

2022 Asia Pacific Signal and Information Processing Association  
Annual Summit and Conference  
(APSIPA ASC)



Proceedings of 2022 APSIPA  
Annual Summit and Conference



7 - 10 November 2022



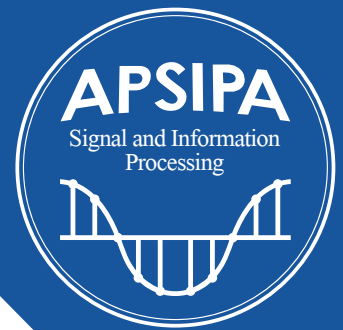
Chiang Mai, Thailand,

# APSIPA ASC 2022

[www.apsipa2022.org](http://www.apsipa2022.org)

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APSIPA  
ASC  
2022

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# Message from General Co-Chairs



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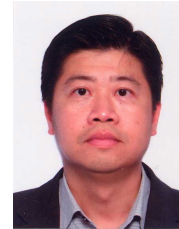
Kosin  
Chamnongthai



Toshihisa Tanaka



Anthony Kuh



Kenneth Kin-  
Man Lam

Welcome to the 2022 version of Asia Pacific Signal and Information Processing Association Annual Summit and Conference (APSIPA ASC 2022). This year ASC is held in Chiang Mai, the capital of the ancient Lanna Kingdom dated back over 700 years. APSIPA ASC 2022 is our first face-to-face ASC after the beginning of COVID-19. The committee decided to have the ASC in presence so that we can get back to normal life. However, we allow video presentations by the participants who cannot come in person due to restrictions established by their countries or institutions.

This year ASC provides the broad spectrum of activities like previous years. It is our great honor to welcome 3 keynote speakers:- Kyoung Mu Lee, Weisi Lin, and Dong Yu. For the general track, there are technical sessions on Signal Processing Systems: Design and Implementation; Signal and Information Processing Theory and Methods; Speech, Language, and Audio; Biomedical Signal Processing and Systems, Image; Video, and Multimedia, Multimedia Security and Forensics; Wireless Communications and Networking; Deep Learning: Algorithm, Implementations, and Applications; Signal and Information Processing in Education; Medical Signal Acquisition, Analysis and Processing; Internet of Things Technology; Data Analytics and Machine Learning; Human Biometrics and Security Systems; and Signal and Information Processing for Smart Systems. On top of that, APSIPA ASC 2022 provides 23 special sessions, 4 tutorials, and 1 industrial forum. There are 7 lectures for Winter School and Distinguished Lecturer Program. The APSIPA Sadaoki Furui Prize Paper Award will be announced during the ASC. There is also a Special Memorial Event for Prof. Sadaoki Furui,



APSIPA Founding President. The APSIPA social events including Board of Governors (BoG) Meeting, Technical Committee (TC) Meetings, Annual General Meeting (AGM), and APSIPA Women Luncheon are arranged.

Even in the uncertain time period due to the pandemic, APSIPA ASC 2022 still attracted 496 submissions in which 360 of those were accepted. As of now, there are more than 400 participants registered. We anticipate to have some more walk-in registrations during the ASC. We would like to thank Google, Huawei, and Thailand Convention & Exhibition Bureau (TCEB) for the financial sponsorships. The technical sponsors this year include Chiang Mai University, IEEE Signal Processing Society, IEEE Thailand Section, IEEE Computer Society (Thailand Chapter), and Electrical Engineering/Electronics, Computer, Telecommunications and Information Technology Association of Thailand.

Finally, we would like to thank all of committee members, staff, and student helpers who make this ASC possible. Your tirelessly work and efforts to prepare and host our ASC during the past several months till now are recognized. Last but not least, we would like to express our appreciation to all participants for your supports, whether those who can make it to Chiang Mai or join us online. We cannot complete this ASC without your supports. Enjoy your stay in the wonderful city of Chiang Mai.

**General Co-Chairs, APSIPA ASC 2022**

# Message from APSIPA president



On behalf of the Asia Pacific Signal and Information Processing Association (APSIPA) it is my great pleasure and honor to welcome each of you to the APSIPA Annual Summit and Conference (ASC), to be held in-person in Chiang Mai, Thailand from November 7-10, 2022. This is the 14th APSIPA ASC and the first in-person ASC to be held fully in-person since 2019.

The first APSIPA ASC was held in Sapporo, Japan in 2009 and we have had annual ASCs every year since then in locations around Asia, United States, and New Zealand. Since 2009, APSIPA has become a vibrant community of researchers and educators in signal and information processing. APSIPA now has many activities for our members including distinguished lecturers, seasonal schools, technical committee activities, and local chapter activities. In addition, we have the APSIPA Transactions on Signal and Information Processing and the APSIPA Newsletter.

Our premier event and most visible activity continue to be our Annual Summit and Conference. We hope that all of you can enjoy, learn, and benefit from this year's ASC.

This year, the APSIPA ASC will be held in the beautiful city of Chiang Mai which has a rich history and is a cultural landmark (UNESCO title of creative city) located in a mountainous region in northern Thailand. This is the first APSIPA ASC to be held in-person since the outbreak of COVID-19 as APSIPA ASC 2020 held in Auckland, New Zealand was entirely virtual and APSIPA ASC 2021 held in Tokyo, Japan was a hybrid (in-person and virtual) conference. We look forward to welcoming back the APSIPA community in person at the ASC.

We give our sincere thanks to the entire organizing committee and volunteers with special thanks to the General Co-Chairs: Prof. Nipon Theera-Umpon, Prof. Kosin Chamnongthai, Prof. Toshihisa Tanaka, and Prof. Kenneth Kin-Man Lam. They have worked hard to put together a great program that includes keynote talks, overview sessions, special sessions, regular sessions, and an industrial forum. Additionally, there will be a winter school (date and time to be announced) and the second APSIPA women's event (date and time to be announced). We would also like to thank the keynote speakers, authors of special session and regular papers, and all attendees.

We look forward to a very successful APSIPA ASC and I hope to interact with many of you.

Best wishes and thank you,

**Anthony Kuh**

President, APSIPA (2021-2022)

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Kazumasa Yamamoto	Sermsak Uatrongjit	Zhiyong Zhang
Kazunori Hayashi	Sheng Li	
Keigo Wakayama	Shi-Lin Wang	



# Keynote Speakers I



Prof. Kyoung Mu Lee

Director of Interdisciplinary Program in Artificial Intelligence  
Dept. of ECE, Seoul National University

## *“Task Adaptive Meta-Learning for Computer Vision”*

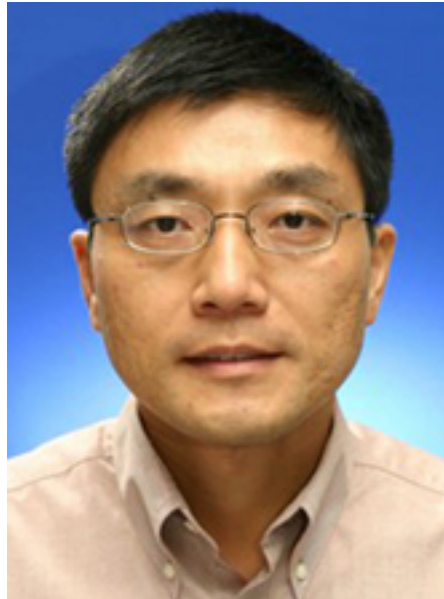
**Abstract:** Few-shot learning is an emerging yet challenging problem in which the goal is to achieve generalization from only a few examples. Meta-learning tackles few-shot learning via learning prior knowledge shared across tasks and using it to learn new tasks. Owing to the flexibility and generalizability, optimization-based meta-learning algorithms have emerged as one of the promising methods for few-shot learning. MAML is one of the most popular instances of optimization approaches, owing to its simplicity and applicability across diverse problem domains. However, it is known for its low generalization performance. To overcome the limitations of the MAML-based methods, we introduce effective and flexible optimization-based meta-learning algorithms that are generalizable across diverse practical domains. More specifically, to achieve outstanding and robust performance, novel task-adaptive optimization schemes (task-adaptive initialization, task-adaptive update-rule, and task-adaptive loss

function) are introduced to more effectively facilitate the adaptation to diverse tasks. The extensive experiments have demonstrated the outstanding performance of proposed meta-learning algorithms with task-adaptive optimization across few-shot learning benchmark datasets and more realistic computer vision problems such as visual tracking and video frame interpolation.

**Short Bio:** KYOUNG MU LEE (Fellow, IEEE) is currently the Editor in Chief of the IEEE TRANSACTIONS ON PATTERN ANALYSIS AND MACHINE INTELLIGENCE (TPAMI); He received the B.S. and M.S. degrees in control and instrumentation engineering from Seoul National University (SNU), Seoul, South Korea, in 1984 and 1986, respectively, and the Ph.D. degree in electrical engineering from the University of Southern California, in 1993. He is the director of the Interdisciplinary Graduate Program in Artificial Intelligence at SNU. He is an Advisory Board Member of the Computer Vision Foundation (CVF). He was a Distinguished Lecturer of the Asia-Pacific Signal and Information Processing Association (APSIPA), from 2012 to 2013. He has received several awards, in particular, the Medal of Merit and the Scientist of Engineers of the Month Award from the Korean Government, in 2018 and 2020, respectively; the Most Influential Paper Over the Decade Award by the IAPR Machine Vision Application, in 2009; the ACCV Honorable Mention Award, in 2007; the Okawa Foundation Research Grant Award, in 2006; the Distinguished Professor Award from the College of Engineering of SNU, in 2009; and the SNU Excellence in Research Award in 2020. He has also served as a General Chair for ICCV2019, ACMMM2018, and ACCV2018; a Program Chair for ACCV2012; a Track Chair for ICPR2020 and ICPR2012; and an Area Chair for CVPR, ICCV, and ECCV many times. He has served as an Associate Editor-in-Chief (AEIC) and an Associate Editor for the Machine Vision and Application (MVA) journal, the IPSJ Transactions on Computer Vision and Applications (CVA), and the IEEE SIGNAL PROCESSING LETTERS (SPL); and an Area Editor for the Computer Vision and Image Understanding (CVIU). He is the founding member and served as the President of the Korean Computer Vision Society (KCVS). Prof. Lee is a Fellow of IEEE, a member of the Korean Academy of Science and Technology (KAST) and the National Academy of Engineering of Korea (NAEK).

**Personal website:** <https://cv.snu.ac.kr/index.php/~kmllee/>

# Keynote Speakers II



Weisi Lin

## *“New Opportunities of Visual Representation for Machine Intelligence”*

**Abstract:** With the waves of AI, increasingly more visual signals are intended for machines (rather than humans) as the ultimate users. What opportunities may this shift bring for visual representation, e.g., to address the requirements of Video Coding for Machines (VCM), JPEG AI and beyond? In this talk, we will first discuss how to determine visual signal sensitivity toward machine intelligence (MI). MI-oriented models can be also developed for identity/privacy protection. Secondly, a possible paradigm change of visual representation is explored: intermediate, deep-learnt visual features (instead of a whole image) can be the basic unit of representation for MI. This brings intelligence to the edge, facilitates edge-cloud collaboration, and leads to integration of signal representation and computer vision which have been separate processes for long.

**Short Bio:** Weisi Lin researches in intelligent image and video processing, computational perceptual signal assessment, and multi-modality/media modeling. He received his B.Sc and M. Sc from Sun Yat-Sen University, China, and Ph.D. from King's College, U.K. He is currently a Professor in School of Computer Science and Engineering, Nanyang Technological University, Singapore, where he also serves as the Associate Chair (Research).

He is a Fellow of IEEE and IET, and has been a Highly Cited Researcher 2019, 2020 and 2021. He has elected as a Distinguished Lecturer in both IEEE Circuits and Systems Society (2016-17) and Asia-Pacific Signal and Information Processing Association (2012-13), and given keynote/invited/tutorial/panel talks in 40+ international conferences. He has been an Associate Editor for IEEE Trans. Image Process., IEEE Trans. Circuits Syst. Video Technol., IEEE Trans. Multimedia, IEEE Signal Process. Lett., Quality and User Experience, and J. Visual Commun. Image Represent., and a Senior Editor in APSIPA Trans. Info. and Signal Process, as well as a Guest Editor for 7 special issues in different journals. He also chaired the IEEE MMTC QoE Interest Group (2012-2014); he has been a Technical Program Chair for IEEE ICME 2013, QoMEX 2014, PV 2015, PCM 2012 and IEEE VCIP 2017. He leads the Temasek Foundation Programme for AI Research, Education & Innovation in Asia, 2020-2025. He believes that good theory is practical, and has delivered 10+ major systems for industrial deployment with the technology developed.

**Personal website:** <https://personal.ntu.edu.sg/wslin/Home.html>

# Keynote Speakers III



**Dr. Dong Yu**

## *“Voice Enhancement, Separation, and Compression”*

**Abstract:** We have seen significant progress in voice processing in the past several years. In this talk, I will introduce a series of techniques developed at Tencent AI Lab on voice enhancement, separation, and compression and their applications in real-world scenarios such as music separation, in-car voice processing, and online meetings. I will describe the key paradigm change behind all these advancements and the solutions to new problems observed in the new paradigm.



**Short Bio:** Dr. Dong Yu is an IEEE Fellow, an ISCA Fellow, and an ACM distinguished scientist. He currently works at Tencent AI Lab as a distinguished scientist and vice general manager. Prior to joining Tencent in 2017, he worked as a principal researcher at Microsoft Research (Redmond), where he had been since 1998. He has concentrated his research on speech recognition and processing, as well as natural language processing in recent years. He has two monographs and over 300 papers to his credit. His work has been widely cited, and he has received the prestigious IEEE Signal Processing Society best paper award in 2013, 2016, and 2020, as well as the 2021 NAACL best long paper award. He was a forerunner in the use of deep learning techniques in automatic speech recognition.

Dr. Dong Yu is currently serving as the chair of the IEEE Speech and Language Processing Technical Committee (SLTC). He has served on the editorial boards of numerous journals and magazines, as well as on the organizing and technical committees of numerous conferences and workshops, including serving as the technical co-chair of ICASSP 2021.

**Personal website:** <https://sites.google.com/view/dongyu888/>

# **Overview Session**

6 November 2022	16.00 - 18.00	Registration Desk Open	
7 November 2022	8.00 - 16.00	Registration Desk Open	
	8.30 - 10.00	Tutorial Room1	Tutorial Room2
		Title: Fake News Detection and its impact analysis (1st Half)  Speaker: Mehul S Raval  <u>(Abstact)</u>	Title: Statistical Learning for Multi-Sensor Signals and Multivariate Time-Series Data (1st Half)  Speaker: Pavel Loskot  <u>(Abstact)</u>
	10.00 - 10.15	Break	
	10.15 - 11.45	Tutorial Room1	Tutorial Room2
		Title: Fake News Detection and its impact analysis (2nd Half)  Speaker: Mehul S Raval  <u>(Abstact)</u>	Title: Statistical Learning for Multi-Sensor Signals and Multivariate Time-Series Data (2nd Half)  Speaker: Pavel Loskot  <u>(Abstact)</u>
	11.45 - 13.00	Lunch	
	13.00 - 14.30	Tutorial Room1	Tutorial Room2

		<p>Title: Human Biometrics: A Deep Learning Approach (1st Half)</p> <p>Speaker: Waleed H. Abdulla</p> <p>(Abstact)</p>	<p>Title: Tensor Regression: Methods and Applications (1st Half)</p> <p>Speaker:Yipeng Liu</p> <p>(Abstact)</p>
	14.30 - 15.15	Break	
	15.15 - 16.45	Tutorial Room1	Tutorial Room2
		<p>Title: Human Biometrics: A Deep Learning Approach (2nd Half)</p> <p>Speaker: Waleed H. Abdulla</p> <p>(Abstact)</p>	<p>Title: Tensor Regression: Methods and Applications (2nd Half)</p> <p>Speaker:Yipeng Liu</p> <p>(Abstact)</p>
	16.45 - 17.15	<p>Invited Talk "Promoting Yourself: How to appeal accomplishments for member-level elevation, award nomination, and promotion in the affiliation"</p> <p>Speaker: Akihiko K. Sugiyama</p> <p>(Abstact)</p>	
	18.30 - 20.30	Welcome Party	
8 November 2022	8.00 - 16.00	Registration Desk Open	
<a href="#">Full Session Link</a>	8.30 - 8.45	Opening Ceremony	
	8.45 - 9.45	Title: Task Adaptive Meta-Learning for Computer Vision	

		Keynote: Prof. Kyoung Mu Lee  <u>(Abstact)</u>							
	9.45 - 10.15	APSIPA Sadaoki Furui Prize Paper Award							
	10.15 - 10.35	Break							
	10.35 - 12.35	TuAM1-1 (SS13:Advanced Topics on Sound Event and Scene Analysis)	TuAM1-2 (Speech, Language, and Audio 1)	TuAM1-3 (Human Biometrics and Security Systems)	TuAM1-4 (Signal Image and Information Processing Theory and Methods)	TuAM1-5 (SS01: Reconfigurable Computing and Performance Evaluation)	TuAM1-6 (Signal and Information Processing Theory and Methods)	TuAM1-7 (Speech, Language, and Audio 2)	TuAM1-8 (SS10: Real-world sensing technologies of human function)
		Chair: Nobutaka Ono	Chair: Tomoki Toda	Chair: Jessada Karnjana	Chair: Daranee Hormdee	Chair:Ukrit Mankong	Chair: Xiao-Lei Zhang	Chair: Natthanan Promsuk	Chair: Yumie Ono/Toshihisa Tanaka
	12.35 - 14.00	Lunch /APSIPA TC meetings							
	14.00 - 15.00	Title: New Opportunities of Visual Representation for Machine Intelligence  Keynote: Prof. Weisi Lin  <u>(Abstact)</u>							
	15.00 - 15.20	Break							
	15.20 - 17.40	TuPM1-1 (SS15: Advanced Sensing Technologies using Wireless Signal)	TuPM1-2 ( Speech, Language, and Audio 1)	TuPM1-3 (Signal Processing Systems: Design and Implementation)	TuPM1-4 (Signal Image and Information Processing Theory and Methods)	TuPM1-5 (Research Review )	TuPM1-6 (SS02: Deep Learning Systems and Applications for Cloud, Fog, and Edge)	TuPM1-7 (Speech, Language, and Audio 2)	TuPM1-8 (SS12: Advanced signal detection and inspection technology)



		Chair: Rohan Kumar Das	Chair: Kasemsit Teeyapan	Chair: Tatsuya Yokota	Chair: Jia-Ching Wang	Chair: Jesin James	Chair: Christian H Ritz	Chair: Settha Tangkawanit	Chair: Rohan Kumar Das
	17.40 - 18.40	Special Memorial Event for Prof. Sadaoki Furui, APSIPA Founding President							
	18.40 - 20.40	Banquet (Best Paper Award)							
9 November 2022	8.30 - 16.00	Registration Desk Open							
Full Session Link	9.00 - 11.00	WedAM1-1 (SS11: Transfer Learning for Real World)	WedAM1-2 (Speech, Language, and Audio 1)	WedAM1-3 ( Deep Learning: Algorithm, Implementations, and Applications)	WedAM1-4 (Signal Image and Information Processing Theory and Methods)	WedAM1-5 (Research Review)	WedAM1-6 (SS17: Emerging Diseases and Smart Image Processing)	WedAM1-7 (Speech, Language, and Audio 2)	WedAM1-8 (SS04: Advanced Signal Processing and Machine Learning for Audio and Speech Applications)
		Chair: Xiaoxu Li/ Dome Potikanond	Chair: Xiaofen Xing	Chair: Hiroyoshi Ito	Chair: Mingyi He	Chair: Ying-Hui Lai	Chair: Krisana Chinnasarn	Chair: Wei-Ping Zhu	Chair: Shoji Makino
	11.20 - 12.20	Title: Voice Enhancement, Separation, and Compression  Keynote: Prof. Dong Yu  <u>(Abstact)</u>							
	12.20 - 14.00	Lunch/ APSIPA Women Luncheon							
	14.00 - 16.00	WedPM1-1 (SS05: Advanced Image and Video Processing	WedPM1-2 (Speech, Language, and Audio 1)	WedPM1-3 ( Deep Learning: Algorithm, Implementations, and Applications)	WedPM1-4 (Signal Image and Information Processing Theory and Methods)	WedPM1-5 (Research Review )	WedPM1-6 (Signal Proceesing for Audio and Speech Applications)	WedPM1-7 (Speech, Language, and Audio 2)	WedPM1-8 (Data Analytics and Machine Learning)

		using Deep Learning)							
		Chair: Chul Lee	Chair: Ashish Panda	Chair: Jen-Tzung Chien	Chair: Zhang Ke	Chair: Koichi Fujiwara	Chair: Tomoyosi Akiba	Chair: Daranee Hormdee	Chair: Chern Hong Lim
	16.00 - 16.20	Break							
	16.20 - 18.40	WedPM2-1 (SS05: Advanced Image and Video Processing using Deep Learning)	WedPM2-2 (Speech, Language, and Audio 1)	WedPM2-3 ( Deep Learning: Algorithm, Implementations, and Applications)	WedPM2-4 (SS14: Emerging Signal Processing Technology for Medical Applications/ Biomedical Signal Processing and Systems)	WedPM2-5 (SS16: Emerging Techniques in Multimedia Data Analytics and Codings)	WedPM2-6 (Signal Proceesing for Audio and Speech Applications)	WedPM2-7 (SS20: High Performance Intelligent Technologies for Image and Video Applications)	WedPM2-8 (Data Analytics and Machine Learning)
		Chair: Chul Lee	Chair: Kasemsit Teeyapan	Chair: Masaomi Kimura	Chair: Yuttapong Jiraraksopakun	Chair: Patiwet Wuttisarnwattana/ Kampil Woradit	Chair: Sunao Hara/Sutasinee Thovuttikul	Chair: Jing-Ming Guo	Chair: Wanus Srimaharaj
	19.00 - 21.00	Board of Governors (BoG) Meeting							
10 November 2022	8.30 - 16.00	Registration Desk Open							
<a href="#">Full Session Link</a>	9.00 - 11.00	ThAM1-1 (Image Video Multimedia)	ThAM1-2 (Speech, Language, and Audio 1)	ThAM1-3 ( Deep Learning: Algorithm, Implementations, and Applications)	ThAM1-4 (Biomedical Signal Processing and Systems)	ThAM1-5 (SS21: Recent Advances and Applications in Encrypted Domain)	ThAM1-6 (SS19: Towards real-world human-centric acoustic signal processing)	ThAM1-7 (SS22: Recent Advances in Biometrics and Security)	ThAM1-8 (Other related speech processing)
		Chair: Masaaki Ikehara		Chair: Kasemsit Teeyapan	Chair: Daranee Hormdee	Chair: Simying Ong	Chair: Sermsak Uatrongjit	Chair: Koichi Ito	Chair: Sansanee Auephanwiriyakul

			Chair: Ying Hu/ Toshio Irino						
	11.00 - 12.30	Lunch							
	12.30-14.30	ThPM1-1 (Image Video Multimedia)	ThPM1-2 (Speech, Language, and Audio 1)	ThPM1-3 (Deep Learning: Algorithm, Implementations, and Applications)	ThPM1-4 (SS07: Latest Wireless Technologies for Sensing and Communications)	ThPM1-5 (SS08: Digital Convergence of 5G/B5G, AIoT and Security)	ThPM1-6 (SS23: Selected Papers from APSIPA Workshop in Hanoi, Vietnam)	ThPM1-7 (SS06: Adversarial Attacks and Defense)	ThPM1-8 (Industrial Forum "New era opened by AI-based image processing")  <a href="#">(More details)</a>
		Chair: Masaki Kawamura	Chair: Takanobu Nishiura	Chair: Jen-Chun Lin	Chair: Osamu Takyu	Chair: Kampol Woradit	Chair: Nguyen Linh Trung	Chair: Minoru Kuribayashi	Chair: Jangwoo Kwon
	14.30 - 15.00	Break							
	15.00 - 17.00	ThPM2-1 (Image Video Multimedia)	ThPM2-2 (Speech, Language, and Audio 1)	ThPM2-3 (Deep Learning: Algorithm, Implementations, and Applications)	ThPM2-4 (SS18: Metaverse: Future of Internet)	ThPM2-5 ( Wireless Communication and networking)	ThPM2-6 (SS23: Selected Papers from APSIPA Workshop in Hanoi, Vietnam)	ThPM2-7 (SS15: Advanced Sensing Technologies using Wireless Signal)	
		Chair: Nam Ik Cho	Chair: Yoshiaki Itoh	Chair: Kasemsit Teeyapan	Chair: Navadon Khunlertgit	Chair: Poompat Saengudomlert	Chair: Nguyen Linh Trung	Chair: Kampol Woradit	
	17.00 - 17.30	Annual General Meeting (AGM)							
	17:30 - 17:45	Closing ceremony							

# Industrial Forum



Yanzhi Wang

Northeastern University, Chairman and former CEO of CoCoPIE Inc., USA

## *“Towards Best Possible Deep Learning Acceleration on the Edge – A Compression-Compilation Co-Design Framework”*

### Abstract:

Mobile and embedded computing devices have become key carriers of deep learning to facilitate the widespread of machine intelligence. However, there is a widely recognized challenge to achieve real-time DNN inference on edge devices, due to the limited computation/storage resources on such devices. Model compression of DNNs, including weight pruning and weight quantization, has been investigated to overcome this challenge. However, current work on DNN compression suffer from the limitation that accuracy and hardware performance are somewhat conflicting goals difficult to satisfy simultaneously.

We present our recent work CoCoPIE, representing Compression-Compilation Codesign, to overcome this limitation towards the best possible DNN acceleration on edge devices. We propose novel fine-grained structured pruning schemes, including pattern-based pruning, block-based pruning, etc. They can simultaneously achieve high hardware performance (similar to filter/channel pruning) while maintaining zero accuracy loss, with the help of compiler, which is beyond the capability of prior work. Similarly, we present novel quantization scheme that achieves ultra-high hardware performance close to 2-bit weight quantization, with almost no accuracy loss. Through the CoCoPIE framework, we are able to achieve real-time on-device execution of a number of DNN tasks, including object detection, pose estimation, activity detection, speech recognition, just using an off-the-shelf mobile device, with up to 180X speedup compared with prior work. Our comprehensive demonstrations are at :

<https://www.youtube.com/channel/UCCKVDtg2eheRTEuqIJ5cD8A>

### **Biography:**

Yanzhi Wang is currently an associate professor and faculty fellow at Dept. of ECE at Northeastern University, Boston, MA. He received the B.S. degree from Tsinghua University in 2009, and Ph.D. degree from University of Southern California in 2014. His research interests focus on model compression and platform-specific acceleration of deep learning applications. His work has been published broadly in top conference and journal venues (e.g., DAC, ICCAD, ASPLOS, ISCA, MICRO, HPCA, PLDI, ICS, PACT, ISSCC, AAI, ICML, NeurIPS, CVPR, ICLR, IJCAI, ECCV, ICDM, ACM MM, FPGA, LCTES, CCS, VLDB, PACT, ICDCS, RTAS, Infocom, C-ACM, JSSC, TComputer, TCAS-I, TCAD, TCAS-II, JSAC, TNNLS, etc.), and has been cited above 12,000 times. He has received six Best Paper and Top Paper Awards, and one Communications of the ACM cover featured article. He has another 12 Best Paper Nominations and four Popular Paper Awards. He has received the U.S. Army Young Investigator Program Award (YIP), IEEE TC-SDM Early Career Award, Massachusetts Acorn Innovation Award, Martin Essigmann Excellence in Teaching Award, Massachusetts Acorn Innovation Award,

Ming Hsieh Scholar Award, and other research awards from Google, MathWorks, etc. He has received 22 federal grants from NSF, DARPA, IARPA, ARO, ARFL/AFOSR, etc.. He has participated in a total of \$40M funds with personal share \$8.5M. Six of his former Ph.D./postdoc students become tenure track faculty at Univ. of Connecticut, Clemson University, Chongqing University, Beijing University of Technology, Texas A&M University, Corpse Christi, and Cleveland State University.



**Shuhao Wang, Ph.D.**

Co-founder and CTO of Thorough Future

***“Empowering future pathology with artificial intelligence”***

**Abstract:**

The shift from traditional microscopy to digital pathology has paved the way for the use of AI-assisted diagnostic systems in pathology diagnosis. Through nearly five years of technology exploration and clinical practice, we have successfully built the AI-assisted pathological diagnostic platform. The deep learning system has a sensitivity close to 100% and a specificity over 80% for the recognition of malignant tumors in stomach, intestine, lung, and prostate, and is able to

complete the diagnosis of tumor subtypes. In the platform deployed at PLAGH, the diagnostic models of all organs are embedded. The platform supports all digital scanners on the market. We have also connected the platform with the information system in the hospital, so that we can obtain information about the samples and export the diagnostic report. Thus, the platform can be seamlessly embedded into the diagnostic process for pathologists, improving their working efficiency. Every day, all slides supported by the intelligent diagnostic platform are scanned and uploaded, and pathologists can use digital slides and artificial intelligence in the interface of the information system in their daily diagnoses, and issue reports with a single click. In this report, we will introduce the large-scale application of the AI pathology diagnosis platform in the real world.

**Biography:**

Doctor Shuhao Wang, the co-founder and CTO of Thorough Future, has a Ph.D. from Tsinghua University, was a postdoctoral fellow at the Institute for Interdisciplinary Information Sciences, Tsinghua University, and an assistant researcher at Baidu, NovuMind, and JD, and has more than 20 national patents, and has published many academic papers in top journals/conferences such as Nature Communications, Modern Pathology, ICCV, etc. He received the Elite Award of “30 New Generation Digital Economy Talents” at the World Internet Conference 2019. Dr. Shuhao Wang has extensive experience in the implementation of cutting-edge AI techniques and has a background in medical AI research for many years.