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THE 5TH INTERNATIONAL CONFERENCE ON UNIVERSAL VILLAGE

Program Book

THE 5TH IEEE UV2020

OCTOBER 24-27 BOSTON USA

Integrated, Systematic, UV-Oriented Solutions for Harmony, Resilience, Inclusiveness, and Sustainability.

OCTOBER 24-27, 2020 | BOSTON MA USA

THE 5TH IEEE

UV 2020

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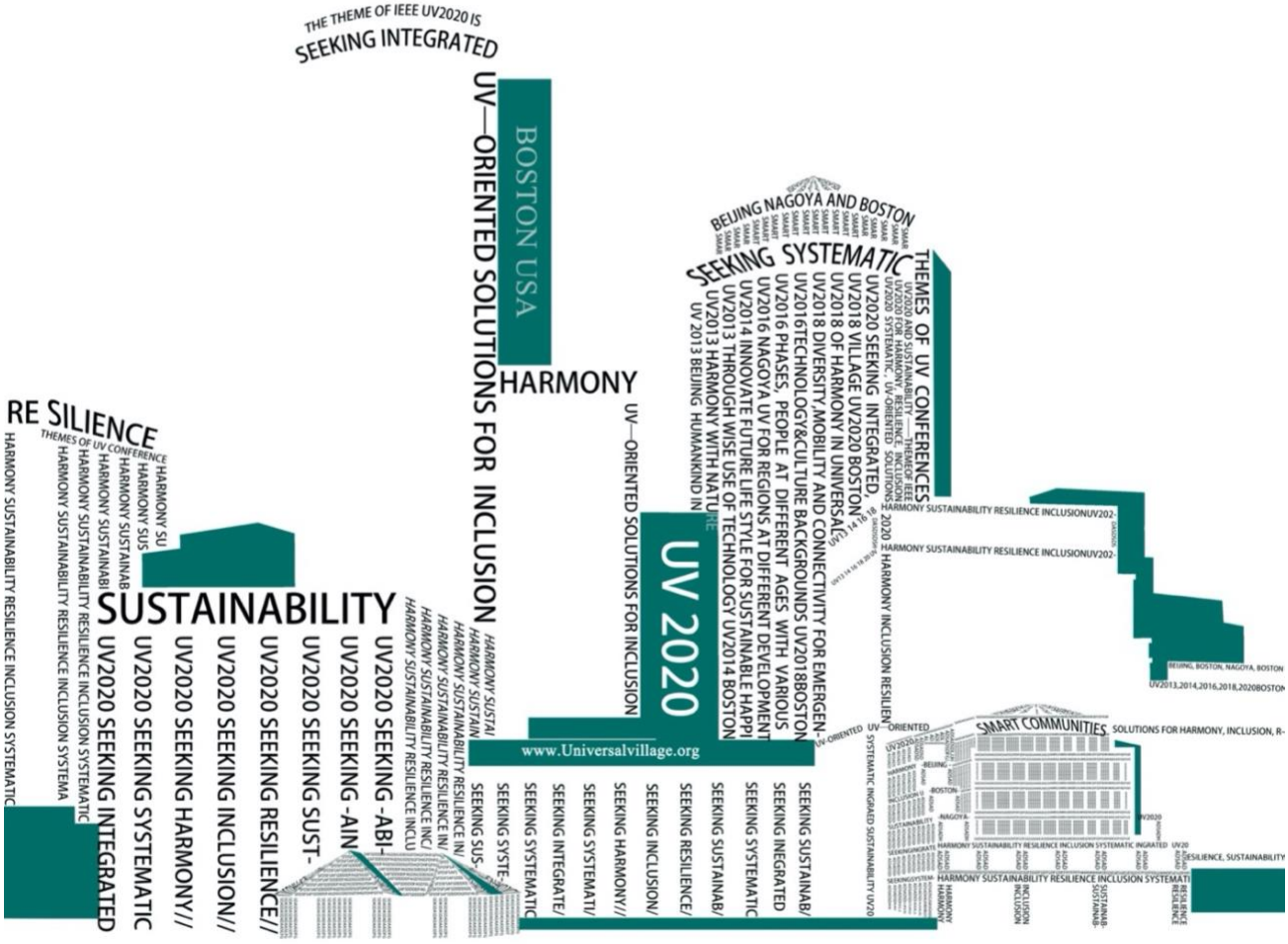
10/24-10/27

BOSTON USA



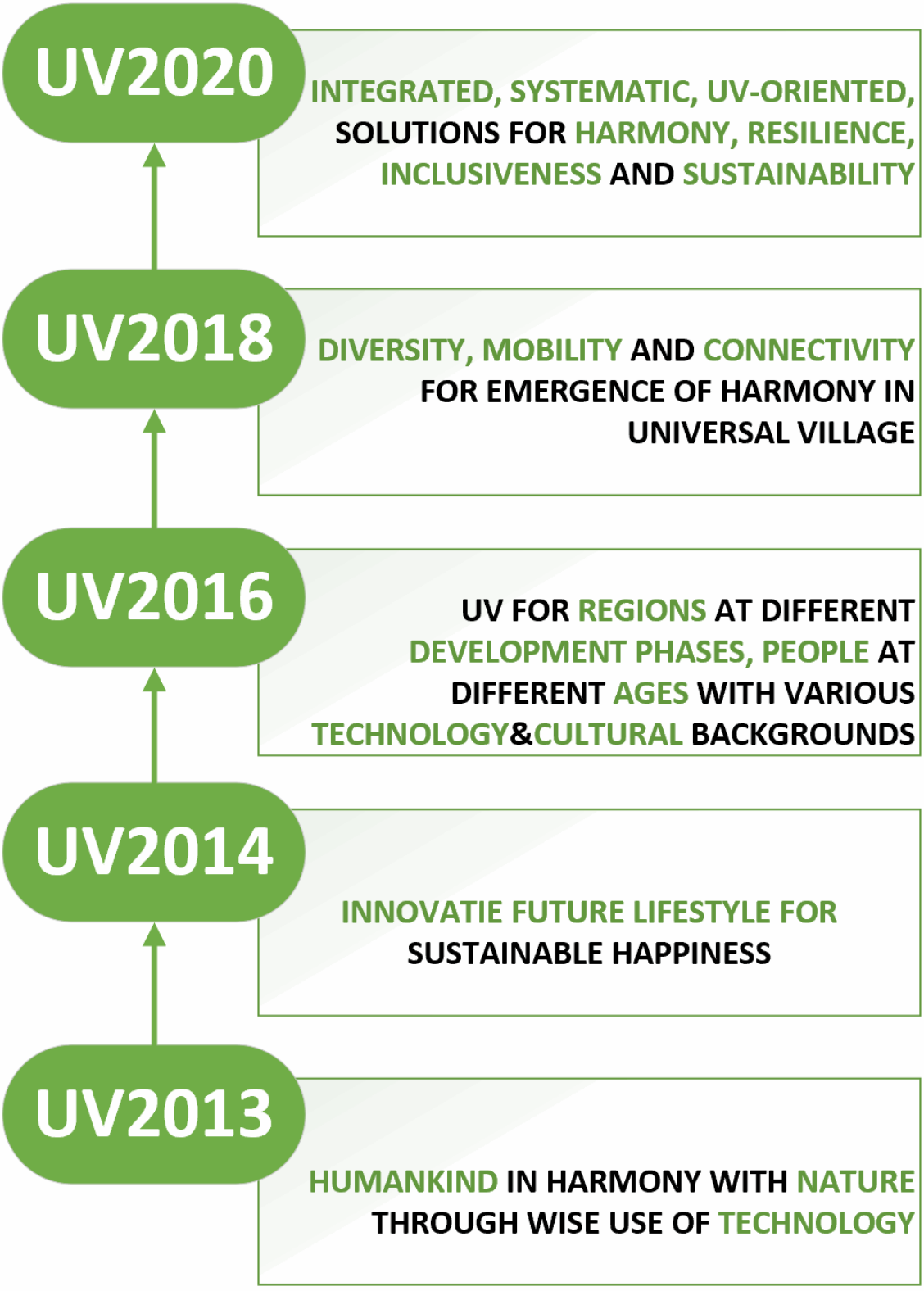
THE 5TH IEEE UV2020 Seeking integrated, systematic, UV–oriented solutions for harmony, resilience, inclusion and sustainability

The 5th International Conference on Universal Village

IEEE UV2020
Program Book

October 24st-27th, 2020
Boston, USA

Previous UV Theme



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GREETINGS FROM CONFERENCE CHAIRS

General Chairs

Roy E. Welsch, Ichiro Masaki, Lionel C. Kimerling, Kazuya Takeda, Shuguang Zhang, Zheng Xiong and Thomas P. Sakmar







Welcome to the 5th International Conference on Universal Village UV2020. Universal Village (UV) is a desired future society which pro-vides their residents with sustainable happiness. In order to develop UV, we take a top-down or, in other words, system- oriented approach instead of a bottom-up or element-oriented approach. In the development process, a higher-level objective such as sustainable happiness of the residents defines lower- level objectives including environment protection, energy management, communication, healthcare, transportation, and other related systems. Feedback from the bottom to the top is also important in this integration and collaboration. I hope this conference stimulates various kinds of collaborations.

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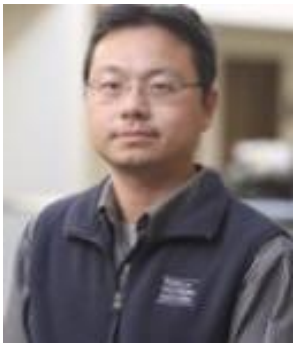
International Chairs

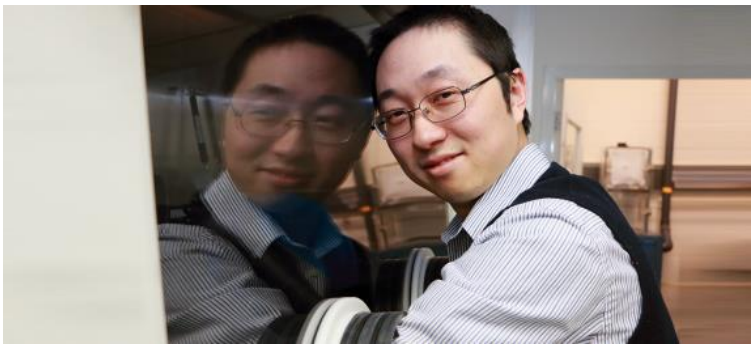
Yasha Yi, Xiaoman Duan and Yajun Fang



On behalf of the Universal Village International Conference Committee, we warmly welcome you to the 5th Universal Village International Conference! We are gathering from around the world with a common purpose: to make this world a better place, a Universal Village that we can all call home. We are here to challenge environmental problems that threaten the quality of our lives; we are here to share our advanced research results and experiences working with the concept of a Universal Village; we are here to discuss the issues that we have come across in our research efforts and to collectively find potential solutions as well as pose new questions; and lastly, we are here to discuss how we can create milestones for the Universal Village through innovation, technology, and the endless human capacity for learning and discovery. We are exceedingly grateful for your great contributions to UV2020! Without you, UV2020 would not be happening today! It is you who will make UV2020 successful! It is you who will give our "Universal Village" a brighter future! Please accept the deepest appreciation from our UV International Committee.

Conference Chairs

Juejun Hu and Lin Zhang



As Conference Chairs, we welcome to UV2020, the 5th International Conference on Universal Village. Universal Village (UV) is a desired future society which provides their residents with sustainable happiness. In order to develop UV, we take a top-down or, in other words, system-oriented approach instead of a bottom-up or element-oriented approach. In the development process, a higher-level objective such as sustainable happiness of the residents defines lower-level objectives including environment protection, energy management, communication, healthcare, transportation, and other related systems. Feedback from the bottom to the top is also important in this integration and collaboration. I hope this conference stimulates various kinds of collaborations. At the end of my greeting, we would like to say "Congratulations!" to everyone who contributed to starting up this conference. Please enjoy the conference. Thank you very much!

Local Chairs

Lin Zhang, Wei Wang and Stanley Tao



It is our greatest pleasure to welcome you to the 5th International Conference on Universal Village (UV2020). As local conference chairs, we are here to support you! A lot of information from multi-disciplinary fields will be presented in the four-day conference, so that researchers with different background can collaborate beyond the traditional boundaries of their individual research fields. We hope you can find a systematic, coordinated, long-term solution for the future of human kind and nature at the end of this conference. As the theme for UV2020, we would like to expand our horizon: UV for regions at different developing phases, and for people of different ages, with various technology & culture backgrounds. Finally, we want to extend our thanks to those who are truly responsible for making UV 2020 a successful event by devoting their time and energy. Thank you very much for attending UV2020!

Program Chairs

Longfei Zhou, Hao Sheng, Yang Qing, Hirofumi Aoki, Yang Liu, Lijuan Su and Shengsheng Cao, Wenhe Zhan

It is a great pleasure and an honor to welcome you to the fifth Conference of Universal Village, UV2020! On behalf of the program committee, we would like to extend our appreciation to all participants of the conference. Thanks to the hard work of the organizing committee, we are proud of attractive events as well as technical sessions hosted by the UV2020. We hope all participants will enjoy technical presentations and joining discussions throughout the conference. Again, thank you very much for your great support and participation in the UV2020.

CONFERENCE COMMITTEE

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- **Berthold K.P. Horn (MIT, USA)**

General Chairs

- **Roy E. Welsch (MIT, USA)**
- **Ichiro Masaki (Universal Village Society, USA)**
- **Lionel C. Kimerling (MIT, USA)**
- **Kazuya Takeda (Nagoya Univ., Japan)**
- **Shuguang Zhang (MIT, USA)**
- **Zhang Xiong (Beihang Univ., China)**

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- **Xiaoman Duan (Universal Village Society, USA)**
- **Yajun Fang (Universal Village Society, USA)**

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- **Lin Zhang (Beihang University, China)**

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- **Wei Wang (Americar.ai, USA)**
- **Stanly Tao (Universal Village Society, Canada)**

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- **Hao Sheng (Beihang Univ., China)**
- **Qingyang Du (MIT, USA)**
- **Hiro Aoki (Nagoya Univ., Japan)**
- **Yang Liu (Universal Village Society, USA)**
- **Lijuan Su (Shenzhen Joy Smart AI Co. Ltd., Chian)**
- **Shengsheng Cao (Ningbo University, China)**
- **Wenhe Zhan (Shenzhen PIAT, China)**

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- **Wenya Du (Universal Village Society, USA)**
- **Gina Franzetta (MIT, USA)**

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- **Guanghua Cheng (Universal Village Society USA)**
- **Yi Tao (Universal Village Society, USA)**

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- **Yilin Wang (MIT Analytics, USA)**
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- **Hongyan Cui (MIT/BUPT, USA/China)**
- **Lin Zhang (MIT, USA)**

Media Chairs

- **Ronghua Chen (Oriental Foco Films, Singapore)**
- **Benjamin Cheung (SmugMug Inc., USA)**

International Coordinators

- **Javier Sanchez-Medina (EU/ULPGC, Spain)**
- **Toshimitsu Hamada (Tsukuba Gakuin Univ., Japan)**

Student Forum Chairs

- **Lifeng Zhang (BUPT/UMASS Boston, China/USA)**
- **Zhiyuan Yang (Beijing Institute of Technology, China)**
- **Hao Yuan (Vanderbilt University, USA)**
- **Yuanhong Cao (Cornell University, USA)**

Pitch Competition Chairs

- **Zhiyu Chen (Chongqing University, USA)**
- **Qiansheng Zhou (Penn State University, USA)**

K-12 Challenge Chairs

- **Jingyuan Chen (Universal Village Society, USA)**
- **Yuhao Dong (Boston University, USA)**

Student Committee

- **Chaoyi Wang (Southern University of Science & Technology, China)**
- **Lin Li (Hunan University, China)**
- **Kaijun Jin (Hong Kong Baptist University, China)**
- **Yu Zhang (Xi'an Jiao Tong Liverpool University, China/UK)**
- **Yiyang Gao (Universal Village Society, USA)**
- **Ruoyu Xue (University of Maryland, USA)**
- **Songze Wu (College of William, USA)**
- **Mingzhi Cai (University of Michigan, USA)**
- **Mo Song (High school of NNU, China)**
- **Weijie Du (University of CA Irvine, USA)**
- **Wenjie Lin (University of Science and Technology, China)**
- **Zhixiang Yang (University of Washington, USA)**
- **Fangyuan Sha (Nanyang Technological University, Singapore)**
- **Chen Xiong (University of Toronto, Canada)**
- **Yifan Zhou (Boston College, USA)**
- **Lixin Xu (Qingdao University, China)**
- **Shuyu Jia (University of Illinois at Urbana Champaign, USA)**

GENERAL INFORMATION

After great success in China (Beijing, UV2013), United States (Boston, UV2014), Japan (Nagoya, UV2016) and United States (Boston, UV2018), the fifth International Conference on Universal Village (UV2020) will be held again in Boston, United States. UV2020 will extensively exemplify a desired future society pursuing human-nature harmony through wise application of advanced technologies. The concept is an expanded/advanced version of Smart Cities and signifies that we follow the law of universe to protect the environment and ecosystems while innovating new lifestyles to provide sustainable happiness for humanity's future.

UV2020 will call for the collective efforts across multi-disciplinary fields to develop a platform where researchers with different backgrounds can collaborate beyond the traditional filed boundaries, and to find a systematic, coordinated, long-term solution for the future of human kind and mother nature.

Subjects for UV2020 include but are not limited to the following topics:

- Systematic methodologies to advance UV technologies and to develop UV systems, including, intelligent transportation, intelligent environment & communities, intelligent healthcare, intelligent food systems, 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 UV2020 is "Integrated, Systematic, UV-Oriented Solutions for Harmony, Resilience, Inclusiveness, and Sustainability,".

Due to safety concerns arising from the COVID-19 pandemic, the 5th International Conference on Universal Village (IEEE UV2020) will be held as an online conference using the Microsoft Teams from October 24th-27th, 2020.

UV 2020 Website

https://universalvillage.org/

Contact Information

Please Contact us whenever you have any question at this email:

uv2020.conf@universal-village.org

PROGRAM AT A GLANCE

Session Schedule of IEEE UV2020

Information of when and where all sessions will be held

Date (US Eastern Time)	Meeting Teams (Join in *Microsoft Teams*)	Time (US Eastern Time)	Session
10/23	[13,Shenzhen] IEEE UV2020 Session	20:30-23:00 23:00-24:00 24:00-1:00(Oct 24)	Session 13A,13B,13C(Pitch Competition) Session 13D(K-12 Challenge) Session 12B(Entrepreneurship Initiative)
10/24	[11A,Shenzhen] IEEE UV2020 Session	2:00-4:30	Session 11A (Guangdong Session)
	[4A] IEEE UV2020 Session	8:00-11:00 11:00-13:00	Session 4A Session 12B(Smart Energy Management)
	*Zoom	9:00-12:00	Session 14B
	[3C,Bejing] IEEE UV2020 Session	20:00-24:00	Session 3C (Beijing Session)
	[4B] IEEE UV2020 Session	20:00-24:00	Session 4B
	[9C,9D] IEEE UV2020 Session	20:00-24:00	Session 9C/9D
10/25	[7B, Xi'an] IEEE UV2020 Session	2:30-6:30	Session 7B (Xi'an Session)
	[5B] IEEE UV2020 Session	8:00-12:00	Session 5B
	[1C] IEEE UV2020 Session	8:00-12:00	Session 1C
	[12B] IEEE UV2020 Session	8:00-10:00	Session 12B(ITS, Urban Planning & Crowd Management)
	[8B] IEEE UV2020 Session	17:00-21:00	Session 8B
		21:00-23:00	Session 12B (Smart Medicine & Healthcare)
	[2A] IEEE UV2020 Session	20:00-22:00	Session 2A
	[12B] IEEE UV2020 Session	20:00-23:00	Session 12B (Smart City Infrastructure& Smart Response System for City Emergencies)
	[1A,1B] IEEE UV2020 Session	20:00-24:00	Session 1A/1B
	[9A,9B] IEEE UV2020 Session	20:00-21:30 21:30-24:00	Session 9A Session 9B
10/26	[Main] IEEE UV2020 [20201026]Plenary	8:00-18:30	Keynote Speeches&UV2020 Panel
	[8A] IEEE UV2020 Session	20:30-23:00	Session 8A
10/27	[12A] IEEE UV2020 Session	2:00-5:00	Session 12A
	[7A,Shenzhen] IEEE UV2020 Session	2:30-5:00 5:00-7:00	Session 7A (Guangdong Session) Session 12B (Smart Home & Community)
	[2B,10] IEEE UV2020 Session	8:00-12:00	Session 2B/10
	[3A,3B,3D] IEEE UV2020 Session	8:00-12:00	Session 3A/3B/3D
	[5A] IEEE UV2020 Session	8:00-10:00	Session 5A
	[6] IEEE UV2020 Session	8:00-10:00 10:00-11:20 11:20-12:45	Session 12B (Smart Environmental Protection) Session 6 Session 11B
	[Main] IEEE UV2020 [20201027]Closing Ceremony	14:30-17:00	Session 15B
		17:00-17:30	Closing Ceremony

Oct. 23rd: Pitch Competition, Shenzhen Session

[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. 23rd: K-12 Challenge

[Aims] Inclusive, education-oriented special session.

[Contents] All K-12 students who care about harmony between humans and nature are welcome to participate in this challenge.

[Events]

- ◆ Online Game
- ◆ Research Presentation
- ◆ Innovation Competition
- ◆ Talent Shows

Oct. 24th-25th: 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]

- ◆ Talent Shows and Online Games
- ◆ UV Introduction Video
- ◆ UV Research Project Report
- ◆ Technology News, Social Hot Topics, Future Vision
- ◆ UV Philosophy and Stories Sharing
- ◆ UV Entrepreneurship Initiative and Pitch Competition

Oct. 26th: Plenary Session

[Aims] UV encourages interdisciplinary cooperation for a coordinated and systematic solutions 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
- ◆ Panel Discussion (Session 15-A, 15-B)

Oct. 24th-27th: Technical Program

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

[Sessions] Research Reports

- Session 1-A Vision for Universal Village and UV Indices
- Session 1-B Development Status of Universal Village
- Session 1-C Evaluation of Smart City-Related Methods, Technologies, and Systems
- Session 2-A Systematic and Integrated Frameworks for UV Subsystems and Contributing Factors
- Session 2-B Intelligent Modeling, Simulation, and System Analysis
- Session 3-A Intelligent Transportation, Urban Planning, and Crowd Management
- Session 3-B Smart City Infrastructure
- Session 3-C Information Flow, Communication, and Networks
- Session 3-D: Smart Response Systems for City Emergencies
- Session 4-A: Renewable Energy and Smart Energy Management
- Session 4-B: Smart Materials and Devices
- Session 5-A: Smart Manufacturing
- Session 5-B: Smart Agriculture
- Session 6: Ecological and Environmental Systems, Material Cycles
- Session 7-A: Smart Homes
- Session 7-B: Mobility, Connectivity, and Innovative Lifestyles
- Session 8-A: Advanced devices/systems for healthcare monitoring
- Session 8-B: Smart Medicine and Smart Healthcare
- Session 9-A: Urbanization and Smart Communities
- Session 9-B: Smart Government and Social Services
- Session 9-C: Integrated Solutions for Smart Humanity
- Session 10-A: Data Management and Processing
- Session 10-B: Algorithm Development and Analysis
- Session 11-A: Coordinated UV Solutions for Epidemic Prevention and Control
- Session 11-B: Coordinated UV Solutions for Trash and Scrap Collection, Processing, Reuse, and Recycling
- Session 12-A: UV City Forum
- Session 12-B: UV Student Forum
- Session 13: UV Pitch Competition
- Session 14: UV Exhibition

PLENARY SESSION

Meeting Room (Microsoft Teams): [Main] IEEEUV2020->[20201026]Plenary

Opening Remarks

Host by Conference Chair Juejun Hu (MIT)

- Opening Speech by General Chair

  Roy E. Welsch (MIT).
- Greetings by International Chairs

  Xiaoman Duan (UVS) & Yajun Fang (UVS).
- Welcome by Local Chair
  Lin Zhang(MIT)

Keynote Speeches

Host by Conference Chair Lin Zhang

Kazuya Takeda

Professor, Institute of Innovation for Future Society/ Graduate School of Informatics, Nagoya University

Title: Signal Information Processing of Human Driving

Time: 8:10am-8:50am，October 26th, U.S. Eastern Standard Time

Abstract: This talk reviews data-centric approaches for statistical modeling of driver behavior. Modeling driver behavior is challenging due to its stochastic nature and the high degree of inter- and intradriver variability. One way to deal with the highly variable nature of driving behavior is to employ a data-centric approach that models driver behavior using large amounts of driving data collected from numerous drivers in a variety of traffic conditions. To obtain large amounts of realistic driving data, several projects have collected real-world driving data. Statistical machine-learning techniques, such as hidden Markov models (HMMs) and deep learning, have been successfully applied to model driver behavior using large amounts of driving data. We have also collected on-road data recording hundreds of drivers over more than 15 years. We have applied statistical signal processing and machine-learning techniques to this data to model various aspects of driver behavior, e.g., driver pedal-operation, car-following, and lane-change behaviors for predicting driver behavior and detecting risky driver behavior and driver frustration. By reviewing related studies and providing concrete examples of

our own research, this talk is intended to illustrate the usefulness of such data-centric approaches for statistical driver-behavior modeling.

Lin Zhang

Professor, School of Automation Science and Electrical Engineering, Beihang University, Beijing, People's Republic of China

Title: Model Engineering for Complex System Simulation: Concept and Advances

Time: 8:50am-9:30am, October 26th, U.S. Eastern Standard Time

Abstract: Simulation is an activity based on models. How to build a right model is the core issue in simulation. A model generally experiences requirement analysis, model design, model construction, VV&A, model implementation, and model maintenance. These processes compose a whole lifecycle of a model. Although importance of the engineering idea is gradually recognized in applications of the model lifecycle, currently still lacks complete theory and technology system and philosophy. Model Engineering (ME) aims at setting up a systematic, normalized and quantifiable engineering methodology to manage the data, knowledge, activities, processes and organizations/people involved in the whole life cycle of a model, in order to obtain a right model with the minimum cost. This lecture will discuss the challenges involved in the model lifecycle of a complex system, such as the complexity of evolution process of a model, the model reuse problem, the multidisciplinary collaboration in model development and management, etc. Some

new advances in key technologies of model engineering, e.g. model description languages, model management, service-oriented model composition, quantitative analysis and evaluation, and etc., will be introduced.

Hirofumi Aoki

Professor, Global Research Institute for Mobility in Society (GREMO), Nagoya University, Japan

Title: A New Mobility Society and Driving Support Systems for the Future

Time: 9:30am-10:10am, October 26th, U.S. Eastern Standard Time

Abstract: As has been increasingly highlighted by the recent COVID-19 pandemic, “mobility” is important for a healthy, comfortable, and meaningful life. We have been continuously investigating the relationship between physical/mental functions and driving characteristics of the elderly since 2014 through the Center of Innovation (COI) program supported by the Japanese government. This presentation will introduce our program and the characteristics of elderly drivers that have been identified as contributing to dangerous driving and their countermeasures.

Yifan Yu

Professor, College of Architecture and Urban Planning, Tongji University, Tongji University, People's Republic of China

Title: Spatial Behavior and Healthy Aging: A GPS-based study of the older residents in Shanghai
Time: 10:10am-10:50am, October 26th, U.S. Eastern Standard Time

Abstract: The spatial behavior of elderlies is essentially the result of interactions between people and the environment. In order to explore a demand-responsive spatial intervention through new types of data from the perspective of urban planning, this study attempts to identify the differentiated trip features within the aged group, and proceed to gain a further understanding of their daily trip pattern, trip chain, and daytime activity sequence . 76 older residents from a typical public housing neighborhood in Shanghai were asked to carry an Android Phone for 102 consecutive days. By collecting and analyzing the trajectory data, we found that even in a highly consistent social and physical environment, there are still significant differences among the elderlies' daily activities, mainly existing in the age and gender aspects. The research indicates that elderlies' daily trip patterns are related to the starting point, effective interval, travel time, and the physical conditions of the individuals.

Jun Xu

Associate Director, Hunan Xiaoxiang Research Institute of Big Data, People's Republic of China

Title: Rethinking Smart Infrastructure and Smart City Development through the Lens of Resilience and Sustainability

Time: 10:50am-11:30am, October 26th, U.S. Eastern Standard Time

Abstract: Reliable, efficient, healthy and safe urban infrastructures are vital to the sustainable development and livability of our future cities. Despite the significant amount of investment that public and private sectors have put or are planning to make into smart city development, cities are still extremely vulnerable to disruptions brought by unexpected natural and human-induced events, such as COVID-19 pandemic, exacerbated climate change and social movements. This talk will give a retrospective review on the smart city and smart region initiatives in China and around the world through the prisms of resilience and sustainability. The review aims to identify research, knowledge and practice gaps, and encourage constructive discussions to come up innovative solutions to put these concepts into operational practices to shape the future of our inclusive and livable cities and human-centered universal villages.

Shuguang Zhang

Professor, Media Lab, Massachusetts Institute of Technology, USA

Title: Curiosity-driven Research: Fractals, and the QTY code
Time: 11:30am-12:10pm, October 26th, U.S. Eastern Standard Time

Abstract: Shuguang Zhang in 2011 started to design membrane proteins, because there are ~30% genes code for membrane protein in genomes that are crucial for both internal and external cellular communications. He invented a simple and elegant molecular QTY code, namely glutamine (Q), Threonine (T) and Tyrosine (Y) to systematically replace the hydrophobic amino acids Leucine (L), Valine (V), Isoleucine (I), and Phenylalanine (F) in the 7 transmembrane α-helices of G protein-coupled receptors (GPCRs). GPCRs function similar like our mobile phones to communicate and interact with external world. Their results suggest that despite 46%-56% transmembrane α-helices changes, water-soluble QTY variants still maintain stable structures and biological function, namely, ligand-binding activities. This simple QTY code is a likely useful tool and has big impact for designs of water-soluble variants of previously water-insoluble and perhaps aggregated proteins, including amyloids.

The QTY code is based on two key molecular structural facts: 1) all amino acids are found in natural alpha-helices regardless of their chemical properties; 2) several amino acids share striking structural similarities despite their very different chemical properties, for example, glutamine (Q) vs Leucine (L); Threonine (T) vs Valine (V) and Isoleucine (I); and Tyrosine (Y) vs Phenylalanine (F). The QTY code

systematically replaces water-insoluble amino acids (L, V, I and F) with water-soluble amino acids (Q, T and Y) in transmembrane α-helices. Thus, it changes the water-insoluble form of membrane proteins, including GPCRs, into a water-soluble form. Despite substantial transmembrane domain changes, the QTY variants maintain stable structure and ligand-binding activities. My lab has been successful in designing water-soluble variants of membrane proteins.

Afternoon Plenery-1:

Host by International Chair Yajun Fang

Clinton J. Andrews

Center for Green Building, Edward J. Bloustein School of Planning & Public Policy, Rutgers, The State University of New Jersey

Title: Making Micromobility Smarter & Safer
Time: 13:00-13:40, October 26th, U.S. Eastern Standard Time

Abstract: Electric scooters, electric bikes, and bikeshares are now augmenting old-fashioned walking as ways to get around the campus and nearby neighborhoods. These new mobility options are a mixed blessing, because while they are clean and convenient, they cause sidewalk clutter and significant safety issues. With funding from the National Science Foundation's Smart and Connected

Communities program, a multidisciplinary team at Rutgers University is tackling the micromobility safety challenge. They are developing novel methods for measuring safety by tracking frequent near misses rather than only rare crashes, using advanced machine learning tools that integrate computer vision and distributed sensors. They are also testing alternative safety improvement strategies ranging from low-tech tactical urbanism and education to advanced smart-city systems that integrate sensors, models, and alerting interfaces distributed among pedestrians, scooter/bike users, automobiles, and the underlying transportation infrastructure. This is a collaboration among researchers in urban planning, civil engineering, and computer science; the university transportation office, and the host municipalities. It illustrates the rich potential of the “living lab” vision of smart-cities research.

Alex Yasha Yi

University of Michigan, Department of Electrical and Computer Engineering, Dearborn and Energy Institute, Ann Arbor

Title: Integrated on-chip optoelectronic devices and systems for applications on artificial intelligence
Time: 13:40-14:20, October 26th, U.S. Eastern Standard Time

Abstract:

Integrated optoelectronicson chip is enabling artificial intelligence (AI). Combination of photonics and AI for photonics-enabled applications is an exciting new prospect. AI is one of the emerging topics. AI encompasses many technologies, such as machine learning, cloud computing and big data. It overlaps considerably with photonics and integrated semiconductormaterials and photonics. With current rapid development of new photonic materials and devices, many AI based devices and systems, like robots, autonomous driving, unmanned autonomous vehicles (UAVs), and drones, rely heavily on photonic sensors, photonic networks, neuromorphic photonics, programmable photonics and telecommunications to realize practical and smart functionality. This talkwill introduce thisemerging field of integrated chip-scale photonics with applications on AI.

Georgios Theodoropoulos

School of Computer Science and Engineering, Southern University of Science and Technology

Title: From Big Data to Big Models: The next frontier for Info-Symbiotic Systems

Time: 14:20-15:00, October 26th, U.S. Eastern Standard Time

Abstract: The emergence of extreme scale computing systems and the data explosion have presented an unprecedented opportunity for the modelling and simulation of systems at a rapidly increasing scale, complexity and granularity. Digital twins, the culmination of Dynamic Data Driven Application Systems (DDDAS), provide a powerful paradigm for linking models with data and may support an info-symbiotic intermingling of “what-if” and data analytics approaches at a grand scale. Incorporating intelligence and cognition in a digital twin will unlock the full potential of this disruptive technology, and will provide seamless integration, calibration and info-symbiotic collaboration between the physical and virtual worlds. The talk will focus on the interplay between simulation and data in info-symbiotic systems and will outline a roadmap towards cognitively rich intelligent twins, discussing gaps, opportunities and some concrete examples.

Afternoon Plenery-2:

Host by Program Chair Longfei Zhou

Jose Campos

Office of Community Investment and Infrastructure, San Francisco, CA

Title: The Opportunities and Challenges of Implementing Sustainable Urban Redevelopment. A San Francisco Case Study with a Focus on its “Eco-District” Typology

Time: 16:00-16:40, October 26th, U.S. Eastern Standard Time

Abstract: Key elements of Sustainable Urban Districts can be described as pertaining to either “hardware” or “software.” The “hardware” includes deep-green, district-level infrastructure, such as district heating and cooling, or decentralized water recycling facilities, combined with green building improvements at the property or site level. Successful Sustainable Urban Districts also require functioning “software,” which means clear district governance structures and agreements, community-building communication platforms, and viable long-term financing schemes for capital improvements and maintenance. San Francisco established an eco-district program in 2012, and with it, an eco-district typology that categorize districts to help guide the transformation of the city, neighborhood by neighborhood, and development by development, into a substantially more sustainable city. Each Sustainable Urban District Type is mutually exclusive and covers all property within the city limits:

Type I – Master Redevelopment Plan under a single property owner.

Type II – Rezoned Districts by a Master Redevelopment Plan under multiple property owners.

Type III – Historic Districts and Traditional Neighborhoods.

Type IV – Industrial and Logistics Districts.

Type V – Natural Areas and Open Space Networks.

In some cities, a sixth Type needs to be added:

Type VI – Informal Settlements.

Gene Fry

Citizens Climate Lobby

Title: Albedo Changes Drive 4.9 to 9.4°C Global Warming by 2400

Time: 16:40-17:20, October 26th, U.S. Eastern Standard Time

Abstract: Based on the Vostok equation using CO_2 only, holding ∆GST to 2°C requires 318 ppm CO_2. This means Earth's remaining carbon budget for +2°C is estimated to be negative 313 billion tonnes. Meeting this target will require very large-scale CO_2removal. Lagged warming of 4.0°C (or 7.4°C when CH4 is included), starting from today's 1.1°C ∆GST, comes mostly from albedo changes. Their effects are estimated here for ice, snow, sulfates, and cloud cover. This study estimates magnitudes for sulfates and for future snow changes. Magnitudes for ice, cloud cover, and past snow changes are drawn from the literature. Albedo changes, plus their water vapor multiplier, caused an

estimated 39% of observed GST warming over 1975-2016. Estimated warming effects on GST by water vapor; ocean heat; and net natural carbon emissions (from permafrost, etc.), all drawn from the literature, are included in projections alongside ice, snow, sulfates, and clouds. Six scenarios embody these effects. Projected ΔGSTs on land by 2400 range from 2.4 to 9.4°C. Phasing out fossil fuels by 2050 yields 7.1°C. Ending fossil fuel use immediately yields 4.9°C, similar to the 5.1°C inferred from paleoclimate studies for current CO_2 levels. Phase-out by 2050 coupled with removing 71% of CO_2 emitted to date yields 2.4°C. At the other extreme, postponing peak fossil fuel use to 2035 yields +9.4°C GST, with more warming after 2400.

Yulin Pan

Naval Architecture and Marine Engineering, University of Michigan

Title: Resolution of extreme motion statistics of marine structures in irregular waves

Time: 17:20-18:00, October 26th, U.S. Eastern Standard Time

Abstract: We consider the statistics of extreme motions of marine structures in a nonlinear irregular wave field. While an accurate computation is possible by using a full Monte-Carlo method to cover all individual wave conditions, the computational cost may become prohibitively high (when coupled with high-fidelity simulations) due to the rareness of the extreme events. In this work, we develop a new framework, which allows the statistics (and causal wave conditions) of

extreme motions to be efficiently resolved. This development leverages a range of physics and learning based approaches, including nonlinear wave simulation, structure response CFD simulation, dimension-reduction techniques and sequential sampling. The effectiveness of the new framework is successfully validated through the coupling with a nonlinear roll equation, where the exact extreme roll statistics can be calculated and compared with. Finally, the framework is coupled with the CFD model to demonstrate its applicability to more realistic and general problems.

Weihua Mu

Wenzhou Institute, University of Chinese Academy of Sciences, and Department of Electrical Engineering and Computer Science, Massachusetts Institute of Technology

Title: Membrane theory of liquid crystals: the Helfrich equation and new applications

Time: 18:00-18:40, October 26th, U.S. Eastern Standard Time

Abstract: The shape of materials is an ancient and cutting-edge challenge in materials science. In the field of bio-materials and bio-mechanics, how to understand the physical mechanism behind the biconcave shape of red blood cells with the physiological activity has been successfully resolved. The key breakthrough is the establishment of the liquid crystal theory of membranes, that is, the lipid bilayer membrane is regarded as a liquid crystal phase, and the energy

of the biological membrane is expressed by the curvature of the membrane. Subsequently, Helfrich introduced a key term - the spontaneous curvature term in the energy functional of a biological membrane, to reflect the asymmetry of the environment inside and outside the membrane. Based on this idea, Ou-Yang and Helfrich obtained the universal equation of equilibrium shape of a biological membrane, i.e., Ou-Yang-Helfrich equation, which became a milestone achievement in the theoretical research of bio-membrane. In the present talk, we will review the history of biological membrane research and the Ou-Yang-Helfrich equation, and then focus on our new innovative applications in this area. It is particularly noteworthy that we have applied the liquid crystal theory of the membrane to the study of two-dimensional nano-materials, and obtained some beautiful analytical results which are difficult to obtain by usual molecular simulation methods, such as the quantitative relationship axial torsion induced by the stretching/compression in a chiral single-walled carbon nanotube. We will also present some new applications of Ou-Yang-Helfrich equation in virology research.

PANEL

UV2020 Panel – Opening (Session 15A): New Legal, Social, and Ethical Challenges Posed by Applications of AI

Time: 15:00-16:00, October 26th, U.S. Eastern Standard Time
Meeting Room (Microsoft Teams): [Main] IEEE UV2020 -> [20201026] Plenary
Moderator: Georgios Theodoropoulos
Assistant: Chaoyi Wang

[Outline]
The last decade Artificial intelligence (AI) has witnessed an explosion of interest and scientific and technological breakthroughs. The race between countries and Big Tech companies for AI dominance has been accompanied by an increasingly intense debate on the disruptive impacts of AI on the world's economy and society. Contributing to this growing global discourse, this panel brings together five of the world's most influential and distinguished scholars to discuss the new challenges society will face in this emerging AI-dominated world.

[Moderator]
Georgios Theodoropoulos, Southern University of Science and Technology, Shenzhen

[Panelists]
Joseph Sifakis, Turing Award Laureate, Emeritus Senior CNRS Researcher at Verimag

Frederica Darema, Retired Senior Executive Service Director
Carlos Alvarez Pereira, Executive Committee Member, Club of Rome,Advisory Board Member, Bateson Institute

Phaedra Boinodiris, Leadership Council, IBM Academy of Technology

Audrey Lobo-Pulo, Founding Director, Phoensight, Head of Conditions Watch, Resilient Futures

UV2020 Panel – Closing (Session 15B): Lifestyle Innovations Enabled by Emergent Technologies

Time: 14:30-17:00, October 27th, U.S. Eastern Standard Time
Meeting Room (Microsoft Teams): [15B] IEEE UV2020 Session

Moderator: Fang Fang

Panel Discussion
Panelists: All Session Chairs
Brief Introductions of Session Meetings
Discussion

TECHNICAL PROGRAM

Session 1A&1B: Vision for Universal Village and UV Indices& Development Status of Universal Village

Time: 20:00-24:00, October 25th, U.S. Eastern Standard Time
Meeting Room (Microsoft Teams): [1A,1B] IEEE UV2020 Session
Chair(s): Yifan Yu
Assistant(s): Zhiyuan Yang

Meet Our Speakers

[1A&1B-1] Joint Research on Big Data, Deep Learning, and Smart City at Baidu

Speaker(s): Dejing Dou

Abstract: Big data, deep learning, and huge computing are shaping up AI and are transforming our society. Big-data-driven decision making and automation are being utilized to solve significant challenges faced by our society in an unprecedented scope. At Big data lab (BDL) of Baidu Research, we are working on cutting-edge research to better harness big data. At Business Intelligence lab (BIL), we are developing and utilizing state-of-art big data and AI technologies in smart city research. For instance, we have been working on urban quantitative analysis, urban cognitive computing, intelligent online map service, and advance mobile AI technologies, to help humans to improve their city lives with better efficiency, safety, and environmental quality. We also have developed FedCube, a secure data sharing platform for federated learning and cloud-based cooperation and computing. It provides users with comprehensive cloud data and optimal scheduling of computing resources and achieves automated and scalable deployment of workflow. Seven universities and research institutes have used the FedCube platform to analyze the real-time and historical data of 75 major cities in Mainland China, which are collected from the Baidu Maps and Baidu search engines. Interesting scientific discoveries have been reported for analyzing the COVID-19 pandemic in Mainland China.

[1A&1B-2] From Jobs-Housing Balance to Diversity: Evaluating the Diversity of Urban Jobs-Housing Commuting and its Influencing Factors based on Multi-Source Big Data

Speaker(s): Junyan Yang

Abstract: The researches on urban jobs-housing commuting behavior have been focusing on the jobs-housing balance. But few considers that if urban residents follow the same commuting pattern, the urban diversity may also decrease. Estimating the urban jobs-housing commuting patterns based on LBS data, this paper aims to evaluate the diversity of urban jobs-housing commuting patterns. Then it relies on multiple spatial elements and uses multiple linear regression analysis, to evaluate the impact of each factor, and analyze the impact mechanism that causes the different diversification of urban jobs-housing commuting patterns. The results show that, compared to the distance from the city center, the diversity of urban jobs-housing commuting patterns is more affected by the diversity of land use, density of public service facilities, public transportation coverage, and road density. In addition, there are many district-level centers with high diversity of urban jobs-housing commuting patterns and remote regions with low diversity. The diversity of urban jobs-housing commuting patterns shows a trend of non-linear decrease from urban center to edge. Focusing on a new perspective of the urban jobs-housing commuting problems, this study proposes an evaluation method based on multiple big data, discovers important spatial influence factors, and explores the spatial distribution of the diversity of urban jobs-housing commuting patterns.

[1A&1B-3] The Monitoring Indices of Territorial Spatial Planning in China: A Perspective of Human Mobility
Speaker(s): Jianxiang Huang
Abstract: Universal Village Indices: Quantitative Indications of Cities' Smartness, Efficiency, Safety, Environmental Qualities, and Inclusiveness

[1A&1B-4] The Monitoring Indices of Territorial Spatial Planning in China: A Perspective of Human Mobility
Speaker(s): Jian Li
Abstract: This presentation will generally introduce the background of the emerging territorial spatial planning in China, including the role, architecture and administrative system reform, and provide a detailed review of current monitoring indices used in the territorial spatial planning. We aim to grasp the objective reality and key problems of spatial population evolution of typical regions and cities, clarify the methods and paths of multi-source data acquisition, verification, calculation and evaluation, and propose value oriented, easy to operate and practical monitoring indicators and evaluation standards, so as to provide support for the implementation of supervision oriented technical standard system. The feature of the study is to use big data analysis method to put forward dynamic space activity observation index system from the perspective of human mobility.

[1A&1B-5] City Diagnosis with the City Intelligence Quotient (CITY IQ) Evaluation System: Case study of Yangtze River City Cluster, China
Speaker(s): Xinggang Zhou
Abstract: Intelligent city is considered as a new-technology based approach to mitigate urban problems. However, it still remains to be studied how to evaluate the performance of intelligent cities precisely and objectively. This research intends to present an object evaluation system for the construction of intelligent city, but also make response to the practice for further self-improvement, providing well-founded support for the future advance of intelligent cities. This research summarizes the strengths and weakness and establishes a systematic City Intelligence Quotient (City IQ) Evaluation System to dynamically monitor and analyze the degree of intelligence development. The City IQ has a two-level structure: the primary dimensions emphasize on the top-level policy design, including five dimensions. The secondary indicators are made up of 20 indicators based on these 5 dimensions. In this research, 27 cities in Yangtze River Delta, China was selected for empirical study to compare the degree of urban intelligence development. The Yangtze River, deeply associated with China's modernization process, is considered as the development engine for the vitality and huge power of leading region development. The ranking of intelligent cities is determined according to the final scores. Finally, the suggestions for improvement are put forward, taking Shanghai as an example. Based on the system, we could know the

rankings of cities in various dimensions up-to-date, to carry out targeted urban diagnosis, to formulate policies to promote intelligent construction and provide support for the development of intelligent cities.

[1A&1B-6] Understanding City through Geotagged Images
Speaker(s): Liu Liu
Abstract: Urban imagery data study can be generalized as an approach of understanding cities based on geo-tagged images using deep learning technology. This talk includes our experience from both academic research and practical projects. Different aspects, such as city color analysis, assessment of urban visual environment, and street emotional score, will be introduced. A healthy city should focus on serving the people. Considering that urban planning in China is mainly relying on top-down management system, with the help of mobile internet, we are working on establishing channels feedback from the bottom-up society using urban image study. And to stimulate public participation and digest public perception towards physical space we developed tools, apps, algorithm, and solutions for data collection in our projects in China. Thoughts and experiences about this will be discussed in the later part of the talk.

[1A&1B-7] An Alternative Way of Quantitatively Understanding Smartness, Efficiency and Inclusiveness via the Perspective of Street Vending
Speaker(s): Ziwen Sun
Abstract: Cities are not just made of bricks and mortar, they are inhabited by flesh-and-blood humans. The urban built environment is not static but is an ever-changing lived embodiment of human dwelling and action. For example, in Chinese cities pavements are designed for pedestrians but are temporarily occupied by street vendors, representing the time-related demands and real life needs of a specific neighbourhood. This provides an alternative way of thinking about Smartness, Efficiency and Inclusiveness, towards Liveability, Timeliness and Informality. Using behaviour mapping, this study quantitatively measures street life features, time variations and informal spatial practice of three urban street spaces, during four daily time periods in the small Chinese city of Suihua. Based on the quantitative results, we discuss people's 'smartness' in using the same environment in different ways, emerging times and spatial appropriations of street vendors for 'Efficiency' and twenty-six activities and behaviours for 'Inclusiveness'. We also compare two 'co-operations' of socio-spatial practice and environment-behaviour interaction, through micro-climates, environment characteristics and human activities. The lived knowledge generated by this method of understanding local urban environments could benefit future policy-making and urban design practitioners, helping to achieve harmony between locally lived human practices and context-specific environments.

Session 1C: Evaluation of Smart City-Related Methods, Technologies, and Systems

Time: 8:00 am-12:00 pm, October 25th, Eastern Standard Time
Meeting Room (Microsoft Teams): [1C] IEEE UV2020 Session
Chair(s): Guoping Zhang, Ji Li
Assistant(s): Zhiyuan Yang

Meet Our Speakers

[1C-1] Economic Index, Epidemic Data and Top Governance and Emergency System of Public Health: Comparative Analysis between China and Other Countries
Speaker(s): Guoping Zhang

[1C-2] Cultural Tourism Industry and Regional Service Finance Innovation
Speaker(s): Ji Li

[1C-3] Technology Driven, Product Innovation and Urban Intelligent Education
Speaker(s): Peter Wei

[1C-4] Smart Medical Solutions Under 5G Ecology
Speaker(s): Xuezhe Han

[1C-5] Introduction to UV
Speaker(s): Yajun Fang
Abstract: Universal Village (UV) is a new concept proposed by MIT's Universal Village Program. The concept models a desired future society that protects the environment/eco-system and addresses human needs in order to provide sustainable happiness to residents of the society. It is an expanded and advanced version of Smart Cities which pursues harmony between humans and nature through wise use of technologies. The concept comes from the belief that we should follow the laws of the universe and understand human needs in depth while pursuing intelligent technologies to improve comfort, convenience, and efficiency. Otherwise, nature suffers and we humans suffer eventually.

[1C-6] Economic Index, Epidemic Data and Top Governance of Public Health System: International Comparison
Speaker(s): Zeyao Wang

Session 2A: Systematic and Integrated Frameworks for UV Subsystems and Contributing Factors

Time: 20:00-22:00, October 25th, U.S. Eastern Standard Time
Meeting Room (Microsoft Teams): [2A]IEEE UV2020 Session
Chair(s): Hirofumi Aoki
Assistant(s): Yiyao Wang

[2A-1] Smart Society Platform for Transdisciplinary Mobility Innovation

Speakers: Nobuo Kawaguchi

Abstract: With the increasing complexity of global issues and the diversification of values, "Transdisciplinarity" is becoming an important keyword for the realization of a smart society. In this talk, I introduce new concepts of information platforms for a smart society and the development of human resources for mobility innovation based on transdisciplinarity.

Session 2B: Intelligent Modeling, Simulation, and System Analysis

Time: 8:00am-9:20am, October 27th, U.S. Eastern Standard Time
Meeting Room (Microsoft Teams): [2B,10]IEEE UV2020 Session
Chair(s): Lin Zhang
Assistant(s): Hao Yuan

Session 2B and Session 10 will be held together. Session 2B starts first.

[2B-1] Cyber-Physical Systems in Manufacturing: An Overview
Speaker(s): Chen Yang
Time: 8:00-8:30, October 27th, U.S. Eastern Standard Time
Abstract: Cyber-Physical Systems (CPS) envision the seamless interconnection of the physical world and the cyber space. This provides a promising opportunity to transform the manufacturing sector. This talk tries to provide an overview of key research issues to be addressed and the latest advances. Therefore, we first introduce the core technologies of CPS, such as Wireless Sensor Networks, Cloud Computing, and Big Data. Then we discuss key research issues of CPS-enabled manufacturing in term of system architecture and standard, deployment and business model, data acquisition and processing, model & simulation based decision-making, social development of intelligent products, service provision and dynamic composition, user-centric pervasive environment and latency reduction with state-of-the-art reviews. Finally, we point out some key potential application areas of CPS in manufacturing.

[2B-2] Modeling and Simulations for Robotic CPS in the Context of Cloud Manufacturing
Speaker(s): Yongkui Liu
Time: 8:30-9:00, October 27th, U.S. Eastern Standard Time

[2B-3] Analytical-Solution-based Autopilot Design for Airdrop of Cruise Missile Equipped with Parachute
Author(s): Mengya Gao, Wenbin Yu, Wanchun Chen
Time: 9:00-9:20, October 27th, U.S. Eastern Standard Time
Abstract: After being delivered from aircraft, a cruise missile needs to decelerate by parachute to meet the requirements for engine ignition, especially on altitude, speed, and Angle Of Attack (AOA). Thus a new autopilot design problem arises, where the effect of parachute should be taken into account. During the falling, the parachute exerts a huge force on the missile through the hinge point, which makes the traditional autopilot lose potency. In this paper, the analytical solution for hinge force is deduced and used to establish a new attitude dynamics model. By linearizing the new dynamics model and using pole placement method, a new three loop autopilot considering the effect of parachute is put forward. The superiority of the new autopilot is verified by conducting trajectory simulations.

Session 10 Continues.

Session 3A&3B&3D: Intelligent Transportation, Urban Planning, and Crowd Management, Smart City Infrastructure, Smart Response Systems for City Emergencies

Time: 8:00am-12:00pm, October 27th, U.S. Eastern Standard Time
Meeting Room (Microsoft Teams): [3A,3B,3D]IEEE UV2020 Session
Chair(s): Jun Xu
Assistant(s): Lin Li

Meet Our Speakers

SPEAKERS

Session Chair
Jun Xu
Associate Director

Xiaoxiang Research Institue of Big Data

Keynote Speaker
Cynthia Hou
Assistant Professor

Department of Management in the Built Environment
Delft University of Technology

Keynote Speaker
Mohammad Uzzal Hossain
Research Assistant Professor

Department of Civil Engineering
The University of Hong Kong

OVERVIEW

Intelligent transportation systems are expected to improve the capacity and safety of urban transport, and to reduce energy consumption and pollutions. Smart infrastructure systems are fundamental to many other subsystems for smart cities, especially smart response systems for emergency management, intelligent transportation, and smart healthcare. From the perspective of Universal Village, intelligent transportation systems should work with other systems collaboratively, especially with smart infrastructures and smart response systems for city emergency, to handle crowd management, transportation, and urban governance and management issues, as well as to promote the achievement of Sustainable Development Goals, e.g. "Make cities and human settlements inclusive, safe, resilient and sustainable", set by the United Nations.

TOPICS

01. Intelligent transportation, intelligent vehicles, and its infrastructure,etc.
02. Traffic control & management, human-centered transportation, etc.
03. Smart facilities, smart construction, Coordinated city infrastructure development, etc.
04. Emergency prediction, detection and management; cyber-security, etc.

[3A&3B&3D-1] Understanding Users' acceptance of Smart Technologies: A Perspective from the Hospitality Industry and its Implication on Urban Development Speaker(s): Cynthia Hou
Time: 8:10 am-8:40 am, October 27th, U.S. Eastern Standard Time
Abstract: The emergence of ICT has transformed a city's urban landscape as well as the experience of people. Technology has changed human society while the interruption of ICT alters people's interactions in their social space, which is constituted by people, the built environment and the mental space. Smart technologies refer to a combination of functions provided by both hardware and software components to establish the seamless connection within the social space in form of smart devices and smart systems. The extent to which smart technologies are accepted affects service provider, ex-ante, and user's attitude and belief, ex-post. Based on empirical data collected from Hong Kong, this study sheds lights on the hospitality industry, discusses the application of smart technologies in the context of hotel sector, explore the smart technologies application in the hotel operation from the hotel operators' perspective, and investigate tourists' acceptance of and attitude of experience-enhancement hotel smart technologies. Furthermore, the future development of smart technologies application in the hospitality industry and their extended implication on urban development will be discussed.

[3A&3B&3D-2] Life Cycle Assessment and Industrial Ecology: Practical Applications
Speaker(s): Mohammad Uzzal Hossain
Time: 8:40 am-9:10 am, October 27th, U.S. Eastern Standard Time

[3A&3B&3D-3] Pilot Tests of Automated Bus Aiming for Campus Transportation Service
Speaker(s): Bo Yang
Time: 9:15 am-9:35 am, October 27th, U.S. Eastern Standard Time
Abstract: The aging of population and shortage of drivers have troubled the public transportation in Japan for years. Recently, automated bus has become a promising way to provide future public transport, including the university campus transportation service, with the rapid development of automated driving technologies. On-road pilot tests are considered as an effective way in promoting the deployment of automated buses. In this paper, several on-road pilot tests of automated bus aiming for campus transportation would be introduced, of which the tests conducted in Okinawa were mainly aimed for technical verification, and the tests performed at Kashiwa campus, the University of Tokyo, were mainly focused on the operation and maintenance issues. It is expected that the tests can provide an evidence for the possibility of applying automated bus in public transportation.

[3A&3B&3D-4] Analysis of walkability of historical blocks of Shanghai Old

City Area based on spatial syntax
Speaker(s): Ruolin Wang
Time:9:35 am-9:55 am, October 27th, U.S. Eastern Standard Time
Abstract: The improvement of walking environment quality can effectively alleviate the traffic pressure of the city, which is conducive to the environment construction of the low-carbon city. The measurement of the pedestrian environment is an important premise of urban planning and construction, and an important indicator to measure social ecology and pedestrian safety. From the perspective of spatial syntax, this paper selects four parameter values, namely connection value, global integration degree, local integration degree and comprehensibility degree, to quantitatively analyses the spatial structure and road network characteristics of blocks, and to explore the walkability of blocks from the topological structure itself. The empirical research object is Shanghai Old City area, which is the cradle of Shanghai-style culture and the window to show the historical accumulation and traditional culture of Shanghai to foreign tourists. Through the research and analysis, it provides a theoretical basis for further optimizing the walking experience of historical districts and updating the planning and design of road space.

[3A&3B&3D-5] Efficient Abnormal Motion Change Detection Based on Translational Velocity Indicator
Speaker(s): Mingzhi Cai
Time: 9:55 am-10:15 am, October 27th, U.S. Eastern Standard Time
Abstract: The translational velocity indicator (TVI) estimation is a simple and convenient way of solving for objects' motion direction without segmentation or tracking. Based on this, we defined and distinguished the change level of image sequences by defining Abnormality Coefficient (AC). An abrupt increase in AC can indicate the happening of abnormal motion change. To gauge the accuracy of judgment, we also introduced the width of S-band which is related to the size of the field of view. TVI, AC, and S-band can be estimated from videos captured by a single camera and do not require the detection of image information in detail. The proposed method is computationally efficient and simple to implement. Our motivation stems from the limited number of provided screens and a large number of monitoring cameras require the videos or image sequences ordered by change level. We demonstrate the TVI method by applying it on two video sequences, and the results show that the method can distinguish the different change levels for sequences with and without abnormal motion change; the S-band method is applied on another two video sequences and it successfully shows different sizes of the field of view.

[3A&3B&3D-6] An Attention-based Graph Neural Network Enabled Method to Predict Short-term Metro Passenger Flow
Speaker(s): Lin Li
Time: 10:15 am-10:35 am, October 27th, U.S. Eastern Standard Time

Abstract: Effective, accurate and reliable prediction of short-term metro passenger flow is essential to improve the operational efficiency and passenger's travel experience of public transport, as well as to enhance stakeholders' emergency response capability against adverse events. Various deep learning models like Long Short-Term Memory (LSTM) models and Graph Convolutional Network (GCN) have been implemented to predict short-term metro passenger flow, but they are either high computational cost or less accurate. To achieve the balance between computational cost efficiency and accuracy at the same time this study proposes to apply Attention-based Graph Neural Network (AGNN) to short-term metro passenger flow prediction. The proposed method can also effectively improve the accuracy of prediction when traffic peaks occur compared to LSTM and GCN based models. Empirical studies are conducted to validate the proposed method.

[3A&3B&3D-7] Real-Time Anomaly Detection and Feature Analysis Based on Time Series For Short Surveillance Video

Speaker(s): Ruoyu Xue, Jingyuan Chen

Time:10:35 am-10:55 am, October 27th, U.S. Eastern Standard Time

Abstract: The intelligent surveillance system urgently needs the real-time machine recognition of abnormal events to solve the extremely uneven human supervision resource and digital cameras. However, the existing Deep Learning approaches generally encounter low-efficiency problems, lack of interoperability, and unstable performances under different scenarios. This paper presents a robust methodology for real-time video anomaly detection under five different scenarios: road accident, explosion, burglary, fighting and robbery. The main idea of the proposed method is to evaluate the sensibility of common features to different types of abnormal events based on SVM. We created the Video-Energy-Vector to greatly reduce the dimension of feature maps while maintaining the spatial-temporal information. Also, we adopt voting models among different features, which significantly increase the performance. Further More, our algorithm uses fewer frames of a short video to recognize anomaly; thus, it much meets the need for real-time surveillance with low time complexity. The simulation result on well-known UCF-Crime Dataset has proved that our approach achieves robust results on all types of abnormal events.

Session 3C: Information Flow, Communication, and Networks

Time: 20:00-24:00, October 24th, U.S. Eastern Standard Time
Meeting Room (Microsoft Teams): [3C,Bejing]IEEE UV2020 Session
Chair(s): Lan Chen
Assistant(s): Songze Wu

Meet Our Speakers

[3C-1] GPU-based Implementation of Error Control Codecs
Speaker(s): Rongke Liu

Time: 20:10-20:40, October 24th, U.S. Eastern Standard Time

Abstract: To improve the resource utilization of the entire communication system and reduce the development cycle and cost, communication systems based on software platforms have become a hot spot in academic and business research, such as software-defined radio (SDR), software-defined networks (SDN), network functions virtualization (NFV). Channel decoding is one of the most resource-consuming processes in the physical layers of the communication systems. Therefore, it is very important to design efficient decoders with high throughput and low latency. In recent years, software-programmed processors such as CPUs and GPUs have evolved into powerful processors with numerous cores. This study will introduce the GPU-based parallel decoder architectures for the error control codes. Some practical optimization methods are presented to improve the performance of the GPU-based decoders through several application examples. This study will also discuss possible challenges of designing GPU-based decoders with high performance.

[3C-2] Cross-system Inter-connections for Internet-of-things: State-of-art, Challenges, and Key Technologies
Speaker(s): Yunhuai Liu
Time: 20:40-21:10, October 24th, U.S. Eastern Standard Time
Abstract: With the repaid development of Internet-of-things (IoT) technology, there have been a large number of IoT system in deployment in various application scenarios and field. Representative applications systems include but not limited to intelligent transportations, industrial IoT, intelligent logistics, intelligent power grid, and Intelligent emergency response. As projected by HIS, there will be over 7.54 million IoT devices deployed all over the world. This large number of heterogeneous and diverse IoT systems leads to severe system challenges, e.g., system isolations, over-utilized network resources such as the wireless spectrums, and security issues. To address these challenges, it is essential to make these heterogeneous system inter-connected. Towards this end, in this talk we will introduce some recent advances for inter-connection heterogeneous IoT systems such as cross-technology communications, network function virtualizations, and knowledge graph for IoT devices. Some challenges and future research directions will be highlighted.

[3C-3] Earthquake Disaster Analysis based on Multi-source Communication Data Processing
Speaker(s): Xiaoxiang Wang
Time: 21:10-21:40, October 24th, U.S. Eastern Standard Time
Abstract: Rapid assessment of disaster information such as seismic intensity area and affecting field direction after an earthquake is important for rescue. However, seismic equipment has limited coverage and need a long time to assess disasters.

Compared to seismic equipment, mobile phone and basestations have wider coverage, higher density, and faster response to the damage, which can be used to quickly assess earthquake disasters. Existing methods only take damaged base stations into calculation and treat them as identical, but they should have different contributions in different conditions. In our algorithm, both damaged base stations and normal basestations are considered altogether. In order to make full use of the information, we increase the sampling points, reasonably calculate by kernel density method, and propose the concept of "damage ratio" to determine the weight of all points. Finally, the weighted standard deviation ellipse algorithm is used to obtain the seismic intensity area and affecting field direction. This method can be verified to be better than the traditional method through the real earthquake case.

Also, we set up a scheme for Earthquake Disaster Analysis based on Multi-source Communication Data Processing, by developing APP stored in Android mobile phone and its corresponding Servicer Database. Data from multiple resources including data collected by mobile phones and message from MicroBlog etc. are able to be collected and analyzed in time for the purpose of earthquake emergency rescue.

[3C-4] Intelligent Computing Network with Cloud-Edge-End Collaboration in the 5G Era

Speaker(s): Xiaofei Wang

Time: 21:40-22:10, October 24th, U.S. Eastern Standard Time

Abstract: From the perspective of the 5G-oriented mobile network, this talk will describe the deep integration of cooperative edge caching, edge computing and edge intelligence, and discuss the core issues, challenges and key technologies of edge intelligence. At the same time, it will present preliminary research results on 1) optimizing computing networks with edge-cloud collaborated deep reinforcement learning and 2) optimizing edge computing with federated learning frameworks. Further, the opportunities and challenges of intelligent computing networks for future smart city will be discussed.

Short Break(22:10-22:25)

[3C-5] Rapid Implementation of Covid-19 AI Assisted Diagnosis System Based on Supercomputing Platform

Speaker(s): Bo Kang

Time: 22:25-22:45, October 24th, U.S. Eastern Standard Time

Abstract: This speech will introduce a technical solution to quickly establish a Covid-19 AI assisted diagnosis system by using the Tianhe artificial intelligence innovation integrated platform deployed on the Tianhe-1A supercomputer.

[3C-6] An Intelligent Wearable Temperature Monitoring System for Epidemic Surveillance
Speaker(s): Ming Chen
Time: 22:25-23:05, October 24th, U.S. Eastern Standard Time
Abstract: This speech will introduce a continuous temperature monitoring system with high precision, continuous and long-time measurement, remote temperature collection, and low power consumption, which can monitor and warn the population with abnormal temperature in the epidemic in time.

[3C-7] A Novel Prefetching Scheme for Non-volatile Cache in the AIoT Processor
Speaker(s): Mao Ni
Time: 22:25-23:05, October 24th, U.S. Eastern Standard Time
Abstract: This speech will introduce a method to bring STT-RAM into the cache system of AIoT processors.

[3C-8] An Online Cold-Chain Monitoring System Powered by Miniature Smart Tag and Blockchain
Speaker(s): Liting Ji
Time: 23:25-23:45, October 24th, U.S. Eastern Standard Time
Abstract: This speech will introduce a food supply chain tracing system powered by a smart tag hardware and blockchain technology.

Session 4A: Renewable Energy and Smart Energy Management

Time: 8:00am-11:00am, October 24th, U.S. Eastern Standard Time
Meeting Room (Microsoft Teams): [4A]IEEE UV2020 Session
Chair(s): Yulin Pan
Assistant(s): Yuhao Dong

[4A-1] Intelligent Windows for Energy-efficient Buildings
Speaker(s): Ruitao Wen
Time: 8:00-8:30, October 24th, U.S. Eastern Standard Time

[4A-2] Recent Effort in Offshore Renewable Research in SJTU
Speaker(s): Ye Li
Time: 8:30-9:00, October 24th, U.S. Eastern Standard Time
Abstract: This speech will introduce a food supply chain tracing system powered by a smart tag hardware and blockchain technology.

[4A-3] Preliminary Systematic Modeling and Dynamic Optimization of Power System Stability
Speaker(s): Zhiyuan Yang
Time: 9:00-9:20, October 24th, U.S. Eastern Standard Time
Abstract: Dynamic stability is a primary concern in power systems. Small disturbances without safe control can develop into widespread blackouts. In 2015, 3571 recorded outages in the US affected 13 million people (United States Annual Report 2015). However, today's regulating and controlling methods mostly aim at local optimization but lack a systematic optimization framework and dynamic interaction analysis, which may not perform well and cannot trace and control cascading events in a real complex system. Machine learning cannot deal with various unanticipated cascading events. In this paper, we integrate all primary operating conditions and regulating methods of power systems in a novel systematic model. Then we innovatively apply state transitions between operating conditions to describe the dynamic complexity of power systems. Our work supports the feasibility of adaptive model-based machine learning and hybrid Human-AI electrical power management system.

[4A-4] Data-driven Model with Ensemble Learning Predicting Thermal Runaway of Real Working Condition Vehicles
State of Health Estimation and Remaining Useful Life Prediction of The Lithium Battery for New Energy Vehicles with Long Short-Term Memory Neural Network
Speaker(s): David Chang
Time: 9:00-9:40, October 24th, U.S. Eastern Standard Time
Abstract: Battery failure is a big obstacle that should be tackled for new energy vehicles, and thermal runaway is one of the principal threats, which could cause vehicle fire and lead to casualties. So, it is urgent and vital to develop an algorithm that can predict if and when the thermal runaway will happen and then send alerts to passengers. Nevertheless, it is hard to make a precise prediction because the causing factors of thermal runaway are complicated and comprehensive, and it can not only be triggered from inside the power battery, but also from the external

force. We aim to make more accurate predictions as much as possible; thus, we construct a combined machine learning algorithm that is highly accurate and flexible to predict the probability of lithium battery thermal runaway that happens in real life. By considering voltage and temperature, abnormal current, single battery consistency, and overcharge risk factor separately, we build a stacked model consisting of five sub-models linked with grid- search chosen hyper-parameters. We get a relatively high accuracy rate.

This paper introduces a model-based method to estimate the real-time State of Health (SoH) of the lithium battery of NEV (New Energy Vehicle) with machine learning algorithms upon the traditional ampere-hour integral method. The traditional methods for estimating the SoH (State of Health) of the lithium battery are ampere-hour integral, IC-curve, Big data, and Kalman filtering, but the problem of those methods is that it can only estimate the SoH in the past based on the historical battery data rather than the current SoH or the future life cycle. By combining machine learning algorithms and the ampere-hour method, we develop a way to estimate the real-time SoH, enabling the car manufacturer to better understand the current state of the lithium battery of NEV. Upon that, we also develop an algorithm to predict the future decay curve of SoH by using a deep neural network, the long short-term memory network, making the life cycle of the lithium battery more predictable. By performing on the dataset based on actual real-time monitoring data provided by one OEM, our method hits 0.009 absolute mean error of real-time SoH prediction, and 0.021 for future decay curve prediction from the real NEVs test.

Session 4B: Smart Materials and Devices

Time: 20:00-24:00, October 24th, U.S. Eastern Standard Time
Meeting Room (Microsoft Teams): [4B]IEEE UV2020 Session
Chair(s): Weihua Mu, Yuan Cheng, Tian Wang

Meet Our Speakers

[4B-1] Artificial Intelligence with Materials Science

Speakers: Tian Wang

Time: 8:00 pm-8:50 pm, October 24th, U.S. Eastern Standard Time

Abstract: Thermoelectric (TE) materials provide a solid-state solution in waste heat recovery and refrigeration. A fundamental understanding of the interaction processes between the various energy carriers, such as electrons and phonons, is critical for advances in the development of TE materials. However, this understanding remains challenging primarily due to the inaccessibility of time scales using standard atomistic simulations. Artificial Intelligence (AI) methods are well known for their data-analysis capability. This brief introduction will give an overview of the AI methods used in thermoelectric studies. Furthermore, the scale of thermoelectric-related databases is much smaller than those in other traditional AI fields. To overcome this limitation, possible strategies to utilize small databases in promoting materials science are also discussed.

[4B-2] Chalcogenide Glasses for Two-dimensional Materials Photonic Integration

Speakers: Hongtao Lin

Time: 8: 50 pm-9:40 pm, October 24th, U.S. Eastern Standard Time

Abstract: Chalcogenide glasses (ChG) are amorphous compounds contain Sulfur, Selenium, and Tellurium. Given their superior optical properties and fabrication flexibility, they have been recognized as emerging integrated photonic material platforms for all optical signal processing, mid-infrared chemical sensing, etc. Here, through utilize their amorphous nature and low temperature deposition capability, we developed a new integration strategy to directly deposited and fabricated chalcogenide glass photonics device on graphene. By using this new process, we demonstrate several photonic devices with record performance, include: 1) an on-chip polarizer with a record bandwidth spanning half octave; 2) an on-chip thermo-optic switch with the highest energy efficiency of 10 nm/mW; 3) a broadband mid-IR waveguide-integrated detector with a high responsivity of 250 mA/W and the first waveguide-integrated graphene detector on a flexible substrate; and 4) the first mid-IR waveguide-integrated graphene modulator. Last but not least, we have also demonstrated monolithic integration of chalcogenide photonic components on several other 2-D materials including black phosphorus, MoS2, InSe, etc. The glass-on-2-D-material approach therefore provides a facile universal route for photonic integration based on 2-D materials.

[4B-3] Flexible and Stretchable Photonics Based on Inorganic Materials

Speakers: Lan Li

Time: 9:40 pm-10:30 pm, October 24th, U.S. Eastern Standard Time

Abstract: Integrated photonics open up emerging applications ranging from flexible optical interconnects, broadband photonic tuning to conformal or implantable sensing on biological tissues. In this talk, we present recent

development on integrated photonics based on amorphous glass materials, which possess exceptional properties including low optical loss, wide accessible range of refractive indices, low deposition temperature, enabling extreme processing versatility as they can be monolithically deposited and patterned on virtually any substrate. However, glasses are usually considered to be brittle and fragile and cannot sustain large deformation. Here we will challenge this conventional thought and use novel mechanical design including multi-neutral axis nanomechanical design and Euler-spiral waveguide design to achieve passive photonic devices that can be repeatably bent down to sub-millimeter radius or stretched with > 40% tensile strain without measurable optical performance degradation. We further demonstrated hybrid integration of active optoelectronic components onto the flexible photonic platform, which potentially enables complete system-on-a-flexible-chip solutions for a wide cross-section of applications.

[4B-4] Accelerated Discovery of Functional and Thermoelectric Materials using Machine Learning Combined with High Throughput Screening
Speakers: Singh
Time: 10:45 pm-11:15 pm, October 24th, U.S. Eastern Standard Time
Abstract: Data driven machine learning methods are emerging as one of the promising tools for predicting the properties of large class of materials and discovering new desired materials for different applications. In this talk, the power of these methods will be illustrated via three examples. The first example is focused on the metal to semiconductor classification and accurate band gap prediction of materials1. This model was developed for 2D family of materials - MXene, which is very promising class for optical, electronic, energy storage and photocatalytic applications. By using very simple set of elemental features, the metal-semiconductor classification model is developed with 99% of accuracy. The regression model for the band gap with GW level accuracy is built, which predicts the band gaps with very low root mean squared error (rmse) of 0.14 eV. As MXene is promising for a wide range of electronic to energy applications, which rely on the accurate position of band edges. A model is multivariate machine learning model for positioning of the band edges2 with GW level accuracy has been developed with rmse of 0.12 eV. Based feature importance, few intuitive guidelines/models have been proposed for high throughput screen of MXene. The third example is about coupling the high-throughput and machine learning methods for the lattice thermal conductivity prediction. Owing to the computational complexity involved in the calculation of lattice thermal conductivity, screening the materials having desired thermal conductivity is challenging. By employing the high-throughput approach, several ultra-low and ultra-high lattice thermal conductivity compounds are predicted3. The property map is generated from the high-throughput approach and four simple features directly related to the physics of lattice thermal conductivity are proposed. The designed model with these features gives a small rmse of 0.21 for the log-scaled lattice thermal conductivity. The performance of the model is far superior than the physics-based Slack model, highlighting the simplicity and power of the proposed machine learning models.

1) A. C. Rajan, A. Mishra, S. Satsangi, R. Vaish, H. Mizuseki, K. R. Lee, A. K. Singh, Chem. Mater. 2018, 30, 4031.
2) A. Mishra, S. Satsangi, A. C. Rajan, H. Mizuseki, K. R. Lee, A. K. Singh, J. Phys. Chem. Lett. 2019, 10, 780.
3) R. Juneja, G. Yumnam, S. Satsangi, A. K. Singh, Chem. Mater. 2019, 31, 5145.

[4B-5] Machine Learning Predictions on Melting Temperatures of High-Entropy Alloys

Speakers: Shuai Chen

Time: 11:15 pm-11:45 pm, October 24th, U.S. Eastern Standard Time

Abstract: High-entropy alloys (HEAs) are composed of five or more principle elements in equal or nearly equal molar concentrations. Their huge compositional space provides a great opportunity to discover HEAs with desired properties, among which the melting temperature plays an important role in additive manufacturing (AM). In this work, we employ machine learning (ML) approach to predict the melting temperatures of AlxCoyCrzCuuFevNiw HEAs. First, a dataset with both experimental and simulation records on the melting temperatures is established. Then, diverse ML models are trained by using the dataset, and decision tree regression (DTR) algorithm performs best. A large search space of HEAs with diverse concentrations of each constituent is further constructed, and their melting temperatures are also predicted by the DTR trained model. Last, we perform molecular dynamics simulations combined with Monte Carlo method to validate our ML predictions and provide physical insights of the discovery. Our work demonstrates a powerful route to discover HEAs with desired melting temperatures for AM applications.

[4B-6] B-factor and Light-induced Allostery in NMDA Receptors

Speakers: Weihua Mu

Abstract: Light-sensitive protein with the light-induced allostery has great applications in bio-medical researches, which can be obtained by introducing the mutation at certain site in the protein. In the present work, we investigate the experimental data on NMDA receptors with light-sensitive mutations, and propose empirical formulas to connect the structural factors to the observable electric current change, which is the signature of the light-induced allosteric effect. We found our formulas present good agreement with experimental data using the full-length structure of NMDA receptor 4tll. It can be used to predict the light-sensitive phenomena of this protein with other types of mutation. Present method can be directly extended to other proteins beyond the current 4tll.

[4B-7] Thermoelectric Materials Performance Prediction Based on Machine Learning

Speakers: Jiahui Chen, Lin Tian
Abstract: Thermoelectric materials provide solid-state solutions for waste heat recovery and refrigeration. Due to the wide variety of atomic composition and complex structure of thermoelectric materials, traditional methods are difficult to discovery and represent all the experiment performance. Using machine-learning methods to analyze and predict the performance of thermoelectric materials can reduce costs as much as possible. This paper investigates the thermoelectric properties of thermoelectric materials using first-principles computational data and machine learning algorithms. This work selected the Seebeck coefficient of thermoelectric materials and developed the DNN model to predict the Seebeck coefficient of the materials in real time, which allows researchers to analyze and predict the thermoelectric properties of unknown materials.

[4B-8] Preprocessing of industrial instrument Recognition——Model Matching Search and Image Correction
Speakers: Rui Zhang, Mengqiao Wang, Hongyan Cui, Yuanchang Fu
Abstract: In the process of intelligent recognition of industrial instruments, the target recognition area in the image remotely transmitted from the camera equipment must first be located. At present, in the field of image intelligent recognition classification, deep learning and neural networks have made relatively big breakthroughs, and various industries have achieved effective corresponding applications. However, in the actual application scenarios of industrial instruments, there are many types of instrument subdivisions. The instrument meters of the same functional type have various appearances due to different manufacturers, and the difference of the instrument range will also cause the shape design of the same type of instrument. The difference. Therefore, it is difficult to find and locate the instrument through the deep learning neural network, and it does not have the cost-effectiveness of engineering realization, because a large number of instrument classification training samples are required, and every new instrument style produced cannot be applied to the previous one. Model and instrument image correction cannot be achieved by this method. Through the research of various algorithms of computer vision and continuous experimentation, an effective solution to this problem has been obtained: using the MatchTemplate algorithm combined with the calibration information of the template image (stored locally in the JSON format) to search and match the instrument dial and Corrected realization.

[4B-9] Recognition and Pointer Positioning Algorithm for Pointer Instruments
Speakers: Rui Zhang, Mengqiao Wang, Hongyan Cui, Yuanchang Fu
Abstract: Pointer instruments are widely used in industry, such as barometers, thermometers, water pressure gauges, current voltmeters, etc., all have pointer types. The positioning of the pointer is the most critical and difficult step in the recognition process of pointer meters. In the actual application scenario of pointer

meter recognition, when the pointer in the meter is detected by the Hough detection method, the effect is very susceptible to various factors. For example, there are many scale lines in the instrument panel. If the scale line is long, it will easily interfere with the judgment of the pointer's straight line, causing misjudgment of the pointer; if the pointer passes the scale, the overlap of the number and the pointer will affect the pointer Line identification; sometimes the labels on the dashboard will cover part of the pointer, which will also seriously affect the use of Hough transform to detect pointers. In these cases, the detected straight line of the pointer is disconnected, which makes it impossible to determine which is the real straight line of the pointer. Considering the actual situation of the dashboard display and combining the common characteristics of pointer instruments, we have studied a pointer determination algorithm based on disk scanning. This article will introduce the specific process and implementation principle of this algorithm in detail.

[4B-10] Graphene-based Photothermal Antibacterial Composite Films
Speakers: Chunbao Du
Abstract: There are certain limitations for the universal fluids and nanofluids sterilization methods such as drug resistance, restricted range of applications and hardest-to-recycle drawback. Photo-thermal sterilization is a very promising antibacterial strategy owing to its simple operation, easy recycle and non-tolerance, especially for the ongoing pandemic fighting against COVID-19. Graphene-based composite films with photothermal antibacterial function are in high demand in flexible antibacterial gauze due to their superior photoelectric and mechanical properties. However, a major bottleneck of using graphene-based composite films for medical gauze lies in their biocompatibility and flexibility. In this paper, we have prepared the nacre-mimetic composite films via a facile layer-by-layer self-assembly technology of graphene oxide (GO) with biocompatible bovine serum albumin (BSA) and hemoglobin from bovine-blood (HB), respectively. The indentation hardness and equivalent elastic modulus could be improved by 50.0%, 68.6% for GO-BSA nacre-mimetic composite film and 100%, 87.5% for GO-HB nacre-mimetic composite film by comparing GO film without any additive. Moreover, both the nacre-mimetic composite films showed excellent photothermal antibacterial performance against Gram-negative ampicillin-resistant Escherichia coli and Gram-positive methicillin-resistant Staphylococcus aureus. This work is expected to be a facile and effective strategy to fabricate the compatible and flexible composites for universal medical supplies.

[4B-11] Extraction and Test Analysis of Extracellular Polymer of Thiobacillus Thermosulfuroxidans
Speakers: Wenhe Zhan
Abstract: At present, research on the induced expression of EPS in thermophilic sulfur-oxidizing sulfur bacteria under different energy substrate conditions and the adaptability of microorganisms to minerals mainly focused on meso-temperature leaching bacteria, especially A. ferrooxidans bacteria. Research on

thermosulfidooxidans bacteria is still lacking. Extracting cephalosporins from microorganisms is a difficult task. There are many methods based on physical or chemical principles or a combination of multiple methods. Extraction methods including ion exchange resin, crown ether solution, heating, and ultrasound. The extraction methods used by different organisms are also different. To study the difference in surface protein expression and property changes of different substrates of Thiobacillus thermosulfuroxidans, and the effects of different environmental factors on the surface physicochemical properties of Gram-positive bacteria, EPS components and induced impact during the oxidation of sulfur-containing energy substrates will help eliminate the adaptation mechanism of the bacteria to sulfur-containing energy substrates.

Session 5A: Smart Manufacturing

Time: 8:00am-10:00am, October 27th, U.S. Eastern Standard Time
Meeting Room (Microsoft Teams): [5A]IEEE UV2020 Session
Chair(s): Yuanjun Laili, Satarupa Mukherjee
Assistant: Yiyao Wang

[5A-1] Prefabricated B-CORETM Structural Material Applications for Healthcare Facilities
Speaker(s): Jeremy S Zimman
Time: 8:00-8:30, October 27th, U.S. Eastern Standard Time
Abstract: We will introduce B-CORETM, a sustainable, prefabricated, hardened stainless steel structural material that helps to cut global emissions caused by traditional construction materials of concrete and carbon steel, provide increased energy efficiency, and enable a faster construction time for a typical commercial or residential building by a factor of 10. Special emphasis will be given to the construction of Negative Pressure Isolation (NPI) facilities and other emergency care centers with a solution that can be delivered at low cost and fast installation.

[5A-2]Robotic Disassembly Planning & its Demonstration Facilities
Speaker(s): Jiayi Liu
Time: 8:30-8:50, October 27th, U.S. Eastern Standard Time
Abstract: The traditional disassembly process is always finished by manual labor while robotic disassembly could cover the shortcomings. In addition, robotic disassembly planning helps to improve the disassembly efficiency under robotic disassembly mode. In this presentation, robotic disassembly sequence planning and robotic disassembly line balancing problem are studied. Based on the physical industrial robots, in the demonstration, robotic disassembly planning methods are encapsulated into services and the optimal solutions could be sent to the physical facilities in the form of disassembly commands. Afterwards, the physical industrial robots could execute the practical disassembly process according to the disassembly commands.

[5A-3]Collaborative Reasoning of Design Knowledge with a Hypernetwork Model
Speaker(s): Gongzhuang Peng
Time: 8:50-9:10, October 27th, U.S. Eastern Standard Time
Abstract: Modern product development entails creation and sharing of design knowledge in a collaborative and integrated working environment. In this context, the multifaceted feature of design knowledge become a central issue to address for such a collaborative knowledge sharing scheme. We proposed a knowledge representation method based on hypernetwork to explicitly capture the relationships between various elements in a multifaceted knowledge structure, which specifically consists of a designer network, a product network, an issue network and a knowledge unit network. The relationships between various nodes from different networks are identified and defined according to the node properties. Topological characteristics of the hypernetwork structure are analysed and statistical indicators are defined. On this basis, the Bayesian approach is adopted to conduct the collaborative reasoning process whereby knowledge elements relevant to the current design task are recommended according to the issues to be resolved and the current design context.

[5A-4]Smart Remanufacturing
Speaker(s): Jun Huang
Time: 9:10-9:30, October 27th, U.S. Eastern Standard Time
Abstract: Remanufacturing is a key component of Circular Economy with resource savings, environmental benefits and economic benefits. This presentation introduced operations in remanufacturing life cycle and potential Industry 4.0 technologies to make remanufacturing smart. The authors' team at the University of Birmingham carried out an EPSRC-funded project titled "Robotic disassembly technology as a key enabler of autonomous remanufacturing". Some of the achieved results were presented, which included robotic disassembly strategies and technologies. Finally, two case studies were conducted to demonstrate human-robot collaborative disassembly of a water pump and a turbocharger.

[5A-5]Parallel Computing Scheduler for Co-Simulation
Speaker(s): Xuesong Zhang
Time: 9:30-9:50, October 27th, U.S. Eastern Standard Time
Abstract: With the development of co-simulation technology, there come up many co-simulation platforms, some of which use parallel method to improve the simulation efficiency, i.e., each sub model is computed on one node or thread. However, due to the different execution characteristics of sub models, their execution times usually differs from each other during superdense time step, and the final execution time depends on the longest sub model time, resulting in load imbalance. In this speech, we will share the idea of a parallel co-simulation method with respect to computing resource scheduling. By integration of both the of CPU, GPU scheduling information and the simulation language compiling technique, we try to construct a co-simulation platform with the ability of dynamic adaption for a better computing resource utilization.

Session 5B: Smart Agriculture

Time: 8:00am-12:00pm, October 25th, U.S. Eastern Standard Time
Meeting Room (Microsoft Teams): [5B]IEEE UV2020 Session
Chair(s): Yanling Li, Yong Xu, Liqing Li
Assistant: Hao Yuan

Meet Our Speakers

[5B-1]The Algorithmic Governance in the Communication of Agricultural natural disasters

Speaker(s): Yafeng Wen

Time: 8:00-8:20, October 25th, U.S. Eastern Standard Time

Abstract: This speech mainly expounds the algorithm governance in the communication of agricultural natural disasters, which is divided into three main parts. First, it reviews the literature and defines the two controversial concepts of algorithm and algorithm governance in the academic researches. Secondly, the potential problems and factors of algorithm application in agricultural natural disaster transmission are explained. Finally, an analytical framework and path of algorithm governance in agricultural natural disaster transmission is proposed.

[5B-2]Rural Smart Elderly Care Model: China's Development and Challenges

Speaker(s): Yangming Hu

Time: 8:40-9:20, October 25th, U.S. Eastern Standard Time

Abstract: Under the background of moderate aging population and rapid development of intelligent technology, smart elderly care has become one of the effective solutions to the problem of home-based care in rural China. The smart elderly care in China's rural areas is still in the exploration stage, and academic research divides the smart elderly care into smart home-based elderly care service, smart medical elderly care service and smart institutional elderly care service. The government, enterprises and social organizations play different roles in providing smart elderly care services, and there are mainly three supply modes. The smart endowment model still faces many challenges in China's rural practice in the future. For example, challenges in the whole process of digital management, big data sharing and integration technology, as well as challenges in the ethical aspects of the elderly's adaptation to smart elderly care model, optimization of smart elderly care equipment, and diversified demands for smart elderly care of the aged. In order to meet the challenges in the future, this paper puts forward countermeasures and suggestions from the following five aspects: promoting the effective integration of digital technology and elderly care system, establishing a standardized system for smart elderly care, enhancing the acceptance of intelligent elderly care model for the aged, promoting the diversification of products and services for smart elderly care, and delaminating to meet the needs of diversified elderly care services for the aged. In order to promote the steady development of intelligent elderly care service in China's rural areas.

Session 6: Ecological and Environmental Systems, Material Cycles

Time: 10:00am-12:00pm, October 27th, U.S. Eastern Standard Time
Meeting Room (Microsoft Teams): [6]IEEE UV2020 Session
Chair(s): Gene Fry
Assistant: Hao Yuan

Meet Our Speakers

Session 6 and Session 11B will be held together, Session 6 starts first.

[6-1] Discovery: Reduction in Photosynthesis Correlation to Carbon Dioxide Increase

Speaker(s): Dave White
Time: 10:00-10:40, October 27th, U.S. Eastern Standard Time
Abstract: Carbon dioxide emissions correlate to 363 ppm and are not the cause of the Atmospheric CO2 rise since 1957. The correct cause is eforestation of the Amazon Rain-Forest (0.99 by Pearson's regression). Since 1950, the Amazon Rain forest has been deforested. An average of 12 million hectare per year. This deforestation causes a minimum of 30% of the biomass burned. The burning of the biomass is adding billion of tons of carbon dioxide to the atmosphere. The carbon dioxide has overwhelmed the rain forest and caused massive decay. The rain forest has now become and oxygen sink and carbon dioxide producer. Now emitting 10 billion tons of CO2 annually. Also losing its ability to produce oxygen. To solve these issues the deforestation and burning needs to stop. Then after 10 years, the burning can continue 10% a year for 10 years. This will heal the amazon and bring down atmospheric carbon dioxide quickly by increasing photosynthesis consumption to 100 billion tons annually. Stop non-sustainable deforestation like the Indian and Amazon rain forests. Please native trees and shrubs all over the world. The residence time of atmospheric CO 2 is 150 years. This is why there exists no signature to any recession or other lowering of CO2 emissions.

[6-2] Albedo Changes Drive 4.9 to 9.4°C Global Warming by 2400

Speaker(s): Gene Fry
Time: 10:40-11:20, October 27th, U.S. Eastern Standard Time
Abstract: This study ties increasing climate feedbacks to projected warming consistent with temperatures when Earth last had this much CO2 in the air. The relationship between CO2 and temperature in a Vostok ice core is used to extrapolate temperature effects of today's CO2 levels. The results suggest long-run equilibrium global surface temperatures (GSTs) 5.1°C warmer than immediately "pre-industrial" (1880). The relationship derived holds well for warmer conditions 4 and 14 million years ago (Mya). Adding CH4 data from Vostok yields 8.5°C warming due to today's CO2 and CH4 levels. Long-run climate sensitivity to doubled CO2, given Earth's current ice state, is estimated to be 8.2°C: 1.8° directly from CO2 and 6.4° from albedo effects.

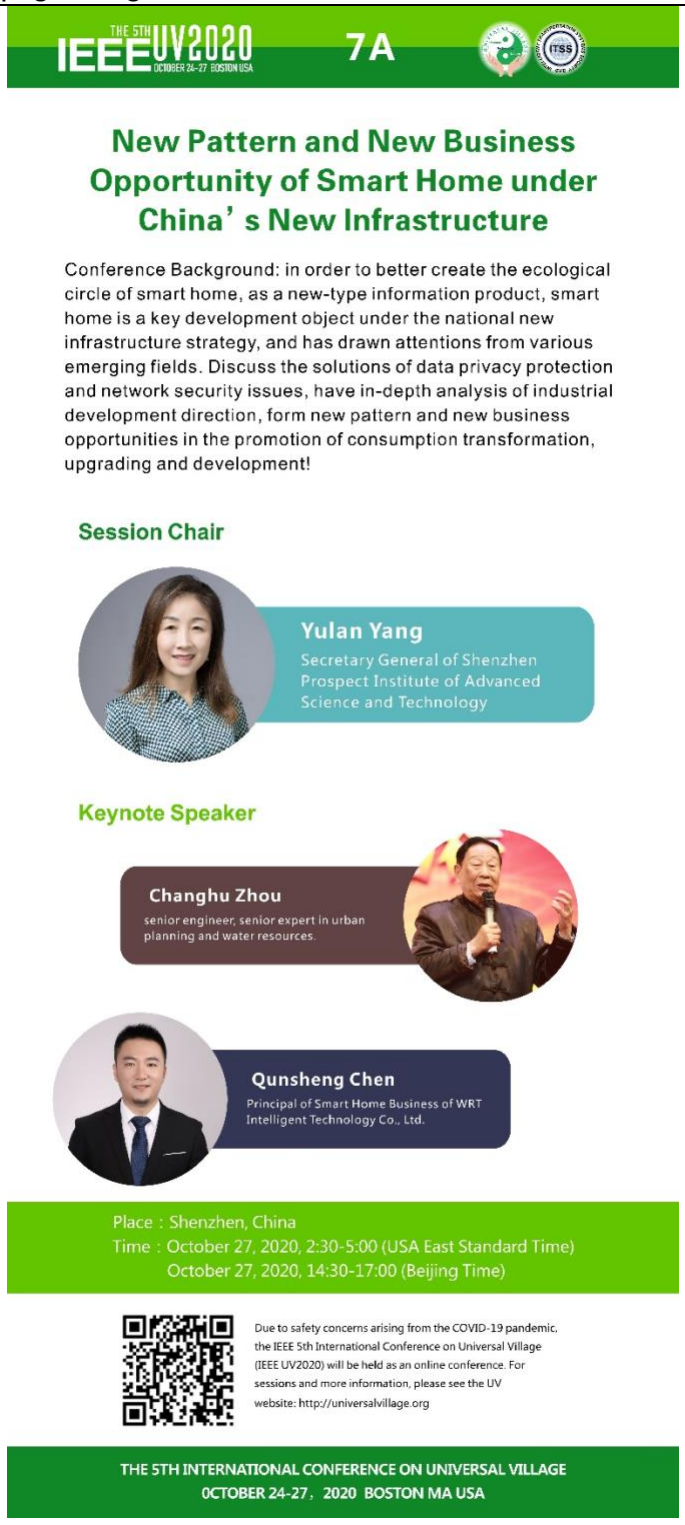
Based on the Vostok equation using CO2 only, holding ΔGST to 2°C requires 318 ppm CO2. This means Earth's remaining carbon budget for +2°C is estimated to be negative 313 billion tonnes. Meeting this target will require very large-scale CO2 removal. Lagged warming of 4.0°C (or 7.4°C when CH4 is included), starting from today's 1.1°C ΔGST, comes mostly from albedo changes. Their effects are estimated here for ice, snow, sulfates, and cloud cover. This study estimates magnitudes for sulfates and for future snow changes. Magnitudes for ice, cloud

cover, and past snow changes are drawn from the literature. Albedo changes, plus their water vapor multiplier, caused an estimated 39% of observed GST warming over 1975-2016. Estimated warming effects on GST by water vapor; ocean heat; and net natural carbon emissions (from permafrost, etc.), all drawn from the literature, are included in projections alongside ice, snow, sulfates, and clouds. Six scenarios embody these effects. Projected ΔGSTs on land by 2400 range from 2.4 to 9.4°C. Phasing out fossil fuels by 2050 yields 7.1°C. Ending fossil fuel use immediately yields 4.9°C, similar to the 5.1°C inferred from paleoclimate studies for current CO2 levels. Phase-out by 2050 coupled with removing 71% of CO2 emitted to date yields 2.4°C. At the other extreme, postponing peak fossil fuel use to 2035 yields +9.4°C GST, with more warming after 2400.

Session 11B Continues.

Session 7A: Smart Homes

Time: 2:30am-5:00am, October 27th, U.S. Eastern Standard Time
Meeting Room (Microsoft Teams): [7A,Shenzhen] IEEE UV2020 Session
Chair(s): Yulan Yang
Assistant: Yangqing Wang



[7A-1]Future of Smart Communities under Chinese New Infrastructure

Speaker: Chen Qunsheng
Time: 2:30-4:30, October 27, 2020 (EDT)
Abstract: With the rapid development of the IoT technology and a boost of the new infrastructure, intelligent household products do embrace upgrade of modalities and business modes, creating more possibilities for us, so in the intelligent process of the human living environment, it is necessary to pay more attention to human-space environment interaction in the next ten or twenty years, wherein intelligent communities will make full use of integrated applications covering a new generation of information technology, such as IoT, cloud computing, mobile internet and AI, in order to provide a modern intelligent living environment highlighting safety, comfort and convenience for community residents, in this way such communities in a new management mode will be shaped on the basis of information, intelligent social management and services. As for these intelligent communities, the applications can be roughly divided into 4 categories: smart home, smart lock, smart one-stop face scanning function and intelligent building talk-back. In an intelligent community, its intelligent building design covers the perception layer (collecting sensory data + receiving cloud instructions for executing certain actions), the network transport layer (accurately transmitting signals in the cabled and wireless modes), the cloud processing layer (divided into basic data platform and business computing platform, and the layer docks various data sources downward and provides services for all kinds of application scenarios upward) as analyzed from the aspect of technical architecture. In general, we believe that intelligent communities not only satisfy all expectations about the future life, but also bring about more intelligent, more human-friendly, simpler and more options.

[7A-2] In-Depth Integration of Smart Home and AI

Speaker: Zhou Changhu
Time: 4:30-5:30, October 27, 2020 (EDT)
Abstract: We are being pushed toward a new era of intelligent interconnection now. And our sound user experience of a product no matter whether it is smart home or any other IoT device must go hand in hand with artificial intelligence, for example AI voice technology, image recognition and so on are all very important. In recent years, the AI researchers have been looking for another interactive product in the field of smart home similar to phones, wherein such interactive product shall have certain values beyond its inherent value for the internet enterprises to become the carriers of value. In this way, the whole smart home industry supported by AI will slowly grow into a platform-like medium based on its original control attributes to integrate users' consumption services to a greater extent. Therefore, AI will provide better frameworks of products and services for consumers from the aspect of technology.

Session 7B: Mobility, Connectivity, and Innovative Lifestyles

Time: 2:30am-6:30am, October 25th, U.S. Eastern Standard Time
Meeting Room (Microsoft Teams): [7B,Xi'an]IEEE UV2020 Session
Chair(s): Yue Wang

[Overview]

The shape of materials is an ancient and cutting-edge challenge in materials science. In the field of bio-materials and bio-mechanics, how to understand the physical mechanism behind the biconcave shape of red blood cells with the physiological activity has been successfully resolved. The key breakthrough is the establishment of the liquid crystal theory of membranes, that is, the lipid bilayer membrane is regarded as a liquid crystal phase, and the energy of the biological membrane is expressed by the curvature of the membrane. Subsequently, Helfrich introduced a key term - the spontaneous curvature term in the energy functional of a biological membrane, to reflect the asymmetry of the environment inside and outside the membrane. Based on this idea, Ou-Yang and Helfrich obtained the universal equation of equilibrium shape of a biological memebrane, i.e., Ou-Yang-Helfrich equation, which became a milestone achievement in the theoretical research of bio-membrane. In the present talk, we will review the history of biological membrane research and the Ou-Yang-Helfrich equation, and then focus on our new innovative applications in this area. It is particularly noteworthy that we have applied the liquid crystal theory of the membrane to the study of two-dimensional nano-materials, and obtained some beautiful analytical results which are difficult to obtain by usual molecular simulation methods, such as the quantitative relationship axial torsion induced by the stretching/compression in a chiral single-walled carbon nanotube. We will also present some new applications of Ou-Yang-Helfrich equation in virology research.

[Session Chair]

Yue Wang, Director of Smiley House Program (SHP)

[Keynote Speakers]

Yueyan LI, Vice Dean at School of Architecture, Xi'an University of Architecture and Technology

Gang MAO, Vice Dean of Planning and Architecture, Southwest Minzu University

Yixiong Li, President of Bostong Intelligent Medical Group. Director of Nanshan Health Care Institute.

Bing Zhu, Ph.D. in Architecture from Harvard, founder, partner and design director of Urban Creative Planning and Design (Beijing)

Ji Li, President of TsingDa Cultural Industry Planning and Design Institute, Chairman of China Cultural Industry Park Alliance.

Wenchuan Cui, Writer and editor, Reading and Man Lifestyle

Session 8A: Advanced devices/systems for healthcare monitoring

Time: 20:30-23:00, October 26th, U.S. Eastern Standard Time
Meeting Room (Microsoft Teams): [8A] IEEE UV2020 Session
Chair(s): Lin Zhang
Assistant(s): Mingzhi Cai

[8A-1]Wearable Devices for Image-Guided Ultrasound Neuromodulation

Speaker(s): Soumyajit Mandal
Time: 20:40-21:10, October 26th, U.S. Eastern Standard Time
Abstract: Over the past decade, neuromodulation has established a wide range of applications as a therapeutic method that supplement its role in prosthetic devices (e.g., retinal and cochlear implants) and neuroscience research. Electrical neural stimulation (ENS) is the best-studied neuromodulation method and has been widely used in neuroprosthetics. ENS devices are surgically placed near their targets, which largely eliminates the need for real-time localization of the device, but have the disadvantage of being invasive. Key safety challenges in designing microelectrode arrays (MEAs) for ENS include i) biocompatibility of the electrode material and ii) minimizing the net creation of harmful electrochemical products. Other limitations of current techniques include poor spatial resolution, limited depth of penetration, power efficiency, size limitations, and/or the need for genetic modification. Among alternative modalities, acoustic neuromodulation is an emerging method that uses low intensity focused ultrasound (FUS) to stimulate or inhibit neural activity. This method has attracted attention due to its potential for non-invasive, portable, and low-cost therapy of a wide range of neurological disorders with high spatial resolution and penetration depth. Low-intensity FUS has already been used to modulate hippocampal slices in mice brains, the function of regional brain tissue in lagomorphs and rodents, high-level cognitive behavior in monkeys, and the sciatic nerves of bullfrogs. A potentially major application in humans is percutaneous tibial nerve stimulation (PTNS) for treating overactive bladder (OAB) syndrome, which occurs in 7-27% of men and 9-43% of women. At-home PTNS would greatly increase access to OAB treatment but is limited by the need for a clinician to administer the necessary percutaneous electrical stimulation. Thus, replacing the corresponding electrodes with FUS from an external array is of great interest. FUS is also promising as a non-invasive replacement for electrical vagus nerve (VN) modulation, which is widely used to treat epilepsy, cardiovascular disease, and psychiatric conditions, while eliminating the risks of implanted electrodes such as voice alterations and dyspnea. Another promising application is treatment of neuropathic pain, which is a common condition with no effective treatments.
This talk will describe our recent progress on wearable devices for delivering image-guided ultrasound neuromodulation to peripheral nerves. Initial results from working prototypes will also be presented.

[8A-2]Piezoelectric Polymers for Energy Harvesting and Wearable Device Applications

Speaker(s): Kailiang Ren
Time: 21:10-21:40, October 26th, U.S. Eastern Standard Time
Abstract: Human machine interface (HMI) devices, which can convert human motions to electrical signals to control/charge electronic devices, have attracted tremendous attention from engineering and science fields. In this presentation, we combined the high output voltage from a nonpiezoelectric meso-poly(lactic acid)

electret-based triboelectric nanogenerator (E-TENG) and the relatively high current from a double-layered poly(L-lactic acid) (PLLA)-based piezoelectric nanogenerator (PENG) for an E-skin (electronic skin) (HMI) device application. The biodegradable hybrid nanogenerator (NG) can generate an output voltage of 70 V and a current of 25 μA. Moreover, the output power of the hybrid NG reached 0.31 mW, which was 11% higher than that from the PLLA-based PENG. Furthermore, we demonstrated that the PLA-based hybrid NG can be used to turn a light-emitting diode (LED) light on and off through an energy management circuit during a bending test. The advantages of biodegradability, ease of fabrication and relatively high output power in the hybrid NG device shows great promise for future E-skin applications.

[8A-3]Deep Learning in Raw Ultrasound Signals
Speaker(s): Viksit Kumar
Time: 21:40-22:10, October 26th, U.S. Eastern Standard Time
Abstract: Sparse arrays reduce the number of active channels that effectively increases the inter-element spacing. Large inter-element spacing results in grating lobe artifacts degrading the ultrasound image quality and reducing the contrast-to-noise ratio. A deep learning-based custom algorithm is proposed to estimate inactive channel data in periodic sparse arrays. The algorithm uses data from multiple active channels to estimate inactive channels. The estimated inactive channel data effectively reduces the inter-element spacing for beamforming, thus suppressing the grating lobes. Estimated inactive element channel data was combined with active element channel data resulting in a pseudo fully sampled array. The channel data was beamformed using a simple delay-and-sum method and compared with the sparse array and fully sampled array. The performance of the algorithm was validated using a wire target in a water tank, multi-purpose tissue-mimicking phantom, and in-vivo carotid data. Grating lobes suppression up to 15.25 dB was observed with an increase in contrast-to-noise (CNR) for the pseudo fully sampled array. Hypoechoic regions showed more improvement in CNR than hyperechoic regions. Root-mean-square error for unwrapped phase between fully sampled array and the pseudo fully sampled array was low, making the estimated data suitable for Doppler and elastography applications. Speckle pattern was also preserved; thus, the estimated data can also be used for quantitative ultrasound applications. The algorithm can improve the quality of sparse array images and has applications in small scale ultrasound devices and 2D arrays.

[8A-4]Stretchable TEGs and 3D Printing of Piezoelectric Devices for Healthcare
Speaker(s): Yang Yang
Time: 22:10-22:40, October 26th, U.S. Eastern Standard Time
Abstract: Additive manufacturing (AM) processes (3D printing technology) open an effective pathway in geometrical flexibility for fabricating complex piezoelectric

ceramics. We demonstrated that a piezoelectric-composite slurry with BaTiO3 nanoparticle can be 3D printed using Mask-Image-Projection-based Stereolithography (MIP-SL) technology. Besides, an annular piezoelectric array consisting of different concentric elements printed by MIP-SL technology. The printed array displays stable piezoelectric and dielectric properties. Compared to a traditional single element transducer, the ultrasonic transducer with printed array successfully modifies the acoustic beam and significantly improves spatial resolution. Thermoelectric generators (TEGs) provide a unique solution for energy harvesting from waste heat. However, traditional rigid and flexible TEGs cannot work on complex and dynamic surfaces. Here, we report a stretchable TEG (S-TEG) (over 50% stretchability) and the energy harvesting of S-TEG from the dynamic surfaces of the human skin offers a potential energy solution for the wearable devices for health monitoring.

[8A-5]Design of an Adaptive ECG Signal Processing System Based on Compressed Sensing

Speaker(s): Yaguang Yang

Time: 22:40-23:00, October 26th, U.S. Eastern Standard Time

Abstract: With the rapid development of modern mobile communication technologies, the wireless body sensor network (WBSN) becomes more and more important in medical treatment, especially for non-hospital patients. In general, the data amount transmitted in the WBSN system is large. Hence, developing low-complexity signal processing methods is important. In this paper, we investigate the electrocardiogram (ECG) signal processing based on the compressed sensing (CS) technique. The performances of four typical recovery algorithms in CS, namely, basis pursuit algorithm, orthogonal matching pursuit algorithm, compressive sampling MP algorithm, and block sparse Bayesian learning algorithm, are evaluated by simulation. Based on the evaluation results, we design an adaptive CS-based ECG signal processing system, which can achieve satisfactory performances while adaptively adjusting the data amount transited according to the channel state.

Session 8B: Smart Medicine and Smart Healthcare

Time: 5:00pm-9pm, October 25th, U.S. Eastern Standard Time
Meeting Room (Microsoft Teams): [8B]IEEE UV2020 Session
Chair(s): Stanley Tao
Assistant: Hao Yuan

[8B-1]Structure-function Analysis of Spike Proteins to Reveal Origin of High Contagiousness of SARS-CoV2

Speaker: Shixin Ye-lehmann

Time: 5:10pm - 5:55pm,October 25th, U.S. Eastern Standard Time

Abstract: The classical view of signaling transduction mediated by cells in our body is the process by which a chemical or physical signal is transmitted through a cell as a series of molecular events that ultimately results in a cellular response. Proteins responsible for detecting stimuli are generally termed receptors. The changes elicited by ligand binding (or signal sensing) in a receptor give rise to a biochemical cascade, a chain of biochemical events as a signaling pathway, which leads to a final response. Due to the recent development in structural and cellular biology, we now see that the cellular landscape has enormous complexity composed of small molecules, proteins and nucleic acids. So what determines the specificity of the signal transduction? We have been working on using the genetic code expansion (GCE) technology, a biotechnology tool enabling the modification of proteins with non-cannoical amino acids. In this talk, I will summarize the engineering of light-sensitive receptors using the GCE technology, as well as the technological development of the new concept of “optoproteomics” that, in contrast to “optogenetics”, aims to combine optical methods and site-specific proteomics for investigating and intervening signaling transduction processes. Our development provide novel tools to reveal structural and functional specifies of signaling processes, which have broad implications in drug discovery.

[8B-2] Development of new therapeutics for antimicrobial resistance for better public health

Speaker: Rajkumar Halder

Time: 5:55pm - 6:40pm,October 25th, U.S. Eastern Standard Time

Abstract: The greatest challenge facing our global future today is ‘Health’. To have a better living standard, a growing world population will need easily available and cheaper medicament, especially in infectious diseases caused by microbials. To combat this impending situation of antimicrobial resistance, discovering of novel molecules with unmet physiochemical properties are needed especially in the area infectious diseases. Novel bioactive molecules can be developed by combining basic research with applied science keeping in mind that chemistry is central to everything. This talk will place the scale of the global medical issue in perspective and then discuss some of the issues related to basic science that is needed to emulate antibotics discovery. With this basic science in place, the design and synthesis of desired compounds and their application to cure diseases through controlling the cell fate in vitro and in vivo will be presented.

[8B-3]Conversation Analysis of Robot-Assisted Recreation for Older Adults with Dementia

Speaker: Tomoko Nariai, Shiroh Itai, Hiroaki Kojima

Time: 6:40pm - 7:10pm, October 25th, U.S. Eastern Standard Time

Abstract: Social commitment robots have been used in aged care facilities for a

group activity to enhance the social wellness of older adults with dementia, which is called robot therapy. This preliminary study examined the effects of the scenario-type recreation program, (RAR) by analyzing their conversations. The RAR program is designed for enabling continuous enjoyment of participants and for considering cognitive conditions with dementia. The effectiveness of the design concept and the aim of activating communication between the participants are verified by the four times experiment of RAR activities in a residential care facility. The utterances recorded during the recreation and also in before and after recreation interviews are analyzed with the content of transcripts and also with the number of utterances, duration of answers, and fundamental frequencies of speech data. The results indicated improvements of participants QQL with the aspect of proactiveness of attending recreation programs, a positive mind for the future, and interest in interacting with others.

[8B-4]Based on Machine Learning Algorithm：Construction of An Early Prediction Model of Integrated Traditional Chinese and Western Medicine for Cognitive Impairment after Ischemic Stroke

Speaker: Chengxia Wei, Lizhen Guo, Gendi Lu, Xinhao Chen, Chengyuan Liu

Time: 7:10pm - 7:40pm, October 25th, U.S. Eastern Standard Time

Abstract: Purpose: Based on the risk factors of post stroke cognitive impairment (PSCI), combining the Constitution and Syndrome of Traditional Chinese Medicine, using a variety of Machine learning (ML) algorithms, to construct a prediction model with high accuracy and good fitting degree, so as to provide theoretical and data support for early screening and early prevention of ischemic stroke (IS) patients. Patients and methods: A retrospective analysis was conducted on 85 patients with acute ischemic stroke admitted to the Department of Neurology of a third grade a hospital of integrated Traditional Chinese and Western Medicine (TCM-WM) from June 2019 to January 2020. The patients were divided into three groups: Support Vector Machine (SVM), Random Forest (RF), Gradient Boosting Decision Tree (GBDT), ML algorithms were used to construct the risk prediction model of post-stroke cognitive impairment, and the prediction accuracy and area under curve (AUC) of receiver operating characteristic curve (ROC) were used to evaluate the prediction effect of the three models. Results: The average prediction accuracy of GBDT was 80.77%, the highest and the most stable. The average AUC area of GBDT was 0.85, which was larger than that of the other three ML algorithms, and the prediction effect was better. After analyzing the importance of the features obtained from the training of GBDT model, it is concluded that the features with the highest degree of discrimination for PSCI in this data set are as follows: Barthel index, Age, fasting blood glucose (FPG), blood homocysteine (Hcy). Based on GBDT algorithm, four GBDT models were obtained by training 75%, 80%, 85% and 90% training sets respectively. It was found that the prediction accuracy of the models with 85% and 90% training sets could reach 84.62% and 88.89%, indicating the potential of applying machine learning algorithm to the prediction of cognitive impairment after ischemic stroke. Conclusion: The ML

algorithm is used to construct the early prediction model of TCM-WM integration for cognitive impairment after ischemic stroke, and analyze the influencing factors with strong correlation with PSCI, so as to carry out early detection, early diagnosis and early treatment of PSCI, so as to provide basis and reference for researchers who construct a large sample prediction model of cognitive impairment after ischemic stroke.

[8B-5]Development of Scenario-Type Robot Recreation Program for the Elderly with Dementia and Its Evaluation

Time: 7:40pm - 8:10pm, October 25th, U.S. Eastern Standard Time

Speaker: Shiroh Itai, Atsushi Shimoda, Toshihiko Yoneoka, Toshimitsu Hamada

Abstract: In Japan where the super-aging society is rapidly growing, we expect that the work burden of the care staff in a welfare facility for the elderly should be reduced, and robot-assisted recreation (RAR) has attracted attention. Therefore, in the current research, we propose a scenario-type robot recreation program as an initial research to systematize the implementing method of RAR. And we developed a scenario-type robot recreation program that was aimed at activating communication of the elderly with dementia. This program consisted of “ball game with robot,” “contact with robot,” “gymnastics with robot,” and “sing with robot” activities. We also developed a system to operate the robot using a smart device. Therefore, even the care staff of a nursing home who do not have any specialized knowledge about robots could operate these robots without any problems. Our experimental results demonstrated that the scenario-type robot recreation increased the level of participation of the elderly with dementia compared with the conventional non-scenario-type robot recreation. Furthermore, we confirmed the increase in the frequency of communication and the time for expressing positive emotions when the elderly with dementia participated in the scenario-type robot recreation.

[8B-6]Investigation of the COVID-19 Research - A Big Data Approach

Time: 8:10pm - 8:40pm, October 25th, U.S. Eastern Standard Time

Speaker: Yong Xu

Abstract: The outbreak of novel coronavirus disease in 2019 (COVID-19) has drawn researchers’ attention to find the causes and facts of it in hope of preventing its spread and saving patients’ life. However, there are still lack of researches investigating this problem from a big data perspective. This paper tries to tackle this severe threat from a big data perspective to reveal the unknown facts and research trends concealed in the academic publications and to compare our findings with the traditional statistical methods. We downloaded 16, 560 publications from Web of Science and classified the most frequently mentioned keywords in the abstracts into seven different aspects. Then the cluster and strategic diagram methods were used to identify the core and mature research topics and trend. We found that although the vulnerable had been paid appropriate

attention by researchers, undeveloped countries had not in this health catastrophe; lung was the most fragile organ to be infected and CT and RT-PCR were the most favorite diagnostic methods; and clinical and modelling methods were the most preferably used by researchers as medical and non-medical research tools etc. Strategic diagram revealed that instead of fever, respiratory distress and pulmonary symptoms/disorders were the most mature diagnosable symptoms. Our findings showed that this simple method proves itself as being applicable in bringing to light some unknown facts hidden behind the haphazard research data and revealing the future research trends.

[8B-7] An Innovative Algorithm to Process Imaging Data for Detection of Weak Chick Embryos in Vaccine Production

Time: 8:40pm - 9:10pm, October 25th, U.S. Eastern Standard Time

Speaker: Lei Chen

Abstract: Efficient and accurate detection of weak embryos often requires the detection and classification of both weak and live embryos over a specific period. In this work, we image, detect and classify weak and live embryos hatched between the 9th and 15th day. We introduce a new method called Weak Embryo Detection Network (WEDNet), which is a weak embryo detection method based on a multiscale-feature fusion convolution neural network. First, we broaden the expand convolution layer of the Fire module to implement a multiscale feature extraction using a lightweight network SqueezeNet structure, where convolution kernels of different sizes are stored. A residual connection method is introduced between adjacent modules to achieve feature fusion between layers. Furthermore, a residual multiscale Fire block (RMFB) is proposed. WEDNet is then formed by a cascade of RMFB modules. A batch normalization layer is introduced into the network structure to speed up the network's convergence speed and a dropout method is adopted to suppress the overfitting phenomenon due to the increase of the network's width and depth. Experimental results show that the detection accuracy of the method proposed in this paper can reach 99.35% accuracy, which can achieve good detection of weak embryos.

[8B-8] A Study on Multidimensional Medical Data Processing Based on Random Forest

Author(s): Lifeng Zhang, Hongyan Cui, Roy E.Welsch

Abstract: There are many indicators as the basis for diagnosis in medical detection usually. However, in some situation, many detection indicators, useful or important, account for a small proportion, which causes a certain cost. On the other hand, so many indicators also give inexperienced researchers difficulty in making precise decisions on diagnosis of disease status based on more important indicators. We propose a method of multidimensional data processing based on random forest in this paper, aiming to reduce the difficulties in medical

multidimensional data. We proposed a method based on random forest according to impact score, to classify multi-dimensional attributes as strong impact and weak impact for disease. The experimental dataset is diabetic retinopathy from UIC. In the experiment, we designed a method based on random forest according to impact score, to classify multi-dimensional attributes as strong impact and weak impact for disease. The experimental result shows that the higher-score group has better performance in diagnosing diabetic retinopathy.

Session 9A: Urbanization and Smart Communities

Time: 20:00-24:00, October 25th, U.S. Eastern Standard Time
Meeting Room (Microsoft Teams): [9A,9B]IEEE UV2020 Session
Chair(s): Lu Gao
Assistant: Zhiyuan Yang

Session 9A and Session 9B will be held together, Session 9A starts first.

[9A-1]Critical Urban Data Science for Resilient Smart Urbanism
Speaker(s): Shan Jiang
Time: 20:00-20:30, October 25th, U.S. Eastern Standard Time
Abstract: Cities are growing at an unprecedented speed. As a result, human beings are facing enormous challenges such as environmental degradation, increased energy consumption, decreased quality of life, climate change, and public health crisis. The explosion of urban sensors, the ubiquitous Internet of Things (IoT), and the rise of artificial intelligence have generated much hype to invent future smart cities. However, many obstacles exist, and they call for creative and robust interdisciplinary approaches to solve the most critical challenges in the rapid urbanization era. In this talk, with examples from global cities of Beijing, Boston, New York City, and Singapore, Dr. Jiang will present her research that bridges data science with urban sustainability issues, moving from data to information, knowledge, and action. She will discuss challenges and opportunities in the big data era to plan, design, and manage sustainable, equitable, smart, and resilient cities.

[9A-2]Characterizing Public Perception of Urban Environmental Pollutions using Geo-coded Twitter Data: A Case of the Greater Taipei Metropolitan Region
Speaker(s): Jiangxiang Huang, Mengdi Guo
Time: 20:30-21:00, October 25th, U.S. Eastern Standard Time
Abstract: Urban environmental pollutions, i.e. noise, air pollutants, hygiene and waste, are major causes of nuisance and ill health in cities globally. Traditionally, municipal governments rely on phone or online-based Public Nuisance Petition (PNP) to monitor pollution nuisance, a system which is costly and difficult to verify. The rise of social media provided new opportunities to monitor public perception of environmental pollution in the digital age. Questions rise as whether geo-coded social media (GSM) data can reliably reflect pollution incidents? If yes, what lessons does it hold for urban pollution monitor and management? The aim of this study is to develop and evaluate a GSM-based tool to monitor urban environmental nuisance. Text-mining, topic modelling and machine learning were used to extract pollution incidents from Twitter data collected from the Greater Taipei Metropolitan Region. Results were compared with the official PNP dataset from the same period. Findings suggested that while GSM and PNP-based incidents overlapped significantly; the two tend to reflect two demographic groups: GSM for young, well educated population, while PNP for local and elderly population. GSM-based monitor can serve as a valuable supplement, instead of replacement, to existing PNP procedures. Findings have implications for urban management in the digital age.

[9A-3]After-School Tutoring, Household Substitution and Student Achievement: Experimental Evidence from Rural China

Speaker(s): Hongliang Zhang

Time: 21:00-21:30, October 25th, U.S. Eastern Standard Time

Abstract: Concerns over the implications of difference in access to after-school learning activities by family backgrounds on child development and educational inequality has led to a global rise of public provision of after-school learning support. Yet despite of the enormous policy interest, evidence of the effects of public after-school programs on children's academic outcomes is limited and far from unified. We build a model that integrates public and private inputs to produce student achievement through two competing mechanisms – diminishing returns to total inputs and complementarity between public and private inputs. When diminishing returns dominate complementarity, the model predicts the substitution of private inputs due to increases in public inputs for all households, although the extent of crowding out is smaller and therefore the test score gains are larger for children from disadvantaged family backgrounds. We implement a randomized controlled after-school tutoring experiment in rural China where many children are left-behind by both parents and cared for by grandparents. During the program, tutees living with parents reported large and significant reductions in the amount of tutoring received at home, whereas tutees living apart from both parents reported much smaller, and often insignificant, reductions. We find that tutees' math scores improved significantly, and more for children living without parents, although there is no evidence for improvement in tutees' reading scores.

Session 9B: Smart Government and Social Services

Time: 20:00-24:00, October 25th, U.S. Eastern Standard Time
Meeting Room (Microsoft Teams): [9A,9B]IEEE UV2020 Session
Chair(s): G. Zhiyong Lan
Assistant: Qixin You

Session 9A and Session 9B will be held together, 9A starts first.

[9B-1]Collaborative Governance and Big Data Social Governance Innovation: A Case Study of "Health Code" Used in COVID-19 Pandemic
Speaker(s): Chen Huang
Time: 21:30-22:00,October 25th, U.S. Eastern Standard Time
Abstract: Since the COVID-19 pandemic broke out in a large scale in the city of Wuhan by the end of 2019, which spread quickly to other cities of China. Every city of China strengthened epidemic prevention and control at one hand, and prepared for the work resumption after the new year holiday. Governments faced tremendous challenges of how to ensure the population mobility and work resumption in this special period. Local governments and communities were required to obtain the health condition and risk situation of local residents, enterprises and their employees. It was also important to realize information sharing among different jurisdictions and different governmental departments. Represented by big data, artificial intelligence and other latest technology played significant role in the prevention and control work of COVID-19. “Health code” is a representative bottom-up technology innovation, which had vital influence during the epidemics. On the basis of the theory of collaborative governance and social governance innovation, this paper conducts case study of “Health code” applied in Wuhan city to answer the question of how to enhance the ability of social governance through collaborative governance and big data. We conduct in-depth interviews with several key participants in different procedures, including city governmental departments, local communities, local organizations and enterprises engaged in technology development. We find that big data and technology innovation play significant role in constructing the ecosystem of digital government and smart government. In the meantime, governance philosophy, social institution and organizational capability are the vital supporting measurements. From the COVID-19 Pandemic, we found that gravity of the situation forced social governance innovation, the rapid development of intelligent technology ensured governance capacities, and social system made collaborative governance. In the future, we recommend to enhance the multi-dimensional collaboration in social governance, accelerate technology development and utilization, as well as encourage institutional innovation.

[9B-2]How to Improve the Resilience of Community Against Grave Public Health Emergencies?
Speaker(s): Qiangqiang Luo
Time: 22:00-22:30, October 25th, U.S. Eastern Standard Time
Abstract: The community plays an extremely significant role in the fighting against COVID-19 in China. Although many grassroots communities in Wuhan have achieved stage victory, some do not have sufficient resilience to recover from the emergency. To improve the ability of social governance, it is of great significance to explore and enhance the resilience of communities. This study conducted an in-depth investigation of 12 representative communities in Wuhan and 9 “key

informants" from different fields.

[9B-3] The Use of Health Code to Control the COVID-19 Pandemic: Achievements, Evaluations and Future Prospects
Speaker(s): G.Zhiyong Lan
Time: 22:30-23:00, October 25th, U.S. Eastern Standard Time
Abstract: The COVID-19 outbreak is the most serious public health crisis in the world in recent centuries. In its effort for epidemic prevention and control, China innovatively used "health code" as one of the governance tools. The use of this tool has won applauses as well as aroused discussions and debates. This paper reviews the basic concept, origins, functions, technical framework, content, data source, data management and transmission of health code. It also evaluate the effectiveness of the methods, issues and problems, rooms for improvements, and future social governance ramifications. Issues and problems discussed include precise identification and positioning risk groups, realization of efficient supervision of administrative rating and classification, the reduction of discretion space, provision of discretion benchmark, reduction of administrative execution burden, reduction of administrative costs, regional integration and collaboration, digital security, and privacy concerns. The authors then discusses its future implications and prospects of health code for intelligent health management.

[9B-4] Comparison of Smart City Policies and Practices among Hong Kong, Macau, Guangzhou and Shenzhen in the Greater Bay Area in South ChinaSpeaker(s): Gary Yeung
Time: 23:00-23:30, October 25th, U.S. Eastern Standard Time
Abstract: This paper examines smart city building policies and practices in the four major cities (Hong Kong, Macau, Guangzhou and Shenzhen) in the Guangdong-Hong Kong-Macao Greater Bay Area (GBA), which is one of the target areas in the national development strategy. The study also draws on smart city efforts from international experiences. Through the survey of literature, the study of policies, identification of existing successes, issues and problems, and evaluation of the practices of these cities, the authors offer suggestions for further reform efforts to promote the building of smart urban clusters in the area, including better inter-governmental collaboration and free flow of information, talents, capital, and technology. Platform infrastructure, legal framework, and more effective policies should be made to facilitate efforts of such regional integration.

[9B-5]Smart Community Building in Hangzhou and Shenzhen, China Lessons and Experiences
Speaker(s): Wei Zhong
Time: 23:30-24:00, October 25th, U.S. Eastern Standard Time
Abstract: The paper discusses smart community building experiences and lessons in two of China's prominent cities: Shengzhen and Hangzhou, both have

over 10 million population. The authors reviewed their understanding of the concept of smart cities, their policies and implementation strategies, achievements, issues and problems, and lessons and experiences learned, and future prospects. Efforts are also made to examine smart community practices in other areas of China and in foreign countries. In the end, the authors proposed suggestions for further improvements for future practice.

Session 9C: Integrated Solutions for Smart Humanity

Time: 20:00-24:00, October 24th, U.S. Eastern Standard Time
Meeting Room (Microsoft Teams): [9C]IEEE UV2020 Session
Chair(s): Shengsheng Cao
Assistant: Chaoyi Wang

[9C-1]Ethical Thinking under the Paradigm Shift of Design
Speaker(s): Jun Cai
Abstract: With the change of industrial society into cyber society, we transferred into a new changed and uncertain world that shifted through transformation economy. Design is fast change and developed with new economy, technology and culture when the society challenged by environment and new technology. AI and other new developed technology issues not only bring our innovate output but also could be new threaten for our society from ethics to moral. In this background, we need to develop a new thinking for design and develop a new paradigm for this challenge.

[9C-2]Aesthetics and Ethics of AI Innovation Design for Sustainability
Speaker(s): Jingyan Qin
Abstract: 50 years ago, AI showed Apollo landing moon video, and 50 years later, the United States re-established the "Apollo Brain Plan" to carry out the national strategic blueprint of brain cognition science and artificial intelligence. 2020 COVID-19 changes the world in the way of cliff displacement dramatically. The Communovirus application with Artificial Intelligence carries out the special management of "a community of shared future for mankind" in the special period of the world and promotes the reform of the global governance system. The non-contact economy forms the new human mobility under the artificial intelligence and the fusion of public politics, economy, society and culture in the global public space of "global village". Artificial Intelligence causes the change of productivity production mode, production tools and relations, and the innovation under the influence of Quantum Innovation Thinking. The disruption innovation caused by AI changes of design paradigm, all of which bring opportunities and challenges for the planet of human destiny community to transform zero sum game into non-zero-sum game, so as to achieve ecosphere sustainable development.... AI rapidly moves from concept to application, with various applications emerging and entering the booming period of development, subverting all aspects of production tools, productivity and production relations Innovation. Artificial Intelligence. Artificial Intelligence, from imitation to transcendence, from mapping to copying, from printing to transforming, from supervised learning to autonomous learning, from disembodied metaphor to embodied language, is a kind of accurate matchmaking. With the advent of the era of "Artificial Intelligence + Big Data + Internet + Innovation Design", and the pattern evolution into "AI&HI Fusion Intelligence + Live data + Internet of Everything IoE + Innovation Design", the world is changing in a butterfly effects and long tail theory lotus effects. Black swan and grey rhinoceros show the challenge and opportunity coexistence in the innovation reform based on artificial intelligence GPT (general purpose technology). How to foresee the future world of Life 3.0 and Life X.0 from the perspective of AI global citizens, and then review the life style, survival pattern, production mode and life aesthetics is a worldwide topic concerned by all circles of production, education and research of natural science culture, social science culture, humanities and art design culture. The Artificial Intelligence and Innovation Design, thinking and

exploring in the evolution process of life form, from Life 1.0 version to Life 2.0 version, to life 3.0 version created by AI, to Life X.0 version. Life X.0's innovation design and development prospect include four areas: "Intelligent Life Form", "Intelligent Production Working Mode", "Intelligent Aesthetic Life Culture" and "Intelligent Crowds Survival Civilization". Artificial Intelligence and Innovation Design focuses on "meta design". The algorithm application of artificial intelligence (mainly CNN, RNN, GAN, CAN and other algorithms of visual computing)
and the innovation of its design method are the basis. We should not only keep the high-level of innovation design methods brought by cutting-edge technology, but also put AI ethics forward and form the systematic influence and logical construction of innovation design brought by AI algorithm technology, and pay attention to the combination of artificial intelligence and innovation design through the balance of Aesthetics and Ethics; we should not only pay attention to the influence of various artificial intelligence algorithm technology on innovation design process, understand and master various artificial intelligence technology and its response. In addition, we should pay attention to the analysis of the essence of innovation design, and apply AI to the combination of cross platform and cross media AI application development.

[9C-3]The Human Voice towards the Singularity: the Sustainable Development of AI Industry

Speaker(s): Gang Wu

Abstract: The human sound industry is entering the singularity moment of the emerging technology empowerment represented by artificial intelligence, blockchain and big data. The content dimension of the sound media and the data dimension of the auditory communication are all in the process of reconstruction. The added value of AI lies in the processing of natural language. Speech is becoming the main interface and driving force in the audio industry, but the media industry is not fully prepared for this change. The wave of innovation in the sound industry will envelop the content market from hardware and software, thus driving the transformation of content production and communication models in terms of brand, experience, convenience and connectivity. At the same time, artificial intelligence means new possibilities in content structure and interaction design. In the future, voice AI will promote the integration of media and entertainment industry value chain, and then promote the sustainable prosperity and development of audio digital economy.

[9C-4]From Carbon-based Ethics to Silicon-based Ethics: Ethics in the Era of Artificial Intelligence

Speaker(s): Jiang Lan

Abstract: The rapid development of artificial intelligence technology and its widespread application in daily life have increasingly raised new questions to traditional ethics, that is, whether it is possible to transcend the human-centered perspective and reconstruct the ethics of the artificial intelligence era. In fact, from machine learning to deep learning, the realization of artificial intelligence depends

on the operation of big data, and big data needs to create a data Umwelt that is parallel to the world of human life. Unlike the Umwelt of life, which reduces complicated situations to the relationship between people and other beings, in the data Umwelt, all situations are reduced to a well-ordered data exchange. Therefore, there is a silicon-based ethics that is different from the human-centered carbon-based ethics. The basis of silicon-based ethics is data, and the good measure for data and information exchange is to reduce the uncertainty in exchange as much as possible.

[9C-5]Intelligent Lighting
Speaker(s): Wei Ding

[9C-6]AI and Ceramics
Speaker(s): Qiang Zhao

[9C-7]Evaluation of Smart Humanity Systems and Novel UV-Oriented Solution for Integration, Resilience, Inclusiveness and Sustainability
Speaker(s): Shengsheng Cao, Chaoyi Wang, Zhiyuan Yang, Aijing Sun
Abstract: At the present time, the rapidly developing and iterating technologies cannot solve human's ultimate problems on survival and life, equality and respect, service and sharing and happiness and health. Furthermore, when the scientific and technological advancement lacks humanistic consideration, they lead to even more problems on the aspects. In this paper, we evaluate, from the UV perspective, the challenges of the humanity system based on the framework of closed feedback control loop: data acquisition, communication, decision making and action. We propose that an effective smart humanity system should take into consideration of the interaction between the smart humanity system and other seven smart city subsystems: smart home, smart medicine and healthcare, smart energy management, smart city infrastructure, smart response system for city emergency, smart environmental protection, ITS, Urban Planning and Crowd Management, and also study how smart humanity would be affected by four major impacting factors of smart cities: information flow, material cycle, lifestyle and community. This systematic study will help us explore in depth the complicated dynamic relationship between multiple impacting factors and propose a UV-oriented, integrated, resilient, inclusive and sustainable development framework design to address current imminent challenges and to reevaluate existent technologies and future innovations with a perspective of promoting sustainable development, universal design, communicative action and promoting self-actualization.

[9C-8]Intelligent Transportation
Speaker(s): Baonan Du

[9C-9]Research on the Method of Simultaneous Selection of Design Schemes in Man-machine Environment—Take the environmental Design of "A Dream of Red Mansions Chen Xiaoxu Memorial Hall" as an Example

Speaker(s): Man Luo

Abstract: Aiming at the problem of choosing one good environmental design, an attempt was made to establish an evaluation method based on the simultaneous application of man-machine environment. On the basis of a full investigation of the research objects, a number of design schemes are established to establish the synchronous cognitive semantics of the human-machine environment and assign values to them, use smart technology methods to carry out environmental design cognitive experiments and record corresponding data. According to the reference value established in the early stage, data analysis is used to narrow the selection range, and the appropriate environmental design plan is determined through the extraction and analysis of physiological data.

[9C-11]Sustainable Product Service System Design

Speaker(s): Xiaoyu Zhao

Abstract: The purpose of this article is to explore the possibility of sustainable design in coastal areas. The objective is to deal with the global issue of marine pollution, design to verify the future possibilities of sustainable design, and provide excellent opportunities for innovation. Based on the sustainable design methodology and product-service system design concept, the article explores the actual needs of large retail businesses in coastal areas in the process of development and transformation and proposes design directions and optimization for existing problems from the three dimensions of economic benefits, ecological balance and social equity in product-service system design theory. Conclusion Through the construction of the "The seashore" case system, we provide a practical and feasible method to solve the shoreline sustainability and provide support for the future sustainable design of coastal areas based on the concept of product and service system design.

[9C-12]Communication in Narrative Frames Designing with Smart Material

Speaker(s): Yuke Meng

Abstract: Design oriented by new materials and the experience they provide acts effectively in different frames of narrative design and in such design process, materials represent design as dynamic intermedia. With development of smart technology, smart materials become a new kind of orientation in such context and support design process in different narrative frames in communication and sharing ideas among design participants. A significant feature in this process is, that the communication is divided in to two layers, including the dialogue between the participants and between smart material and participants, for the smart materials give feedbacks and reactions. Based on this situation, this paper constructs a communication framework based on the trend of smart material and relative technologies. This research is based on literature review and empirical design

studies with biomaterial, for its properties of reactions as one of the kinds of smart material in generalized concept.

[9C-14]Assignments and Grades Manager
Speaker(s): Hao Yuan
Abstract: Our target application system aims to help students manage their assignments dues, exam dates and current grades of classes they are taking. What motivates us to design this system is that we, as students, are struggling managing what we should do for next week, next month, etc. because we are taking multiple classes at the same time and we may have some other tasks, such as research and club activities, which makes it very hard to make a reasonable work plan in a short amount of time. We have to take many factors into consideration when making the plan, such as the priorities, difficulties, estimated completion time of tasks and possible schedule conflicts. Moreover, there does not exist an integrated interface where we can see what we should do for all our classes. We have to click into the Brightspace page of each class, find out what we are supposed to do and make plans based on that, which takes a huge amount of effort, while we may simply miss one of the assignment announcements because sometimes assignments are post on different platforms. Plus, exam dates further makes the planning process more complicated. If we can have a system that automatically integrates what assignments are due and if there are exams in 1 or 2 weeks for all classes, it will save us a lot of efforts and time. Moreover, we plan to design the system so that it will enable you to mark you have finished and submitted an assignment, which will further facilitate students' assignment management process, and it will remind you an assignment is due 2 weeks later, 1 week later, 5 days later and 2 days later, which will help the students make plans earlier.

[9C-15]AI and Creative Education
Speaker(s): Hao Zhuo

Session 10: Data Management and Processing, Algorithm Development and Analysis

Time: 9:30am-11:50am, October 27th, U.S. Eastern Standard Time
Meeting Room (Microsoft Teams): [2B,10]IEEE UV2020 Session
Chair(s): Liang Wang, Yong Xu
Assistant: Hao Yuan

Session 2B and Session 10 will be held together. Session 2B starts first.

[10-1] Bilateral Control to Eliminate Traffic Jams

Speaker(s): Liang Wang
Time: 9:30am-10:15am, October 27th, U.S. Eastern Standard Time
Abstract: Bilateral control can suppress traffic flow instabilities. The simplest form of bilateral control uses information about the relative positions and relative velocities of leading and trailing vehicles. In this paper, we provide a multi-node version of bilateral control, in which information about the state of more than just the immediately leading and trailing cars is used. In this mode of control, the question arises: “How much weight should information about vehicles at different positions be given?” Two different methods - a Taylor series approach and a least squares approach - are explored. We show that the least squares approach generates sets of coefficients that can damp out low-frequency components of perturbations faster. This means that traffic under multi-node bilateral control will approach an equilibrium state more rapidly than under the traditional version of bilateral control. Simulation results confirm our analysis.

[10-2]Investigation of the COVID-19 Research - a Big Data Approach

Speaker(s): Yong Xu
Time: 10:15am-11:00am, October 27th, U.S. Eastern Standard Time
Abstract: The current novel coronavirus disease in 2019 (COVID-19) has plagued human beings for more than 10 months as a great global threat to the public health. To tackle this, researchers have been taking whatever measures they can to try to find the facts, truth and causes of this disease in the hope of preventing its spread and saving the patients’ life. Technological or comprehensive reviews were also conducted in an effort to summarize the observations and findings. This paper started with the download of 16,560 publications from Web of Science and employed the big data method, a totally different point of view, to reveal the unknown facts concealed in these publications by identifying some of the most frequently mentioned key words in the abstracts. Then they were classified into seven different aspects, including the basic information, time and countries, people group, symptoms, complications, diagnostic methods and research methods for analyses. Our findings showed that this simple method proves itself as being applicable in bringing to light some unknown facts or factors hidden behind the haphazard research data and that our results are consistent with the facts revealed in traditional statistic methods.

[10-3]Progress and Application Analyses in Blockchain Technology

Speaker(s): Lingzhong Wang
Time: 11:00am-11:25am, October 27th, U.S. Eastern Standard Time

Abstract: The Blockchain is a new technology developed on the basis of Bitcoin system. In fact, the developing blockchain technology has been going beyond the single application scope of cryptocurrency, and becoming one of a core support to solve financial, economic and even social problems on Internet. Based on the Bitcoin system, this paper first analyzes the basic issues of implementing distributed storage, consensus negotiation and cryptographic security in the blockchain. On this basis, several representative blockchain technologies are analyzed, including Smart-contracts, Super-ledger and Stable-currency system. Fi- nally, the trend of his applications are prospected.

[10-4] A Visualization System that Ensures the Localization of Private Geographic Information

Speaker(s): Zhonghua Lv, Yufan Guo

Time: 11:25am -11:50am, October 27th, U.S. Eastern Standard Time

Abstract: Common geographic information visualization systems are based on online map tools to render geographic information, like Google Map. However, in an intranet environment where Internet access is not possible, online map tools will not be available. Therefore, this paper designs a geographic information visualization system based on C/S architecture that can ensure the localization of private geographic information. The system can support Windows, Linux, and MacOS platforms. The system can ensure the confidentiality of private geographic information and realize the visualization of private geographic information. The main functions of the system include user login, private map and cad drawing file loading, drawing geotags, and maintenance of users, geotag data, and building tag data. The test results show that the system has the localization and visualization of private geographic information, and the operation is stable and reliable.

Session 11A: Coordinated UV Solutions for Epidemic Prevention and Control

Time: 2:00am-4:30am, October 24th, U.S. Eastern Standard Time
Meeting Room (Microsoft Teams): [11A,Shenzhen]IEEE UV2020 Session
Chair(s): Yulan Yang
Assistant: Fenglin Wei

[11A-1]Experience from Operation of Shenzhen Cabin Hospital and Internet Healthcare Opinions
Speaker: Shenghu Wang
Time: 2:00-3:00, October 24th, U.S. Eastern Standard Time
Abstract: As the COVID-19 outbreak established internet healthcare on the stage of 2020, Southern Medical University bore this task in emergency and successfully completed the preparatory work for Shenzhen Cabin Hospital featuring remedy, rescue, external surgical arrangement, clinical test and other functions within 36 hours, wherein a batch of atypical service scenarios for epidemic prevention and control were emerging constantly with rapid rise of online consultation & diagnoses and online drug purchase figures.

Under constant development of internet hospitals, internet healthcare mainly faces the challenges in the three aspects of internet information safety, business sharing and technology response. To deal with such challenges, we shall first enhance regulatory supervision over internet healthcare information safety; and then, it is necessary to properly create internet applications, especially safety control for the patients' and doctors' data on the prescription platform; thirdly, the internet healthcare architecture shall be shaped properly.

[11A-2]Sino-America Comparison and Analysis on Construction of Synthetic Biology Research Systems
Speaker: Wenhe Zhan
Time: 3:00-4:00, October 24th, U.S. Eastern Standard Time
Abstract: Sino-America scientific research systems are comparatively analyzed at reporting rules, integrity supervision and management mode and misconduct punishment from the perspective of scientific researchers. According to Chairman Zhan Wenhe, the scientific research system shall be built in a way of inclusiveness and mutual learning for common development, although there are huge differences of culture and regulations between the PRC and the USA.

[11A-3] Cocrystallization of Caffeine–Maleic Acid in a Batchelor Vortex Flow
Speaker: Zunhua Li
Time: 4:00-5:00, October 24th, U.S. Eastern Standard Time
Abstract: Drugs play a vital role in protecting human from diseases and maintaining human health. Among the drugs, the solid form of pharmaceutical cocrystal has the advantages of saving many R&D expenses, extending the drug patent period and shattering patent barriers etc. But this form is far from actual industrialization due to polycrystalline existence and complicated preparation process. And as polycrystalline exists in a solid drug, the dominant crystal type shall be generally selected as the pharmaceutical crystalline type for proper validity, safety and controllable quality of the drug. Therefore, how to prepare co-crystal in the dominant crystal type is the inevitable problem to be solved in front of the pharmaceutical industry.

This study takes the polycrystalline system of caffeine and maleic acid as object, wherein their Crystal Type I has a similar nature of Type III so that the product from the crystallization process is generally the mixture of both. In this background, this study highlights the co-crystallization process of pure crystalline in type I or III through optimization and preparation with a rotary crystallizer shaping Batchelor vortex flow, including rotary speed, initial concentration and cooling rate. In addition, this study applies advanced ATR FTIR infrared spectroscopy to online monitor the concentrations of caffeine and maleic acid in the solution, and offline tests the crystalline type of the final product by use of powder X-ray diffraction. It is the first attempt in China to control the co-crystalline type from the hydromechanics perspective, and providing a new idea for the pharmaceutical industry this study has important theoretical and practical significance.

Session 11B: Coordinated UV Solutions for Trash and Scrap Collection, Processing, Reuse, and Recycling

Time: 11:20am-12:45pm, October 27th, U.S. Eastern Standard Time
Meeting Room (Microsoft Teams): [6]IEEE UV2020 Session
Chair(s): Tian Tan
Assistant: Shengyue Gao

Session 6 and Session 11B will be held together. Session 6 starts first at 10:00.

[11B-1]Landfills Siting Strategies and Urban Planning
Speaker(s): Jiarui Zhang
Time: 11:20-11:40, October 27th, U.S. Eastern Standard Time
Abstract: According to the data, humankind currently produces two billion tons of waste per year between 7.6 billion people. And the total waste production is predicted to rise by 70 percent by 2050 unless we take urgent actions. Worse still, even under such a situation, only 13.5% of today's waste is recycled and 5.5% is composted. And between one-third and 40% of waste generated worldwide is not managed properly and instead dumped or openly burned. Without any actions, problems such as air-quality degradation, water pollution, and global warming will continue to deteriorate, which may cause serious health problems. Simply speaking, humans are destroying themselves. As a member of the human society, I cannot stand aside and let others do all the work. Currently, facing this problem, I have already had my own ideas. Through my study, I found that better landfills siting policy can ameliorate this scenario. In the past, because of mismanagements, many landfills are directly placed near the downtown area, which is potentially danger to human's mental and physical health. Furthermore, it is very difficult to remove these landfills since wastes are directly buried under the landfills, so even if people can remove the above-ground buildings, the underground wastes can still not be handled. In addition, due to the pollution created by these buried wastes, the surface soil can neither be used for farming or agriculture. So, from my own side, I want to change the current situation of landfills siting. I will use Mathematical Weighting Models to take consider of variety of indicators such as the distance between landfills and the downtown area, the distance between landfills and surface water, etc. As a result, I can sift out the best candidate of landfill's site in a certain area in order to avoid some potential harms.

[11B-2]Internet of Things and Artificial Intelligence for Collection of Waste
Speaker(s): RuiEn Zhang
Time: 11:40-12:00, October 27th, U.S. Eastern Standard Time
Abstract: According to the data, humankind currently produces two billion tons of waste per year between 7.6 billion people. And the total waste production is predicted to rise by 70 percent by 2050 unless we take urgent actions. Worse still, even under such a situation, only 13.5% of today's waste is recycled and 5.5% is composted. And between one-third and 40% of waste generated worldwide is not managed properly and instead dumped or openly burned. Without any actions, problems such as air-quality degradation, water pollution, and global warming will continue to deteriorate, which may cause serious health problems. Simply speaking, humans are destroying themselves. As a member of the human society, I cannot stand aside and let others do all the work. Currently, facing this problem, I have already had my own ideas. Through my study, I found that better landfills siting policy can ameliorate this scenario. In the past, because of mismanagements,

many landfills are directly placed near the downtown area, which is potentially danger to human's mental and physical health. Furthermore, it is very difficult to remove these landfills since wastes are directly buried under the landfills, so even if people can remove the above-ground buildings, the underground wastes can still not be handled. In addition, due to the pollution created by these buried wastes, the surface soil can neither be used for farming or agriculture. So, from my own side, I want to change the current situation of landfills siting. I will use Mathematical Weighting Models to take consider of variety of indicators such as the distance between landfills and the downtown area, the distance between landfills and surface water, etc. As a result, I can sift out the best candidate of landfill's site in a certain area in order to avoid some potential harms.

[11B-3]Challenges in Today's Global Recycling Industry
Speaker(s): Tian Tan
Time: 12:00-12:45, October 27th, U.S. Eastern Standard Time
Abstract: Metal scrap recycling industry is currently widely integrated in socioeconomic system including secondary metal commodity trading, residential and industry waste recovery and reuse, and environmental protection. While metal scrap recycling delivers the most basic needs to ensure social functioning, it comes at the cost of high society cost due to its primitive mode of operation. Accordingly, technologies, such as artificial intelligence (AI) and big data, that enable efficient recycling of metal scrap to improve the recovery ratio of renewable scrap sources without sacrificing natural environment or increasing social operation cost are critical to the all-round upgrade of metal scrap recycling in modern society.

Session 12A: UV City Forum

Time: 2:00am-5:00am, October 27th, U.S. Eastern Standard Time
Meeting Room (Microsoft Teams): [12A]IEEE UV2020 Session
Chair(s): Tao Ma
Assistant: Fenglin Wei

[12A-1] Smart Energy-City Systems Outline: Challenges & Opportunities in Energy Transitions
Speaker(s): Tao Ma

Time: 2:00am-2:30am, October 27th, U.S. Eastern Standard Time

[12A-2] Qilihai Zero Waste Discharge Community in Tianjing, China
Speaker(s): Bing Zhu

Time: 2:30am-2:55am, October 27th, U.S. Eastern Standard Time

Session 12B: UV Student Forum

[Technology News, Social Hot Topics, Future Vision]

Time: After Every Subsystem's Presentation
Student Chair(s): Kaijun Jin, Lifeng Zhang

Panel Discussion

[Entrepreneurship Initiative]

Time: 24:00-1:00, October 24th, U.S. Eastern Standard Time
Meeting Room (Microsoft Teams): [13,Shenzhen] IEEE UV2020 Session
Student Chair(s): Lin Li, Lifeng Zhang

[Smart Energy Management]

Time: 11:00-13:00, October 24th, U.S. Eastern Standard Time
Meeting Room (Microsoft Teams): [4A] IEEE UV2020 Session
Student Chair(s): Kaijun Jin, Wenjie Lin

[12B-1] Evaluation of Smart Energy Management and Novel UV-Oriented Solution for Integration, Resilience, Inclusiveness and Sustainability

Speakers: Kaijun Jin, Wenjie Lin, Lin Li, Chaoyi Wang, Hao Yuan, Zhiyuan Yang, Yuhao Dong, Mo Song, Chengpeng Chai
Time: 11:00-13:00, October 24th, U.S. Eastern Standard Time
Abstract:

At present, energy has become an indispensable part of our lives. While we are enjoying the benefits energy bring to us, we are facing challenges, such as ever-increasing energy consumption, limited energy resources, lack of robustness and resilience in response to unexpected disturbances, safety and security issues, costly impact on the environment and human health, and energy inequality. The

transformation into the smart energy management system further aggravates these problems and introduces new challenges, such as the costly construction of smart facilities. In this paper, we evaluate, from the UV perspective, the challenges of the energy system and the current status of the smart energy management system based on the framework of closed feedback control loop: data acquisition, communication, decision making, and action. We propose that an effective smart energy management system should take into consideration of the interaction between the smart energy management system and other seven smart city subsystems: smart home, smart medicine and healthcare, intelligent transportation, urban planning and crowd management, smart city infrastructure, smart environmental protection management, smart response system for city emergency, and smart humanity, and also study how the smart energy management system would be affected by four major impacting factors of smart cities: information flow, material cycle, lifestyle, and community. This systematic study enables us to improve preparedness, coordination & adaptiveness, safety, robustness & resilience of current smart energy management system and propose a UV-oriented, integrated, resilient, inclusive, and sustainable development framework design to address current imminent challenges and to improve the energy efficiency and reduce energy consumption through hybrid, integrative & needed-based data acquisition, proactive communication and information sharing, adaptive decision making based on hierarchical knowledge level across spatiotemporal levels, human-involved and hybrid action.

[12B-17] Preliminary Study of the Coordination and Complicated Dynamics between Smart Energy Systems and other Smart Systems

Speaker: Yiyang Chen

Time: 13:00-13:20, October 24th, U.S. Eastern Standard Time

Abstract: This study focused on how smart energy systems interacted with smart healthcare systems, which was inspired by the UV concept that improving the efficiency of smart energy systems and other systems, including smart healthcare systems and smart environmental protection, had to be achieved coordinately by considering interactions between subsystems. Specifically, this study investigated the unique correlation between energy prices and the number of patients in US hospitals: whenever the price of electricity increased, the number of patients would also increase since many people would reduce their usage of cooling or heating devices and would finally jeopardize their own health status. Hence, when decision makers were determining the price of electricity for a region, they should consider humanity factors, such as the average income and the health status of its residents. This study also explored the arrangement of hospital evacuation during blackout situations that involved coordination among smart energy systems, ITS, and smart healthcare systems and how machine learning algorithms could help to identify the issues of energy theft in real-time, including electricity theft and oil theft, which were traditionally difficult to be detected due to long transmission lines or pipelines. These interactions and dynamics between smart energy systems and other smart systems demonstrated the necessity of a coordinated and globally optimized solution.

[12B-18] Is Electric Vehicle Really More Environmentally-friendly?
Speaker: Chuanqi Jiang
Time: 13:20-13:40, October 24th, U.S. Eastern Standard Time
Abstract: We conducted research on quantitative analysis of electric vehicle pollution. In this project, we applied system dynamics analysis to model the energy consumption and pollution emissions of electric vehicles and measured the environmental protection level of electric vehicles by comparing the environmental costs of electric vehicles and traditional fuel vehicles. The results show that under certain conditions, the environmental cost of electric vehicles will exceed that of fuel vehicles, and balancing the ratio of electric vehicles and fuel vehicles can better reduce environmental costs. Finally, the project also gives specific suggestions for minimizing environmental costs based on actual data.

[Smart Humanity]

Time: 24:00-1:00, October 25th, U.S. Eastern Standard Time
Meeting Room (Microsoft Teams): [12B]IEEE UV2020 Session
Student Chair(s): Chaoyi Wang

[12B-2] A Smart Campus System based on Intention Recognition and Internet of Things
Speaker: Maoxuan Shan
Time: 24:00-00:20, October 25th, U.S. Eastern Standard Time
Abstract: By applying Natural Language Processing, to optimize the human-computer interaction experience and control efficiency of teaching equipment, improve the convenience of campus learning and life information inquiry and classroom teaching management, create a simple, convenient, and smooth user experience, is the development direction of the next generation of Smart Campus. XiaoHu.ai, the campus information interaction and classroom teaching support system "what you say is what you get", based on Natural Language Processing, innovatively developed "Intention Recognition Algorithm Based on Sentence Pattern and Text Similarity", realized accurate analysis and identification of semantics in campus scenarios. A voice or text command can make the required information automatically and quickly pushed to the user, and a voice or text command can make the system quickly and automatically complete the equipment management task. Combining Natural Language Processing technology with specific application situations on campus, XiaoHu.ai realized "what you say is what you get", brought a significant improvement in the efficiency of campus information interaction and equipment management, greatly improved the use experience of students and teachers, and could be a beneficial exploration on development direction of the next generation Smart Campus.

[12B-16] Quality of life index system and smart community evaluation system based on machine learning
Speaker: Sinuo Zhao
Time: 00:20-00:40, October 25th, U.S. Eastern Standard Time
Abstract: This speech is mainly to share the interesting data I found in my UV research and the information hidden behind the data obtained after my self-analysis. The first part is about how lifestyle affects people's life and how we should drive all kinds of lifestyle to develop in a good direction. Young people like fast fashion lifestyle, the food waste it causes, and driving habits can also have an unexpected impact on energy consumption. At the end of this section, I will share a block diagram that discusses how people form their perceptions of their environment. The second part is about the importance of groups formed in the general environment that people tend to ignore. People in the same community tend to have many of the same characteristics, even the environment in which they live affects not only the incidence of a particular disease but also the trajectory of their lives. Policy differences in different regions will also affect various indicators of the overall environment. The third part, personal deep thinking. It is not difficult to find the data, but it is much more difficult to analyze the data. The viewpoints obtained from big data analysis can make the products better serve human beings, instead of simply increasing the difficulty of technology and algorithm.

[12B-20] Ring Shooter Robot
Speaker: Nicholas Chang
Co-Authors: Jaaron Leibson, Max Chen, Darren Lee
Abstract: We built a robot that is able to collect and store up to 3 rings, reliably launch rings into the desired goal, and pick up and move the wobble goal. The robot scores rings, moves the wobble goal to specific locations, and completes various miscellaneous objectives. The robot has the capability to run preprogrammed autonomous code, as well as be able to be driver controlled. In order to accurately and quickly launch rings into the goals, the robot is able to drive quickly, but also precisely, so that the launcher can be aimed. Furthermore, the robot’s structure is simple and parts are easily accessible for frequent inspection and maintenance. The robot does not require full disassembly in order to repair or upgrade components. Lastly, the robot is reliable and has a sturdy foundation to ensure that it does not malfunction.

[ITS, Urban Planning & Crowd Management]

Time: 8:00a-10:00, October 25th, U.S. Eastern Standard Time
Meeting Room (Microsoft Teams): [9C]IEEE UV2020 Session
Student Chair(s): Lixin Xu, Jingyuan Chen

[12B-3] Evaluation of Transportation Systems and Novel UV-Oriented Solution for Integration, Resilience, Inclusiveness and Sustainability

Speakers: Lixin Xu, Jingyuan Chen, Yuanning Chang, Jiarui Zhang, Yunpeng Fang, Yiyao Wang, Lin Li, Sinuo Zhao, Mo Song, Jiashu Ren
Time: 8:00-10:00, October 25th, U.S. Eastern Standard Time
Abstract: Transportation systems have revolutionized the form of society. With modern transportation methods, countries and cities are becoming more interconnected, allowing for less traveling time and efficiency. However, the transportation system nowadays is also facing great challenges. The limited resources cannot meet the ever-growing demand for transportation, the expensive modern lifestyle puts the environment we rely on in jeopardy, the exhaustion of traditional transportation tools damages the health of all living creatures, and the current transportation system even brings about many safety and security issues. Although the Intelligent Transportation System (ITS) has been proposed to address these issues in the last century, many connectivity problems are still not considered. In this paper, we evaluate, from the UV perspective, the challenges of the transportation system and the current status of ITS based on a framework of closed feedback control loop: data acquisition, communication, decision making, and action. We propose that an effective ITS should take into consideration the interaction between the ITS and other seven smart city subsystems: smart home and community, smart medicine and healthcare, smart energy management, smart city infrastructure, smart environmental protection, smart response system for city emergency, and smart humanity, and also study how the ITS would be affected by four major impacting factors of smart cities: information flow, material cycle, lifestyle, and community. This systematic study will help us explore in-depth the complicated dynamic relationship between multiple impacting factors and propose a UV-oriented, integrated, resilient, inclusive, and sustainable development framework design to address current imminent challenges and to improve our modern intelligent transportation system through our innovative methods of accurate static and dynamic information matching based on the redundancy in data acquisition, novel communication mechanism based on multi-dimensional layers of information that ensures the information effectiveness, robustness and self-adaptive methods, and demand-response management.

[12B-15] Relations of Traffic Flow Control System With Other Subsystems and Algorithms of Traffic Flow Control System

Speakers: Zhiyue Zheng
Time: 10:00-10:20, October 27th, U.S. Eastern Standard Time
Abstract: During the UV research program, Zheng showed his passion towards Intelligence Transportation System at the beginning of the research. He discussed a lot of possible ITS topics with the professor and fellow teammates. In the end, Zheng set his topic as traffic flow control hoping to find a way to analyze and predict the future traffic flow using the current real time data in order to mitigate traffic congestion in urban areas. As a team leader of ITS group, Zheng first conducted the research of internal relationships and interactions of Traffic Flow System with other UV subsystems such as smart infrastructure system, smart home system, smart healthcare system, smart emergency system, smart environment system and smart energy system. Then, Zheng did some surveys on the current popular

computer vision algorithms that can efficiently and accurately capture the flow of the traffics and some machine learning models that can predict the spatial-temporal inflow and outflow traffic data. However, Zheng found that almost all the traditional models are for manned vehicles. And with the development of AI and sensor technologies, autonomous vehicles are believed to be the foundation of the next-decade transportation system. But the 100% implementation of autonomous vehicles will not be realized until at least 2060 according to the research. So, Zheng began to analyze the situation of mixed autonomous vehicles and traditional manned vehicles. Zheng used Simulation of Urban Mobility (SUMO) to simulate the traffic flow of one crossroad with traffic lights and change the percentage of autonomous vehicles among all the vehicles. The manned vehicles are trained to minimize their own congestion time just like real life drivers. And autonomous vehicles can share various data such as position, destination, car start time and car stop time with other autonomous vehicles just like future autonomous vehicles with IoT technologies. And autonomous vehicles are trained to minimize the overall congestion time in the crossroad. The results showed that when the percentage of autonomous vehicles reaches 62%-66%, the overall congestion time of a crossroad will reach minimal value. Zheng's results showed that the existence of autonomous vehicles can stabilize the overall traffic flow and reduce the eccentric behavior of human drivers. Zheng's future work is to expand this work to larger areas such as environment consists several crossroads to check if the new results can match the previous results. And Zheng wants to continue to analyze the possible factors that cause traffic congestion for traditional manned vehicles to gain insights of future autonomous vehicle implementations.

[Smart Response System for City Emergency & Smart City Infrastructure]

Time: 20:00-23:00, October 25th, U.S. Eastern Standard Time
Meeting Room (Microsoft Teams): [12B]IEEE UV2020 Session
Student Chair(s): Qiaochu Xu, Songze Wu

[12B-4] Evaluation of Smart Response Systems for City Emergencies and Novel UV-Oriented Solution for Integration, Resilience, Inclusiveness and Sustainability

Speakers: Qiaochu Xu
Time: 20:00-20:45, October 25th, U.S. Eastern Standard Time
Abstract: At present, frequent natural and human-involved disasters and urgent events pose serious threats to human society and call for the smart response system for city emergencies to improve its disaster preparedness and response. In this paper, we first investigate the challenges of the emergency response system, including the inefficiency of prediction before emergencies, uncoordinated preparedness for disasters, and lacking communication and collaboration across different departments as well as unpreparedness of secondary challenges in healthcare, environmental protection, and humanity. We then evaluate, from the UV perspective, the current status of the smart response system for city

emergencies based on the framework of a closed feedback control loop: data acquisition, communication, decision-making, and action. We propose that effective smart emergency response should consider the interaction between smart response system for city emergency and other seven smart city subsystems: smart home, smart medicine and healthcare, intelligent transportation, urban planning and crowd management, smart energy management, smart city infrastructure, smart environmental protection system, and smart humanity. It should also study how smart emergency response would be affected by four major impacting factors of smart cities: information flow, material cycle, lifestyle, and community. This systematic study enables us to improve preparedness, coordination & adaptiveness, safety, robustness & resilience of the current smart emergency response system and propose a UV-oriented, integrated, resilient, inclusive, and sustainable development framework design to address current imminent challenges and improve the response-ability through

1) hierarchical emergency response procedures for individuals, communities, and cities before, during, and after emergencies

2) hybrid, integrative, needed-based data acquisition 3) effective communication channel construction and information sharing 4) adaptive decision-making based on hierarchical knowledge level

5) human-centered and capacity-focused action.

[12B-5] Evaluation of Smart Infrastructure Systems and Novel UV-Oriented Solution for Integration, Resilience, Inclusiveness and Sustainability
Speakers: Songze Wu
Time: 20:45-21:30, October 25th, U.S. Eastern Standard Time
Abstract: Rapid urbanization nowadays demands the stable functioning of a city's infrastructure, but the traditional infrastructure system faces numerous challenges: unpreparedness for extreme situations, aging and deterioration of existing facilities, unorganized, unplanned and haphazard growth of infrastructures and costly maintenance. Moreover, the transformation from traditional infrastructure into smart infrastructure introduces new challenges such as high energy consumption, sensor resolution, communication and latency, and calculation power. In this paper, we evaluate, from the UV perspective, the challenges of the infrastructure system and the current status of the smart infrastructure system based on the framework of closed feedback control loop: data acquisition, communication, decision making and action. We propose that an effective smart infrastructure system should take into consideration of the interaction between the smart infrastructure system and other seven smart city subsystems: smart home, smart medicine and healthcare, intelligent transportation, urban planning and crowd management, smart energy management, smart city infrastructure, smart environmental protection, and smart humanity, and also study how the smart infrastructure system would be affected by four major impacting factors of smart cities: information flow, material cycle, lifestyle. This systematic study will help us explore in depth the complicated

dynamic relationship between multiple impacting factors and propose a UV-oriented, integrated, resilient, inclusive and sustainable development framework design to address current imminent challenges and to improve the efficiency and safety of city infrastructure through crowd-sourcing based sensing and active monitoring; data visualization; static and dynamic data integration; decision making based on life cycle assessment, financial analysis, user profiling; optimized and coordinated demand response management, automation, smart agents, ubiquitous real-time guidance and notification, modular construction and maintenance.

[12B-6] U-Net for Satellite Image Segmentation: improving the weather forecasting

Authors: Yue Zhao, Zhongkai Shangguan, Wei Fan, Zhehan Cao, Jingwen Wang

Time: 21:30-21:45, October 25th, U.S. Eastern Standard Time

Abstract: The alternative face, background masking, color palette completion technologies have developed quickly in recent decades. Such technologies can protect people's privacy. Protecting privacy is one of the major principles of the Universal Village and the technique illustrate in this paper could be applied to privacy protection. Generative Adversarial Nets (GANs) is a generative model that can produce fake currency and can be pitted against an adversary. We developed a modified model of symmetric Deep Convolutional GAN (DCGAN) to generate novel dog images, which could be checked as real by the discriminator. All the datasets are from Kaggle Competition. The training methods includes applying loss functions, normalizing the inputs, BatchNorm, LeakyReLU, applying soft and noisy labels, applying the ADAM Optimizer, adding noise to inputs and using dropouts in generator in both training and testing phase. The performance evaluation is based on Memorization-informed Fre´chet Inception Distance (MiFID) and our final MiFID value reaches 95.85278, which present the outstanding performance of our model.

[12B-7] Dog Image Generation using Deep Convolutional Generative Adversarial Networks

Authors: Yue Zhao, Zhongkai Shangguan, Wei Fan, Zhehan Cao, Jingwen Wang

Time: 21:45-22:00, October 25th, U.S. Eastern Standard Time

Abstract: The clouds organization plays a huge role in forecasting the weather and Earth's future climate; therefore developing a better intelligent model is a way to accurately predict weather and predict weather and meteorological disasters, such as hurricane and tornado. In this paper, we classified the patterns of clouds into four types (sugar, flower, fish, and gravel) proposed by Rasp et al. and performed image segmentation. All the datasets were adopted from the Kaggle Competition. U-net was used as the basic structure and ResNet34 was applied to the original U-net structure after the data analysis. In addition, three different loss functions were used for training, the Test time Augmentation was performed before

feeding the test data to the model and the Amendment method was used to modify the results. The final dice coefficient reaches up to 0.665, which is an outstanding outcome that reflects the robustness of our method and training.

[12B-8] Rapid implementation of Covid-19 AI Assisted Diagnosis System Based on Supercomputing Platform

Authors: Fangzhao Zhang, Longfei Zhou, Jiani Liu

Time: 22:00-22:20, October 25th, U.S. Eastern Standard Time

Abstract: As a global pandemic, New Coronary Pneumonia (Covid-19) has infected more than 10 million people worldwide. In the initial stage of outbreaks that lacks detection capabilities of nucleic acid testing, it become important approach to achieve the initial screening of patients through the application of artificial intelligence and other technologies. We proposed a technical solution to quickly establish a Covid-19 AI assisted diagnosis system by using the Tianhe artificial intelligence innovation integrated platform deployed on the Tianhe-1A supercomputer. The AI supported platform mainly includes three main parts: (1) the large-scale model training development and implementation environment that ensures the rapid training of the new crown AI assisted diagnostic model; (2) the integration of artificial intelligence basic algorithm library that provides a shortcut for the selection of various artificial intelligence models of Covid-19 CT image classification; (3) the design and implementation of the artificial intelligence R&D cloud platform that realizes the online full life cycle management on modeling, training and deployment. First, the data preprocessing and interactive modeling design are provided during the model building phase. Secondly, in the training phase, it provides huge computing source pool supporting parallel and concurrent tasks. Finally, after the model training is completed, the online deployment framework support is provided for public service. Based on the Tianhe artificial intelligence integrated platform, the whole process of modeling-training-validation-deployment activities of Covid-19 AI model development is realized. As a public welfare platform, the Covid19 AI assisted diagnosis system has been adopted by more than 100 hospitals and research institutes around the world, and has contributed to the fight against the epidemic, which provides a technical reference for the response to an outbreak.

[Smart Medicine & Healthcare]

Time: 21:00-23:00, October 25th, U.S. Eastern Standard Time
Meeting Room (Microsoft Teams): [8B]IEEE UV2020 Session
Student Chair(s): Hao Yuan

[12B-9] Evaluation of Smart Healthcare Systems and Novel UV-Oriented Solution for Integration, Resilience, Inclusiveness and Sustainability

Speakers: Hao Yuan, Weishi Wang, Sinuo Zhao, Jiashu Ren, Lifeng Zhang, Yangjia Zhang, Zhiyuan Yang

Time: 21:00-23:00, October 25th, U.S. Eastern Standard Time

Abstract: At the present time, the healthcare system is facing great challenges, such as ever-growing healthcare cost, limited healthcare resources, inconsistent healthcare quality and population aging, while the transformation into the smart healthcare system, enabled by new technologies and algorithms, further aggravated these problems by introducing new challenges, such as privacy, safety and security issues. Furthermore, the lifestyle supported by environmental degradation and soaring resource consumption jeopardizes people's health and wellbeing. In this paper, we evaluate, from the UV perspective, the challenges of the healthcare system and the current status of the smart healthcare system based on the framework of closed feedback control loop: data acquisition, communication, decision making and action. We propose that an effective smart healthcare system should take into consideration of the interaction between the smart healthcare system and other seven smart city subsystems: smart home, smart medicine and healthcare, intelligent transportation, urban planning and crowd management, smart energy management, smart city infrastructure, smart response system for city emergency, and smart humanity, and also study how the smart healthcare system would be affected by four major impacting factors of smart cities: information flow, material cycle, lifestyle and community. This systematic study will help us explore in depth the complicated dynamic relationship between multiple impacting factors and propose a UV-oriented, integrated, resilient, inclusive and sustainable development framework design to address current imminent challenges and to improve human health through patient-oriented monitoring, life-long healthcare data management, personalized lifestyle guidance and suggestions, preventive healthcare, and timely treatment.

[12B-14] A survey on addictions and their impact on human health
Speakers: Mengxi Guo
Time: 23:00-23:20, October 27th, U.S. Eastern Standard Time

[Smart Home & Community]

Time: 5:00-7:00, October 27th, U.S. Eastern Standard Time
Meeting Room (Microsoft Teams): [7A, Shenzhen]IEEE UV2020 Session
Student Chair(s): Yifan Zhou

[12B-10] Evaluation of Smart Home Systems and Novel UV-Oriented Solution for Integration, Resilience, Inclusiveness and Sustainability
Speakers: Yifan Zhou, Zhiyuan Yang, Yi Tao, Yifan Wei
Time: 5:00-7:00, October 27th, U.S. Eastern Standard Time
Abstract: At present time, smart homes are receiving more attention as they are becoming the predominant space which houses people's activities. Even though intelligent home appliances are capable of ameliorating residents' quality of life and decreasing their household workload, current smart homes are still limited to provide support and services to satisfy the needs of the aging society, small families, and busy lifestyles. Moreover, current smart homes lack robustness and resilience and introduce unexpected new challenges, including waste of energy

and resource, safety and security concerns, and financial challenges which are further aggravated by the imbalanced development of different regions and communities. In this paper, we evaluate, from the UV perspective, the challenges of the infrastructure system and the current status of the smart infrastructure system based on the framework of closed feedback control loop: data acquisition, communication, decision making and action. We propose that an effective smart home should take into consideration of the interaction between smart home subsystems and other seven smart city subsystems: smart medicine and healthcare, intelligent transportation, urban planning and crowd management, smart energy management, smart environmental protection, smart city infrastructure, smart response system for city emergency, and smart humanity, and also study how smart home and community would be affected by four major impacting factors of smart cities: information flow, material cycle, lifestyle and community. This systematic study will help us explore in depth the complicated dynamic relationship between multiple impacting factors and propose a UV-oriented, integrated, resilient, inclusive and sustainable development framework design to address current imminent challenges and to improve residents' quality of life through multi-source real-time smart monitoring, hierarchical and context-based data fusion, directed information disclosure within families and communities, "home operating system" featuring life-long learning of users' dynamic preferences, and smart appliances integration for subject-oriented, event-triggered and coordinated action.

[12B-13] Prototype Design of A Novel Simulation Platform for UV Smart Homes

Speakers: Hongye Li

Time: 7:00-7:20, October 27th, U.S. Eastern Standard Time

Abstract: Smart Home, as an indispensable part of future family life, is a core concept in Universal Village. People have also designed many home appliances and simulation software based on the concept of Smart Home. However, the functions of these devices and software are not systematic enough to fully meet the needs of people in daily life, and it is difficult to expand the content according to our vision of the Smart Home scene. Based on the above points and the UV concept, we mainly use Unity3D and Blender to design a Smart Home simulation platform. First, we model houses and character models, as well as some internal objects that will be used in family life. Then, we constructed the logic of interaction between characters and some household items. The results show that the simulation platform we implemented can successfully display some of the life scenes in future smart homes, and has good scalability so that we can continue to add corresponding functions in the future.

[Smart Environmental Protection]

Time: 8:00-10:00, October 27th, U.S. Eastern Standard Time

Meeting Room (Microsoft Teams): [6]IEEE UV2020 Session

Student Chair(s): Hao Yuan

[12B-11] Evaluation of Smart Environmental Protection Systems and Novel UV-Oriented Solution for Integration, Resilience, Inclusiveness and Sustainability

Speakers: Yuihin Shi, Shengyue Gao

Time: 8:00-10:00, October 27th, U.S. Eastern Standard Time

Abstract: At the present time, rapid urbanization is bringing convenience and high efficiency to our daily lives, but the increase in GDP comes with the cost of high metabolic rates, high waste per capita, severe lack of resources, heavy pollution, and waste siege. This cost-expensive lifestyle leads to severe environmental degradation and soaring resource consumption. In this paper, we evaluate, from the UV perspective, the challenges of the environment system, including land pollution, water pollution and air pollution, and the current status of smart environmental protection systems based on the framework of closed feedback control loop: data acquisition, communication, decision making and action. We propose that effective smart environmental protection should take into consideration of the interaction between environmental protection subsystems and other seven smart city subsystems: smart home, smart medicine and healthcare, intelligent transportation, urban planning and crowd management, smart energy management, smart city infrastructure, smart response system for city emergency, and smart humanity, and also study how smart environmental protection would be affected by four major impacting factors of smart cities: information flow, material cycle, lifestyle and community. This systematic study will help us explore in depth the complicated dynamic relationship between multiple impacting factors and propose a UV-oriented, integrated, resilient, inclusive and sustainable development framework design to address current imminent challenges and to improve our living environment through real-time monitoring of pollutions, crowd-sourcing based on hazard reports, identification of pollution sources, preventive waste and pollution control based on comprehensive management of material cycles and personalized lifestyle guidance and suggestions.

[12B-12] Design, Control and Verification of Thrust Vector Vertical Take-off and Landing UAV

Speakers: Sinuo Zhao

Time: 10:00-10:20, October 27th, U.S. Eastern Standard Time

Abstract: At present, UAV has been widely used in oil pipeline inspection, electric power inspection, precision agriculture, fire monitoring and other fields. The vertical take-off and landing (VTOL) UAV based on thrust vector structure can improve work efficiency and conserve energy. In this design, the power structure is optimized on the basis of VTOL, and the thrust vectoring device is used to replace the traditional aileron to change the attitude of the aircraft, thereby improving the flexibility and stability of the aircraft and effectively increasing the flight time of the aircraft, as well as testing and verifying the performance of the aircraft.

[12B-19] A Preliminary Study on the Distribution, Spread, Impacting Factors and Regulation Strategies of Air Pollution

Speakers: Shentong Rao

Time: 10:20-10:40, October 27th, U.S. Eastern Standard Time

Abstract: This study's focus is on the mechanism of air pollution and how to control and reduce air pollution. In this study, the harm and the components of air pollution, as well as several impacting factors that affected air pollution, including pollution sources, wind, and humidity, are investigated. Specifically, how air pollution's spread was affected by wind, pollutant sources, temperature, humidity, and locations, and the relationship between air pollution, fuel burning, and recycling will be introduced. It was found that air pollution couldn't be simply reduced through conventional policy regulation. This study proposes that people should study how air pollution would spread in general conditions, understand the tendency of changes in air pollution's concentration and spread, and take advantage of these factors to propose efficient and economical methods to control air pollution. The future work of this study will focus on analyzing in-depth how air pollution originated and spread, and exploring how to better control air pollution with the help of AI and big data.

Session 13A,13B,13C: UV Pitch Competition

Time: 20:30-23:00, October 23th, U.S. Eastern Standard Time
Meeting Room (Microsoft Teams): [13,Shenzhen] IEEE UV2020 Session
Chair(s): Wenhe Zhan, Yulan Yang
Assistant(s): Zhiyu Chen, Qiansheng Zhou

[13A&13B&13C-1] Smart Bra for Women Breast Pain
Participant(s): Jiashu Ren
Abstract: The Smart Bra is designed for women that are suffering from different kinds of breast pain. The Bra is an objective way to assess the chronic pain of the breast. It is a wearable device that can be used to monitor the electrodermal activity, heart rate, electromyogram and other bio-signals. By doing a fusion on these aspects, we hope we may be able to monitor breast pain and related activities more precisely.

[13A&13B&13C-2] Build-It-Yourself
Participant(s): John Galinato
Abstract: Build-It-Yourself, Educating the Next Generation of Leaders and Builders In the Classroom of the Future... How do we prepare the next generation of leaders and builders to develop intelligent energy, food production, transportation, health care and pollution control systems? Our mission is to develop a classroom of the future that teaches grade school students 21st century creativity and technical skills efficiently and effectively. Our 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. The Build-It-Yourself program reflects the research conducted by Professor Mitchel Resnick's Life Long Kindergarten group at the MIT Media Lab. •

National Science Foundation Grant - Beyond Black Boxes • 4 P's (Passion, Peer interaction, Project-based-learning, and Play) Build-It-Yourself is developing Invention Universe, a gamified LinkedIn for young builders. Invention Universe inspires, guides, and incentivizes kids to build. It enables them to share their portfolios of projects with fellow young builders from around the world. An Invention Universe portfolio can also be used in a college application to demonstrate passion and proficiency for art and technology.

[13A&13B&13C-3]SMART CAMPUS, WHAT IS THE NEXT?
Participant(s): Maoxuan Shan
Abstract: By applying Natural Language Processing, to optimize the human-computer interaction experience and control efficiency of teaching equipment, improve the convenience of campus learning and life information inquiry and classroom teaching management, create a simple, convenient, and smooth user experience, is the development direction of the next generation of Smart Campus. XiaoHu.ai, the campus information interaction and classroom teaching support system "what you say is what you get", based on Natural Language Processing, innovatively developed "Intention Recognition Algorithm Based on Sentence Pattern and Text Similarity", realized accurate analysis and identification of semantics in campus scenarios. A voice or text command can make the required information automatically and quickly pushed to the user, and a voice or text command can make the system quickly and automatically complete the equipment management task. Combining Natural Language Processing technology with specific application situations on campus, XiaoHu.ai realized "what you say is what you get", brought a significant improvement in the efficiency of campus information interaction and equipment management, greatly improved the use experience of students and teachers, and could be a beneficial exploration on development direction of the next generation Smart Campus.

[13A&13B&13C-4]Technical Solution To City Kitchen Waste Disposal
Participant(s): Green Kitchen Team
Abstract: The Green Kitchen team understands the current domestic market pain points of kitchen waste classification, treatment and resource utilization, and takes the lead in proposing a comprehensive solution of kitchen waste washing pretreatment process and black soldier fly cultivation. The scheme has small investment scale, large treatment capacity and low requirements for environmental impact assessment site selection. It can be completed and put into operation in three to five months.

[13A&13B&13C-5]Transmission-based Multichannel Food-borne Pathogenic Bacteria Rapid Detection System
Participant(s): Li Zunhua Team
Abstract: The "transmission-based multi-channel food-borne pathogen rapid

detection system" developed by Li Zunhua's team mainly integrates high-precision temperature control, high-sensitivity photoelectric detection, low-power power management, humanized touch screen, hot lid self-locking, and USB Communication and other functions. The experimental results show that it can detect E. coli within 60 minutes, with good specificity and sensitivity <10 copies/mL. It can be better extended to rapid detection of more food-borne pathogens, has strong application value, and can produce better economic value. Patent Number: A portable rapid bacteria detector, CN201910625978.X

[13A&13B&13C-6]Smart Home Super Smart Screen
Participant(s): WRT Intelligent Technology Co.,Ltd.
Abstract: Entire home intelligent is a simple and yet complex topic. The simplicity lies in realizing automatic control, that is, smart home. The complexity lies in how to transform smart home into intelligent home with the blessing of artificial intelligence, and how to make people not feel the complexity of intelligence in the intelligent home, while only need to simply enjoy comfortable home. This is a simple and yet complex issue.

[13A&13B&13C-7]New Type Emergency Air Source Direct Drinking Water System
Participant(s): Green Membrane Team
Abstract: Our Green Membrane team is committed to providing a holistic solution to the national "civil-military integration and innovation in new materials" through research and development innovation. Functional membrane materials independently developed are widely used in the fields of water purification, air purification, blood purification and emergency protection.There are currently five patents for invention, four utility models and three patents for appearance.

[13A&13B&13C-8]Safety Education Robot
Participant(s): Xiaoyong Team
Abstract: Xiaoyong's team was formed under the inspiration, guidance and guidance of Professor Wang Dawei，the Doctoral Advisor of the National Public Security University of China. It consists large of educational scenarios, focused on artificial intelligence and security education. By using NLP, CV and other AI technologies to create a personalized and visual patterns, with various security knowledge blend into safety education in the ways of games and main themes. In these ways, children would accept safty knowlege easily and to learn more of them. And those children cam improve self-protection abilities, and keep the impact of disasters and disasters to a minimum. Nowadays, our team has the most comprehensive security knowledge in the industry areas, and has built an artificial intelligence security education platform with security education robots as the carrier.

[13A&13B&13C-9]Industrialization of Tape Casting Cellphone Ceramic Back Cover,etc. 5G Components

Participant(s): Shanwei Qianzhan New Materials Co. Ltd.

Abstract: Qianzhan New Material Co. Team is lead by Dr. Li Gang, techniques are on base of special fine ceramic Lab.. Focus on the R. & D. and Production and sals of high-tech. ceramic raw materials, terminal products, equipments, analysing equipments, and software products。Its belong to R. & D. of new materials, manufacture fields.

[13A&13B&13C-10]Intelligent Energy Station

Participant(s): Jingde Team

Abstract: Jingde Team is committed to providing overall solutions for the country's "civil-military integration and new energy application and development" through r&d and innovation. The self-developed intelligent energy station is widely used in the fields of new energy power generation, charging, power supply and electric vehicles. At present, it has 2 invention patents and 4 utility model patents.

[13A&13B&13C-11]Ten Thousand mu of Blueberry Planting Plan

Participant(s): Guolan Team

Abstract: Guolan team cooperated with the School of Biological Sciences of Michigan Technological University in the US to develop and research of blueberry planting, seedling, propagating in the south and growing in the north, breeding and processing products in Guangdong Province. After years of practice, planning and scientific demonstration, the team have achieved certain results.

Session 13D: K-12 Challenge

Time: 23:00-24:00, October 23th, U.S. Eastern Standard Time
Meeting Room (Microsoft Teams): [13,Shenzhen] IEEE UV2020 Session
Chair(s): Wenhe Zhan, Yulan Yang
Assistant: Jingyuan Chen

[13D-1] Our Universe, Our Village
Participant(s): Sunny Tian
Category: Talents Shows
Abstract: The poem I wrote starts off with comparisons are large and small things, just like the relationship between a universe and a village. They come together and make one unified place. The second half of the poem gives some examples of how technology can be used in this generation to improve our day-to-day lives. The drawing is a Ying & Yang symbol, where opposites, in the case the universe and village, attract. On one half of the Ying & Yang is the universe and on the other is the village. One of the symbols for the website is also a Ying & Yang which also inspired me.

[13D-2] MicroCool
Participant(s): Veronica (Yiru) Wang
Category: Research Presentation
Grade: Fifth Grade
Abstract: MicroCool cools fast and I mean really fast. It is portable and you can take it anywhere! It is not too big and pretty light! It solves all your problems, it's fast, and nice size, it keeps your drink/food cold for a long time and it actually cools your food! I know there are already a few companies creating things that cool your drinks fast, but MicroCool is the real reverse microwave. While those other things can only cool drinks. MicroCool can cool ANYTHING! It's about the same size as

a microwave and works about the same, it's literally the reverse microwave you have been waiting for.

[13D-3] The Story of Masks
Participant(s): Qingyue Yang
Category: Innovation Competition
Abstract: In the 2020 epidemic, each of us puts on a mask to prevent the virus' attacking. Masks have become an essential part of my daily life. In this speech, I will explore the importance of design and technology for our safe lives by understanding the different masks of countries all over the world.

[13D-4] The Story of Garbage Classification
Participant(s): Huayue Cao
Category: Innovation Competition
Abstract: Garbage sorting is to protect the earth. My understanding of garbage sorting began when my mother entered the classroom. The kindergarten teacher taught us how to sort garbage. Now garbage sorting has become something I must do every day. In the speech, I explored the close relationship between garbage sorting and healthy life by understanding the design of trash cans in different countries.

[13D-5] Challenges of Current Infrastructure – Costly Maintenance
Participant(s): Julina Li
Category: Research Presentation
Abstract: In this presentation, I evaluated the challenge that the traditional infrastructure is facing from the perspective of costly maintenance. The traditional infrastructure is failing b/c of aging, traditional plans insufficient for new demands, and severe environmental shocks. This systematic study of the city infrastructure maintenance cost will help us search for short-term and long-term solutions to address this issue. I analyzed the challenges that stand in the way of a smart city's development, including high financial requirements, data sharing disconnect, and tedious technology implementation. Challenges can be overcome through predictive maintenance and automation training. After studying a few current solutions and comparing their pros & cons, I propose that Policymakers need to develop more flexible, durable platforms to keep up with maintenance and capital needs.

[13D-6] A Systematic Review of the Interaction between Smart Infrastructure and Other Subsystems of Smart Cities
Participant(s): Andrew Lu
Category: Research Presentation
Abstract: Even considering the rapidly developing technology and advances in infrastructure development, many humans live in an age of infrastructural crisis

and difficulties. Crowds of outdated infrastructure and failed infrastructural procedures awaiting renovation and revision continue to limit the possibilities of a greater future. The slow modernization of infrastructure and smart infrastructure has improved development, while the current society still lays far from perfect. The uncoordinated functions for infrastructure systems induce devastation upon our population's wellbeing. This study investigated the interactions between the aforementioned Smart infrastructure and various Smart subsystems of smart cities, including smart homes, smart healthcare, ITS, smart energy, smart infrastructure, smart response system for city emergency, smart environmental protection, and smart humanity. The interaction study examined how these smart subsystems would help with various infrastructure functions, including supply, construction & planning, centralized coordination, regulation and administration, mobility, waste management, and integrative & sustainable lifestyle. The study also examined several applications of smart infrastructure that effectively exploited the mutual interaction information and improved the performance of infrastructure. Such analysis helped to further the understanding of infrastructure systems and to allow for innovative system design with ideal system coordination.

Session 14: UV Exhibition

Time: 9:00am-11:00am, October 24th, U.S. Eastern Standard Time
Meeting Room (Zoom): https://zoom.us/j/2203649968 Passcode: 902111
Chair(s): John Galinato
Assistant: Shengyue Gao

[14-1]AMERICAR

Americar is a futuristic transport robot that carries leading L4 autonomous driving technologies. We have committed ourselves to innovative autonomous truck systems that will be accessible and beneficial in the smart urban ecology.

[14-2]BROAD GROUP

BROAD GROUP

BROAD Group is a private manufacturing enterprise dedicated to original innovation. Since its inception in 1988, BROAD has never copied any technology of its peers. All technologies developed by BROAD are focused on energy efficiency, material conservation, cleanliness, durability and intelligence, and all its products have reached an unparalleled level that no one in the industry can match.

[14-3]Build-It-Yourself

Our mission is to develop a classroom of the future that teaches grade school students 21st century creativity and technical skills efficiently and effectively. Our 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. The Build-It-Yourself program reflects the research conducted by Professor Mitchel Resnick's Life Long Kindergarten group at the MIT Media Lab.

ONLINE CONFERENCE

Due to safety concerns arising from the COVID-19 pandemic, the 5th International Conference on Universal Village (IEEE UV2020) will be held as an online conference using the Microsoft Teams from October 24th-27th, 2020.

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- This background picture below is for **Speakers** including keynote speakers, invited speakers, authors of papers, participants of Pitch Competition, and participants of student forum.

- This background picture below is for **Organizing Committee** including general chairs, international chairs, program chairs, etc.

- This background picture below is for **UV Staff** including session assistants,
volunteers, and other organizing staff

Microsoft Teams Connection for Plenary Session

There are two methods.

Method 1: Access through Meeting Link

Here below is the link to the *Microsoft Teams* meeting room dedicated to the plenary session.

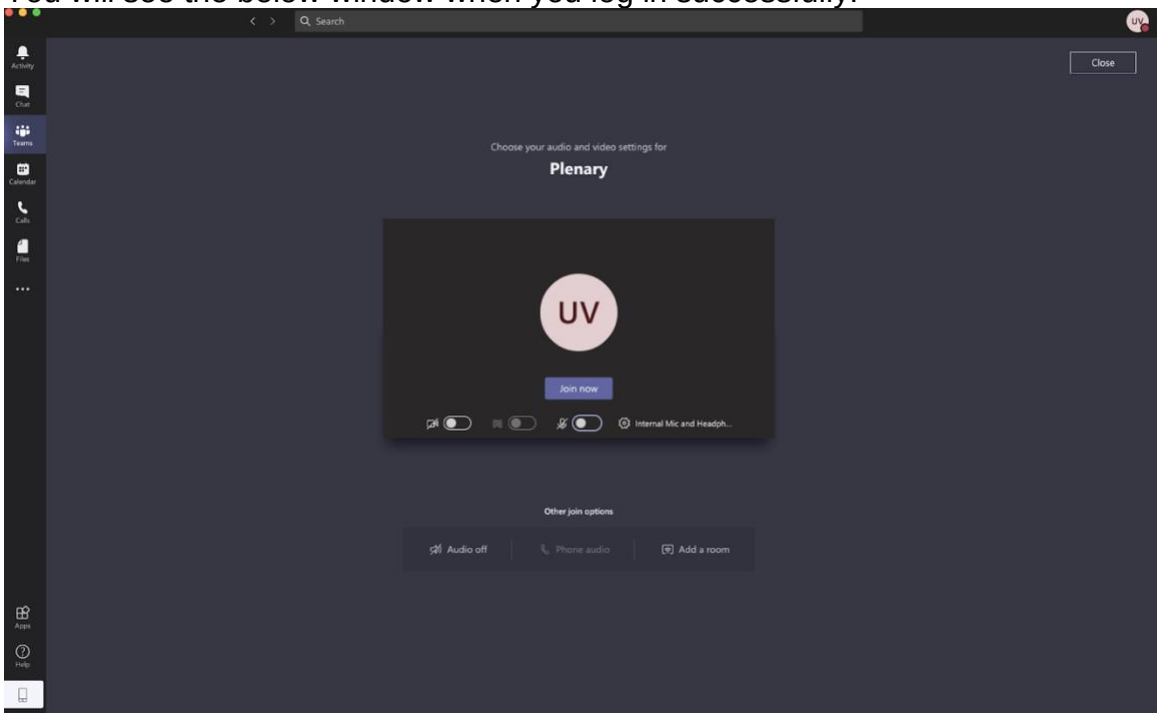
https://teams.microsoft.com/l/meetup-join/19%3a752fdf6675f14cae9192a95b2b006cb1%40thread.tacv2/1603100812409?context=%7b%22Tid%22%3a%229c592e51-f63f-4295-8f23-444bf6d6afd3%22%2c%22Oid%22%3a%225524639c-4f6f-479a-8846-3054346bc2f2%22%7d

Please open the link in a browser. Then, please click “Open your Teams app” and click “Open Microsoft Teams.” Please use the latest Desktop Version of the Microsoft Teams for optimal experience.

Afterwards, if you have previously signed into the Microsoft Teams using other accounts, please log out.

Please use the account and the password that we provide you to log into the Microsoft Teams.

You will see the below window when you log in successfully:

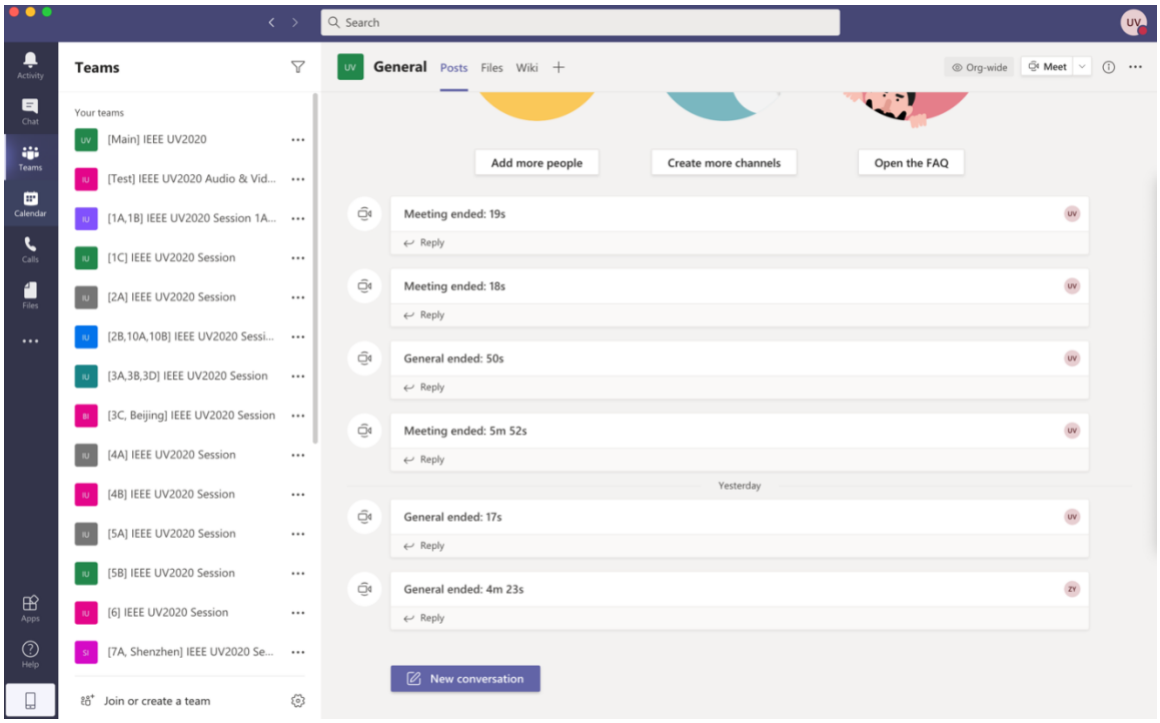


Please then click “Join Now” and you will be able to join the meeting.

Method 2: Access through “Teams”

If you choose to log into *Microsoft Teams* directly without using the meeting link, please use the account and the password that we provide you to log in.

You will see the below window when you log in successfully:



The plenary session will be held in the team of “[Main] IEEE UV2020.” Anyone can join the plenary session by clicking “[Main] IEEE UV2020” and then “[20201026] Plenary.”

Microsoft Teams Connection for Other Sessions - Access through “Teams”

On the left of the window, you can see all sessions in IEEE UV2020 after clicking “Teams”. We have created dedicated “Teams” for all sessions. You can join meetings of all sessions by clicking on their “Teams.” Here below are all the “Teams” (or sessions) you can join.

- **[Main] IEEE UV2020:** For Opening/Closing Ceremony and Plenary Session, and Q&A, as well as session 15A.
- **[Test] IEEE UV2020 Audio & Video Testing Session:** For testing.
- **[1A, 1B] IEEE UV2020 Session:** For holding session 1A and 1B.
- **[1C] IEEE UV2020 Session:** For holding session 1C.
- **[2A] IEEE UV2020 Session:** For holding session 2A.
- **[2B,10] IEEE UV2020 Session:** For holding session 2B, 10A and 10B.
- **[3A,3B,3D] IEEE UV2020 Session:** For holding session 3A, 3B and 3D.
- **[3C] IEEE UV2020 Session:** For holding session 3C.
- **[4A] IEEE UV2020 Session:** For holding session 4A.
- **[4B] IEEE UV2020 Session:** For holding session 4B.

- **[5A] IEEE UV2020 Session:** For holding session 5A.
- **[5B] IEEE UV2020 Session:** For holding session 5B.
- **[6] IEEE UV2020 Session:** For holding session 6.
- **[7A] IEEE UV2020 Session:** For holding 7A.
- **[7B] IEEE UV2020 Session:** For holding 7B.
- **[8A] IEEE UV2020 Session:** For holding 8A.
- **[8B] IEEE UV2020 Session:** For holding 8B.
- **[9A,9B] IEEE UV2020 Session:** For holding 9A and 9B.
- **[9C,9D] IEEE UV2020 Session:** For holding 9C and 9D.
- **[11A] IEEE UV2020 Session:** For holding 11A.
- **[12A] IEEE UV2020 Session:** For holding 12A.
- **[11B] IEEE UV2020 Session:** For holding 11B.
- **[12B,Student Forum] IEEE UV2020 Session:** For holding 12B.
- **[13,Pitch Competition]** IEEE UV2020 Session: For holding 13A, 13B, 13C and K-12 Challenge.
- **[15B] IEEE UV2020 Session:** For holding 15B.

Additional Instructions on using Microsoft Teams for First-time Users

https://docs.google.com/document/d/1fV-fWgRmKHxHmWhwbl8toFC8GRakz8-ysNWM960-cjo/edit?usp=sharing

Zoom Link for Session 14-B

https://zoom.us/j/2203649968
Passcode: 902111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