaluation of hallucinatioN in GenAI Systems

Time: 2:25am-2:40am, October 19th, U.S. Eastern Daylight Time
Presenter(s): **Chuqiao Gu**

Author(s): **Chuqiao Gu, Wuyang Zhang, Zhengqian Huang, Jieren Kou, Zhenyao Liu, Chenjun Zhao, Chang Liu, Lifeng Zhang, Wenjie Lin, Guoxin Huang, Charles Zhang, Zhongda Wang, Jianwei Deng, Yuhuan Xie, Chengming Wang, Hao Yuan, Xiaoman Duan and Yajun Fang**

[SF-TS11-B-10][8007] Comprehensive Evaluation of AI Hallucination and Novel UV-Oriented Framework toward Safe and Trustworthy AI

Time: 2:40am-2:55am, October 19th, U.S. Eastern Daylight Time
Presenter(s): **Zhenyao Liu**

Author(s): **Zhenyao Liu, Jieren Kou, Wuyang Zhang, Chuqiao Gu, Xinyi Fang, Zhenqian Huang, Hao Yuan, Hanxia Li, Xiuyuan Lu, Aobing Yin, Chang Liu, Zhongda Wang, Haoyang Huang, Xiaoman Duan and Yajun Fang**

[SF-TS9-B-2][0795] Medical Deepfakes: Innovation and Ethical Challenges

Time: 2:55am-3:10am, October 19th, U.S. Eastern Daylight Time
Invited Presenter(s): **Yuling Chen**

[SF-TS9-B-3][1814] Five Small Molecule Compounds Targeting Aβ in Alzheimer's Disease

Time: 3:10am-3:25am, October 19th, U.S. Eastern Daylight Time
Presenter(s): **Siying Qu**
Author(s): **Siying Qu**

Part III: Research Presentation

[SF-TS2-B][SF-TS3-A][SF-TS3-B][SF-TS4-A][SF-TS5][SF-TS6][SF-TS10-D][NR-TS12-C]

[SF] Student Forum - Research Presentation
Time: 07:40am, October 19th -11am, October 19th, U.S. Eastern Daylight Time
Meeting Room (Microsoft Teams): Team Channel: [SF] IEEE UV2024 Student Forum
Student Forum Chair(s): Zhenyao Liu, Hanxia Li, Jieren Kou, Yuezhi Luo

[SF-TS] Opening and Speech

Time:07:40am-07:45am, October 19th, U.S. Eastern Daylight Time
Invited Presenter(s): **Zhenyao Liu,** *Student Forum Chair*

[NR-TS12-C-1][4464] Assessing the Relevance of Fancy Shuttlecock Kicking to the Electrical Impedance Measurements of Meridians

Time: 07:45am-08:00am, October 19th, U.S. Eastern Daylight Time
Presenter(s): **Yan Tang**
Author(s): **Yan Tang, Weibo Zhang and Ligong Xue**

[SF-TS2-B-1][3256] Research and Development of Digital Twin System for Deep In-situ Fidelity Coring

Time: 08:00am-08:15am, October 19th, U.S. Eastern Daylight Time
Presenter(s): **Yue Zhong**
Author(s): **Yue Zhong,** ***Ling Chen and Zexiang Chen***

[SF-TS3-A-1][4165] Analyzing road safety development for G20 countries through a reformative ROCOSD-ORESTE-LDA model with MLP to enhance decision reliability

Time: 08:15am-08:30am, October 19th, U.S. Eastern Daylight Time
Presenter(s)**: Xiaoyuan Wang**

[SF-TS3-B-1][3599] Safeguarding Autonomous Driving - Preliminary Study on Common Mistakes and Challenges and Proposed UV-Oriented Solutions

Time: 08:30am-08:45am, October 19th, U.S. Eastern Daylight Time
Presenter(s): **Jordon Li**

[SF-TS4-A-1][9348] Addressing Baltimore County's Landfill

Time: 08:45am-09:00am, October 19th, U.S. Eastern Daylight Time
Presenter(s): **Rebecca Xu**

[SF-TS5-1][7539] Research on Tool Optimization Evaluation Model Based on Combination Weighting

Time: 09:15am-09:30am, October 19th, U.S. Eastern Daylight Time
Presenter(s): **Enze Dong**
Author(s): **Enze Dong, Bin Xia and Yanyan Li**

[SF-TS5-2][6435] Safety Margin Assessment Model for Surface Cracks Based on Path Rate Integral Method

Time**:** 09:30am-09:45am**,** October 19th, U.S. Eastern Daylight Time
Presenter(s): **Jiayin Fu**
Author(s): Jiayin Fu, Ling Chen and Zhehao Wang

[SF-TS5-3][3111] Optimization Analysis of In-situ Fidelity Coring Drill Bit Structure for Subsea Gas Hydrates

Time: 09:45am-10:00am, October 19th, U.S. Eastern Daylight Time
Presenter(s): **Shaojie Zhong**
Author(s): Shaojie Zhong, Ling Chen and Fuda Sun

[SF-TS5-4][2965]A Mobile Equipment Management System based on Internet of Things Technology

Time: 10:00am-10:15am, October 19th, U.S. Eastern Daylight Time
Presenter(s): **Qian Li**
Author(s): **Qian Li**

[SI-TS6-1][6712] Baboon Detection for Smart Agriculture Using Deep Learning Algorithms

Time: 10:15am-10:30am, October 19th, U.S. Eastern Daylight Time
Presenter(s): **Takudzwa Tarutira**
Author(s): **Takudzwa Tarutira, Israel Alagbe,Jessica Ezemba, Ellon Berhanu, Emmanuel Ndashimye**

[SF-TS6-2][1316] Weed29: A Weed Dataset for Machine Learning

Time: 10:30am-10:45am, October 19th, U.S. Eastern Daylight Time
Author(s): **Weiyue Chen, Qi Niu, Hui Li, Lihong Wang, Chengsong Li and Pei Wang**

[SF-TS10-D-1][3138] Digital Creation, Representation, and Parametric Style Editing of Chinese Calligraphy

Time: 10:45am-11:00am, October 19th, U.S. Eastern Daylight Time
Presenter(s)**: Zizhan Chen**
Author(s): **Zizhan Chen, Xinyu Tong and Kai Yu**

Part IV: Research Presentation

[SF-TS1-C][SF-TS7-A][SF-TS12-A]

Time: 09:00pm, October 21st -10:05pm, October 21st, U.S. Eastern Daylight Time
Meeting Room (Microsoft Teams): Team Channel: [SF] IEEE UV2024 Student Forum
Student Forum Chair(s): Zhenyao Liu, Hanxia Li, Jieren Kou

[SF-TS] Opening and Speech

Time: 09:00pm-09:05pm, October 21st, U.S. Eastern Daylight Time
Invited Presenter(s): **Hanxia Li,** *Student Forum Chair*

[SF-TS12-A-1][9721]The Role of Co-Firing Technology with Multiple Fuels in Carbon Emission Reduction

Time: 09:05pm-09:20pm, October 21st, U.S. Eastern Daylight Time
Presenter(s): **Yuxuan Chen**

[SF-TS7-A-2][4026]Evaluation of Smart Environmental Protection Systems and UV-Oriented Solution for Integration, Resilience, Inclusiveness and Sustainability

Time: 09:20pm-09:35pm, October 21st, U.S. Eastern Daylight Time
Presenter(s): **Cecilia Zhang and Ruiyang Zhang**

[SF-TS1-C-1][5197] Preliminary Study on Evaluation of Smart-Cities

Technologies and Proposed UV Lifestyles

Time: 09:35pm-09:50pm, October 21st, U.S. Eastern Daylight Time
Presenter(s): **Hongyang Hua**

[SF-TS1-C-2][8970] Preliminary Study on Evaluation of UV Smart Systems

Time: 09:50pm-10:05pm, October 21st, U.S. Eastern Daylight Time
Presenter(s): **Beifeng Wang**


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