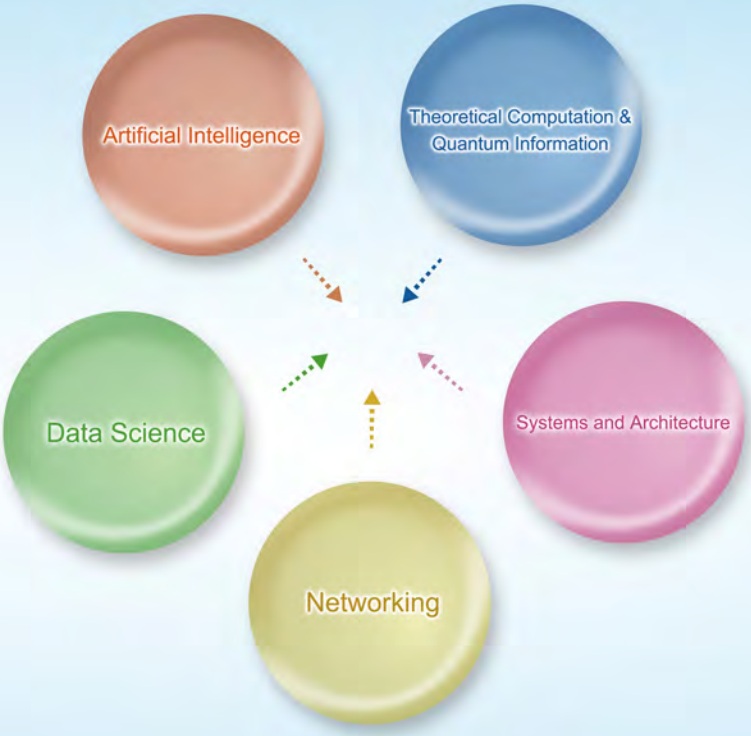
北京大学前沿计算研究中心
Center on Frontiers of Computing Studies, Peking University

上海交通大学
约翰·霍普克罗夫特
计算机科学中心
John Hopcroft Center for Computer Science

清华大学 交叉信息研究院
Institute for Interdisciplinary Information Sciences, Tsinghua University

# Turing Forum of 3 Institutes

Tsinghua University, January 6-7, 2020



# Institute for Interdisciplinary Information Sciences (IIIS)

Established in January, 2011, and now looking toward its first decade, Institute for Interdisciplinary Information Sciences (IIIS) is an academic research organization within Tsinghua University, led by Prof. Andrew Chi-Chih Yao, winner of the A.M. Turing Award in 2000, member of the Chinese Academy of Sciences and foreign member of the US National Academy of Sciences. The institute aims to become one of the leading research centers on interdisciplinary information sciences in the world as well as to offer a habitat for the research and education of computer science, artificial intelligence and quantum information in China.

IIIS undertakes research initially in computer science, with an outstanding record in theoretical computer science. In 2011, it opened Center for Quantum Information and expanded the research areas into a broader range of subjects, targeting interdisciplinary information sciences from artificial intelligence, Fintech to quantum information. Led by Prof. Andrew Chi-Chih Yao, IIIS research community is consisted of 28 award-winning academics who are actively involved and playing a leading role in research. Our research is to advance the frontiers of knowledge and the quality and impact of our research are demonstrated by numerous achievements including our many highly cited publications and the commercial adoption of our research results and innovations.

IIIS provides two exceptional undergraduate education programs, widely known as Yao Class (founded in 2005) and Artificial Intelligence Class (founded in 2019). Since the launch of Yao Class, IIIS has built a reputation as a leading institute of high-impact transformative undergraduate education which was recognized as "the best undergraduate program" through some prestigious national awards and honors. At present there are 400 students in total, including 225 undergraduate students and 174 graduate students from different cultures. Our alumni are now spreading across internationally-renowned universities and innovation enterprises all over the world.

Responding to the needs of economic and social development, IIIS explores new modes of engagement with industry, by linking with local governments and starting up research institutes with industrial collaboration. The modes ensure offering support for research commercialization in the areas of AI, quantum information and Fintech, with the aims of sharing good practice across the industrial and regional partnerships, and helping deliver the government's industrial strategy priorities to grow the economy.

## Keynote Speakers

Wen Gao (Peking University)

John Hopcroft (Cornell University)

Andrew Chi-Chih Yao (Tsinghua University)

## Plenary Speakers

Xiaotie Deng (Peking University)

Luming Duan (Tsinghua University)

## Invited Speakers

### Artificial Intelligence

Hao Dong (Peking University)

Jian Li (Tsinghua University)

Shuai Li (Shanghai Jiao Tong University)

Zhouchen Lin (Peking University)

Kaisheng Ma (Tsinghua University)

Ye Pan (Shanghai Jiao Tong University)

Yang Yuan (Tsinghua University)

Chongjie Zhang (Tsinghua University)

Quanshi Zhang (Shanghai Jiao Tong University)

### Data Science

Yihan Gao (Tsinghua University)

Yunhuai Liu (Peking University)

Wei Xu (Tsinghua University)

Weinan Zhang (Shanghai Jiao Tong University)

Zhanxing Zhu (Peking University)

**Theoretical Computation & Quantum Information**

Qinxiang Cao (Shanghai Jiao Tong University)

Dongling Deng (Tsinghua University)

Hongfei Fu (Shanghai Jiao Tong University)

Yuqing Kong (Peking University)

Jian Li (Tsinghua University)

Nana Liu (Shanghai Jiao Tong University)

Chihao Zhang (Shanghai Jiao Tong University)

**Systems and Architecture**

Mingyu Gao (Tsinghua University)

Jingwen Leng (Shanghai Jiao Tong University)

Yibo Lin (Peking University)

Yuye Ling (Shanghai Jiao Tong University)

Guojie Luo (Peking University)

Kaisheng Ma (Tsinghua University)

Shizhen Zhao (Shanghai Jiao Tong University)

**Networking**

Kaigui Bian (Peking University)

Bo Jiang (Shanghai Jiao Tong University)

Haiming Jin (Shanghai Jiao Tong University)

Chenye Wu (Tsinghua University)

Wenfei Wu (Tsinghua University)

Tong Yang (Peking University)

**Name Badges**

For identification purposes, badges are expected to be worn at all times during the workshop. The badges are color-coded as follows:
Participant - BLUE, Staff - YELLOW

**Registration Desk and Workshop Secretariat**

Jan. 5: Registration desk is located in the lobby on the first floor, FIT Building.
Open from 16:30-17:30.

Jan. 6: Registration desk is located in the lobby of Lecture Hall, FIT Building.
Open from 08:30-09:00.

**Jan. 6-7: The secretariat is located in Room 1-208, FIT Building.**
**Open from 08:00-17:00.**

**Dining**

Buffet lunches are provided in the lobby of RM 1-222 (2nd Floor), FIT Building**.** The workshop banquet takes place at Quanjude Restaurant at 18:00, Jan. 5 and is for invited speakers and attendees.

**Internet**

Internet service is provided at the workshop venues at FIT Building among sessions for occasional research and email access.

Wireless Network Configuration for the workshop:
SSID: **IIISconference**
password: **tsinghua**

## Transportation

### Subway

The nearest subway stations to Tsinghua:

Qinghuadongluxikou (清华东路西口), near Tsinghua Main (East) Gate on Line 15

Wudaokou (五道口), near Tsinghua Main (East) Gate on Line 13

Yuanmingyuan (圆明园), near Tsinghua West Gate on Line 4

### Bus

Bus stops around Tsinghua:

Wudaokou (五道口) near the East Gate

Qinghuayuan (清华园) near the South Gate

Lanqiying (蓝旗营) near the Southwest Gate

Qing Hua Da Xue Xi Men (清华大学西门) near the West Gate

Yuan Ming Yuan Dong Lu (圆明园东路) near the Northwest Gate

Qing Hua Fu Zhong (清华附中) near the North Gate

Dashiqiao (大石桥) near the Northeast Gate (Zijing Gate)

Detailed information about buses passes and route maps can be found here: http://www.bjbus.com/home/

### Taxi

Legal taxis' license numbers in Beijing begin with "京 B". The price of a taxi costs 13 Yuan (≈2 USD) for the first three kilometres and other 2.3 Yuan (≈0.37 USD) per kilometre thereafter. The charge would be higher after 15 kilometres or during the night time (11pm -5am).

## Monday January 6, 2020

| TIME | ACTIVITIES | | VENUE (FIT Building) |
|---|---|---|---|
| 08:30-09:00 | **Registration** | | Lobby of Lecture Hall (2nd Floor) |
| 09:00-09:15 | **Opening Remarks** | | Lecture Hall (2nd Floor) |
| 09:15-10:05 | Keynote Talk 1<br>Chair:<br>**Andrew Yao** | An Introduction to AI and Deep Learning<br>**John Hopcroft** (Cornell University) | |
| 10:05-10:45 | **Group Photo (1st Floor) + Coffee Break** | | Lobby of Lecture Hall (2nd Floor) |
| 10:45-11:35 | Plenary Talk 1<br>Chair:<br>**Baoquan Chen** | Quantum Computing and Quantum Machine Learning<br>**Luming Duan** (Tsinghua University) | Lecture Hall (2nd Floor) |
| 11:45-13:30 | **Lunch Break** | | Lobby of RM 1-222 (2nd Floor) |
| 14:00-14:50 | Keynote Talk 2<br>Chair:<br>**Andrew Yao** | Digital Retina – Improvement of Cloud Artificial Vision System from Enlighten of HVS Evolution<br>**Wen Gao** (Peking University) | Lecture Hall (2nd Floor) |
| 14:50-15:20 | **Coffee Break** | | Lobby of Lecture Hall (2nd Floor) |
| 15:20-17:40 | **Parallel Sessions** | | |

## Parallel Sessions

| **Artificial Intelligence**<br>Session Chair: **Chongjie Zhang**<br>Room 1-315 (3rd Floor, FIT Building) | | |
|---|---|---|
| Jan 6 | 15:20-15:55 | From Deep Generation to Creation<br>**Hao Dong** (Peking University) |
| | 15:55-16:30 | On Generalization and Implicit bias of Gradient Methods in Deep Learning<br>**Jian Li** (Tsinghua University) |
| | 16:30-17:05 | Online Learning to Rank<br>**Shuai Li** (Shanghai Jiao Tong University) |
| | 17:05-17:40 | Towards Efficient Deep Reinforcement Learning<br>**Chongjie Zhang** (Tsinghua University) |

| **Theoretical Computation & Quantum Information**<br>Session Chair: **Dongling Deng**<br>Lecture Hall (2nd Floor, FIT Building) | | |
|---|---|---|
| Jan 6 | 15:20-15:55 | Formal Verification of Probabilistic Programs: Termination, Cost Analysis and Sensitivity<br>**Hongfei Fu** (Shanghai Jiao Tong University) |
| | 15:55-16:30 | Quantum Adversarial Machine Learning<br>**Dongling Deng** (Tsinghua University) |
| | 16:30-17:05 | Adversarial Quantum Learning<br>**Nana Liu** (Shanghai Jiao Tong University) |
| | 17:05-17:40 | Dominantly Truthful Multi-task Peer Prediction with a Constant Number of Tasks<br>**Yuqing Kong** (Peking University) |

| **Data Science**<br>Session Chair: **Yihan Gao**<br>Room 1-202 (2nd Floor, FIT Building) | | |
|---|---|---|
| Jan 6 | 15:20-15:55 | Mobile Crowdsensing in Instant Delivery<br>**Yunhuai Liu** (Peking University) |
| | 15:55-16:30 | Advances of Deep Learning and Reinforcement Learning on Recommender Systems<br>**Weinan Zhang** (Shanghai Jiao Tong University) |
| | 16:30-17:05 | Adaptive Databases<br>**Yihan Gao** (Tsinghua University) |

| **Systems and Architecture**<br>Session Chair: **Mingyu Gao**<br>Room 1-222 (2nd Floor, FIT Building) | | |
|---|---|---|
| Jan 6 | 15:20-15:55 | Serikos: a Platform for Electronic Design Algorithm Development and Execution<br>**Guojie Luo** (Peking University) |
| | 15:55-16:30 | Algorithm and Architecture Co-design for Robust and Low-latency Computer Vision<br>**Jingwen Leng** (Shanghai Jiao Tong University) |
| | 16:30-17:05 | Understanding and Optimizing Hierarchical Dataflow Scheduling for Scalable NN Accelerators<br>**Mingyu Gao** (Tsinghua University) |

| **Networking**<br>Session Chair: **Wenfei Wu**<br>Reception Hall (1st Floor, FIT Building) | | |
|---|---|---|
| Jan 6 | 15:20-15:55 | Smart Content Delivery and Adaptive Rate Selection for Video Streaming at Network Edge<br>**Kaigui Bian** (Peking University) |
| | 15:55-16:30 | Data-Driven Design for Smart Transportation Systems<br>**Haiming Jin** (Shanghai Jiao Tong University) |
| | 16:30-17:05 | A DevOps Framework for Network Functions<br>**Wenfei Wu** (Tsinghua University) |

## Tuesday January 7, 2020

| TIME | ACTIVITIES | | VENUE (FIT Building) |
|---|---|---|---|
| 09:00-09:30 | **Book Launch** | | Lecture Hall (2nd Floor) |
| 09:30-10:20 | Keynote Talk 3<br>Chair:<br>**Xiaotie Deng** | Some Theoretical Aspects of Blockchain Design<br>**Andrew Yao** (Tsinghua University) | |
| 10:20-10:50 | **Coffee Break** | | Lobby of Lecture Hall (2nd Floor) |
| 10:50-11:40 | Plenary Talk 2<br>Chair:<br>**Jian Li** | Game Theoretical Analysis in Economies of Sharing<br>**Xiaotie Deng** (Peking University) | Lecture Hall (2nd Floor) |
| 12:00-13:30 | **Lunch Break** | | Lobby of RM1-222 (2nd Floor) |
| 14:00-15:45 | **Parallel Sessions** | | |
| 15:45-16:05 | **Coffee Break** | | Lobby of RM 1-222 (2nd Floor) |
| 16:05-17:15 | **Parallel Sessions** | | |

## Parallel Sessions

| **Artificial Intelligence**<br>Session Chair: **Chongjie Zhang**<br>Room 1-315 (3rd Floor, FIT Building) | | |
|---|---|---|
| Jan 7 | 14:00-14:35 | Knowledge Self-distillation and Scalable Neural Networks: Towards Accurate, Efficient and Robust Neural Networks<br>**Kaisheng Ma** (Tsinghua University) |
| | 14:35-15:10 | AI Characters - Bring 3D Characters to Life<br>**Ye Pan** (Shanghai Jiao Tong University) |
| | 15:10-15:45 | Learning Based Optimization<br>**Zhouchen Lin** (Peking University) |
| | 15:45-16:05 | **Coffee Break**<br>Lobby of Room 1-222 (2nd Floor) |
| | 16:05-16:40 | Deep Learning: Interpretability, Capacity, and Evaluation<br>**Quanshi Zhang** (Shanghai Jiao Tong University) |
| | 16:40-17:15 | A Stratified Approach to Robustness for Randomly Smoothed Classifiers<br>**Yang Yuan** (Tsinghua University) |

| **Data Science**<br>Session Chair: **Wei Xu**<br>Room 1-202 (2nd Floor, FIT Building) | | |
|---|---|---|
| Jan 7 | 14:00-14:35 | Theoretical Understanding of Stochastic Gradient Descent in Deep Learning<br>**Zhanxing Zhu** (Peking University) |
| | 14:35-15:10 | Scalable and General Privacy-Preserving Data Mining: From Research to Production<br>**Wei Xu** (Tsinghua University) |
| | 15:45-16:05 | **Coffee Break**<br>Lobby of Room 1-222 (2nd Floor) |

| Theoretical Computation & Quantum Information<br>Session Chair: **Dongling Deng**<br>Room 1-312 (3rd Floor, FIT Building) | | |
|---|---|---|
| Jan 7 | 14:00-14:35 | Abstraction in Theorem Proving<br>**Qinxiang Cao** (Shanghai Jiao Tong University) |
| | 14:35-15:10 | Coreset: A Technique to Turn BIG DATA into Tiny Data<br>**Jian Li** (Tsinghua University) |
| | 15:10-15:45 | A Fast Algorithm for Sampling k-SAT Solutions in the Local Lemma Regime<br>**Chihao Zhang** (Shanghai Jiao Tong University) |
| | 15:45-16:05 | **Coffee Break**<br>Lobby of Room 1-222 (2nd Floor) |

| Systems and Architecture<br>Session Chair: **Mingyu Gao**<br>Room 1-222 (2nd Floor, FIT Building) | | |
|---|---|---|
| Jan 7 | 14:00-14:35 | Accelerating IC Backend Design with Deep learning<br>**Yibo Lin** (Peking University) |
| | 14:35-15:10 | Beyond Fourier Transform: Super-solving Optical Coherence Tomography via Optimization<br>**Yuye Ling** (Shanghai Jiao Tong University) |
| | 15:10-15:45 | Sparse-aware DNN Architecture Design: Insights from Resource Utilization and Memory Bandwidth<br>**Kaisheng Ma** (Tsinghua University) |
| | 15:45-16:05 | **Coffee Break**<br>Lobby of Room 1-222 (2nd Floor) |

| | | |
|---|---|---|
| **Networking**<br>Session Chair: **Chenye Wu**<br>Reception Hall (1st Floor, FIT Building) | | |
| Jan 7 | 14:00-14:35 | Bitrate Adaptation for Scalable Video Coding<br>**Bo Jiang** (Shanghai Jiao Tong University) |
| | 14:35-15:10 | Elastic Sketch: Adaptive and Fast Network-wide Measurements<br>**Tong Yang** (Peking University) |
| | 15:10-15:45 | Power the Future Energy System with Computer Science<br>**Chenye Wu** (Tsinghua University) |
| | 15:45-16:05 | **Coffee Break**<br>Lobby of Room 1-222 (2nd Floor) |
| | 16:05-16:40 | The First Step Towards Optical Circuit Switched Data Center<br>**Shizhen Zhao** (Shanghai Jiao Tong University) |

**An Introduction to AI and Deep Learning**

John Hopcroft
Cornell University

09:15-10:05, January 6, 2020
Lecture Hall, FIT Building

**Abstract:** A major advance in AI occurred in 2012 when AlexNet won the ImageNat competition with a deep network. The success was sufficiently better than previous years that deep networks were applied in many applications with great success. However, there is little understanding of why deep learning works. This talk will give an introduction to machine learning and then focus on current research directions in deep learning.

**Bio:** John E. Hopcroft is the director of John Hopcroft Center for Computer Science at Shanghai Jiao Tong University, the IBM Professor of Engineering and Applied Mathematics in Computer Science at Cornell University. He was honored with the A. M. Turing Award in 1986. He is a member of the US National Academy of Sciences (NAS), the US National Academy of Engineering (NAE), a foreign member of the Chinese Academy of Sciences.

**Quantum Computing and Quantum Machine Learning**

Luming Duan
Tsinghua University

10:45-11:35, January 6, 2020
Lecture Hall, FIT Building

**Abstract:** In this talk, I will briefly review the concept and some recent progress on quantum computing. In particular, I will explain why quantum computers are powerful and how to build up a quantum computer. Then, I will discuss potential applications of quantum computing in solving challenging machine learning problems. In particular, I will present a quantum algorithm for generative machine learning, which, under some reasonable assumptions, can be proven to have exponential improvement in term of the representational power and the learning and inference speed compared with any classical algorithms.

**Bio:** Luming Duan is the CC Yao Professor and the Chair Professor on fundamental Sciences at Tsinghua University. Before holding this position at Tsinghua since 2018, he was the Enrico Fermi Collegiate Professor at the University of Michigan (Ann Arbor). Luming Duan has made seminal contributions to quantum information theory and realization of quantum computing and quantum networks with physical systems. He was elected to the fellow of the American Physical Society in 2009 and published more than 160 papers in prestigious journals with over 26,000 citations.

**Digital Retina – Improvement of Cloud Artificial Vision System from Enlighten of HVS Evolution**

Wen Gao
Peking University

14:00-14:50, January 6, 2020
Lecture Hall, FIT Building

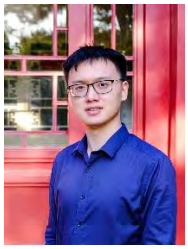
**Abstract:** Smart city wave seems to be making more and more video devices in cloud vision system upgraded from traditional video camera into edge video device. However, there are some arguments on how much intelligence the device should be with, and how much the cloud should keep. Human visual system (HVS) took millions of years to reach its present highly evolved state, it might not be perfect yet, but much better than any of exist computer vision system. Most artificial visual systems are consisted of camera and computer, like eye and brain for human, but with very low level pathway between two parts, comparing to human being. The pathway model of human being between eye and brain is quite complex, but energy efficient and comprehensive accurate, evolved by natural selection. In this talk, I will discuss a new idea about how we can improve the cloud vision system by HVS-like pathway model, which is called digital retina, to make the cloud vision system being efficient and smart. For future work, a spike neural network model will be considered, because the bio-vision system encodes the world into spike train, a different form with conventional video, which inspires us to discover a totally new visual technical system, from new visual sensor to new vision models.

**Bio:** Wen Gao now is a Boya Chair Professor at Peking university. He also serves as the president of China Computer Federation (CCF) from 2016 to 2020.

He received his Ph.D. degree in electronics engineering from the University of Tokyo in 1991. He joined with Harbin Institute of Technology from 1991 to 1995, and Institute of Computing Technology (ICT), Chinese Academy of Sciences (CAS) from 1996 to 2005. He joined the Peking University since 2006.

Prof. Gao works in the areas of multimedia and computer vision, topics including video coding, video analysis, multimedia retrieval, face recognition, multimodal interfaces, and virtual reality. His most cited contributions are model-based video coding and feature-based object representation. He published seven books, over 280 papers in refereed journals, and over 700 papers in selected international conferences. He is a fellow of IEEE, a fellow of ACM, and a member of Chinese Academy of Engineering.

**From Deep Generation to Creation**



Hao Dong
Peking University

15:20-15:55, January 6, 2020
Room 1-315, FIT Building

**Abstract:** As Richard Feynman said, "What I cannot create, I do not understand," if a machine can learn to create, we can achieve a better AI. With the rapid development of deep learning, deep generative models play an essential rule in data representation and generation. In this talk, I will first describe our studies on image generation with less supervision. Then I will discuss our hypothesis of machine creativity and our studies that would like to generate new data out of the distribution of the training data. In the end, I will discuss my thinking about machine creativity and my future directions.

**Bio:** Hao Dong joined Peking University as an assistant professor in August 2019. He received the BEng degree from the University of Central Lancashire in 2011, the MSc and Ph.D. degree in Computer Science from Imperial College London in 2012 and 2019, respectively. His research involves deep learning and computer vision which aim to reduce the data required for learning intelligent systems. He is passionate about popularizing artificial intelligence technologies and established TensorLayer, a deep learning and reinforcement learning library for scientists and engineers, which won the Best Open Source Software Award at ACM Multimedia 2017. He founded a startup for digital healthcare with Prof. Yike Guo between 2012 and 2014.

**On Generalization and Implicit bias of Gradient Methods in Deep Learning**

Jian Li
Tsinghua University

15:55-16:30, January 6, 2020
Room 1-315, FIT Building

**Abstract:** Deep learning has enjoyed huge empirical success in recent years. Although training a deep neural network is a highly non-convex optimization problem, simple (stochastic) gradient methods are able to produce good solutions that minimize the training error, and more surprisingly, can generalize well to out-of sample data, even when the number of parameters is significantly larger than the amount of training data. It is known that changing the optimization algorithm, even without changing the model, changes the implicit bias, and also the generalization properties. What is the bias introduced by the optimization algorithms for neural networks? What ensures generalization in neural networks? In this talk, we attempt to answer the above questions by proving new generalization bounds and investigating the implicit bias of various gradient methods.

(1) We develop a new framework, termed Bayes-Stability, for proving algorithm-dependent generalization error bounds. Using the new framework, we obtain new data-dependent generalization bounds for stochastic gradient Langevin dynamics (SGLD) and several other noisy gradient methods (e.g., with momentum, mini-batch and acceleration, Entropy-SGD). Our result recovers (and is typically tighter than) a recent result in Mou et al. (2018) and improves upon the results in Pensia et al. (2018). Our experiments demonstrate that our data-dependent bounds can distinguish randomly labelled data from normal data, which provides an explanation to the intriguing phenomena observed in Zhang et al. (2017a).

(2) We show gradient descent converges to the max-margin direction for homogeneous neural networks, including fully-connected and convolutional neural networks with ReLU or LeakyReLU activations, generalizing previous work for logistic regression with one-layer or multi-layer linear networks. Finally, as margin is closely related to robustness, we discuss potential benefits of training longer for improving the robustness of the model.

**Bio:** Jian Li is currently an associate professor at Institute for Interdisciplinary Information Sciences (IIIS, previously ITCS), Tsinghua University, headed by Prof. Andrew Yao. He got his BSc degree from Sun Yat-sen (Zhongshan) University, China, MSc degree in computer science from Fudan University, China and PhD degree in the University of Maryland, USA. His major research interests lie in algorithm design and analysis, machine learning, databases and finance. He co-authored several research papers that have been published in major computer science conferences and journals. He received the best paper awards at VLDB 2009 and ESA 2010. He is also a recipient of the "221 Basic Research Plan for Young Faculties" at Tsinghua University, the "new century excellent talents award" by Ministry of Education of China, and the National Science Fund for Excellent Young Scholars.

**Online Learning to Rank**

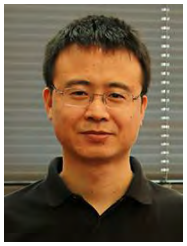
Shuai Li
Shanghai Jiao Tong University

16:30-17:05, January 6, 2020
Room 1-315, FIT Building

**Abstract:** Learning to rank (LTR) is a core problem in information retrieval and machine learning with numerous applications in web search, recommender systems and ad placement. The goal of LTR is to present a list of K documents out of L that maximizes the satisfaction of the user. This problem has been traditionally solved by training supervised learning models on manually annotated relevance judgments. However, strong evidence suggests that users' click feedback can lead to major improvements over supervised LTR methods. In addition, billions of users interact daily with commercial LTR systems, and it is finally feasible to interactively and adaptive maximize the satisfaction of these users from clicks. These observations motivated numerous papers on online LTR methods, which utilize user feedback to improve the quality of ranked lists. These methods can be divided into two groups: learning the best ranker in a family of rankers, and learning the best list under some model of user interaction with the list, such as a click model. The click model is a stochastic model of how the user examines and clicks on a list of items. This talk will focus on online LTR in click models and present the algorithms from the setting of specific click models, like cascade model, to general click models.

**Bio:** LI Shuai is currently a tenure-track assistant professor at John Hopcroft Center of Shanghai Jiao Tong University. She received PhD degree in computer science from Chinese University of Hong Kong. Before that, she received Bachelor' s Degree in Math from Chu Kochen Honors College, Zhejiang University and received Master' s Degree in Math from Institute of Mathematics. She is a recipient of Google PhD fellowship in 2018. Her research interest is bandit algorithm and learning theory.

**Towards Efficient Deep Reinforcement Learning**



Chongjie Zhang
Tsinghua University

17:05-17:40, January 6, 2020
Room 1-315, FIT Building

**Abstract:** Deep reinforcement learning (DRL) has recently shown considerable success in achieving human-level control or decision making in a series of artificial domains. However, DRL is not efficient yet for many real-world problems, requiring vast experiences to learn effective policies. In this talk, I will first present transfer and generalized approaches for enabling fast learning. I will then discuss multi-agent learning methods to enable agents to efficiently learn to collaborate in complex domains.

**Bio:** Chongjie Zhang is an Assistant Professor in the Institute for Interdisciplinary Information Sciences at Tsinghua University. Before joining the faculty, he was a postdoctoral associate in the Computer Science and Artificial Intelligence Lab (CSAIL) at MIT. He received his Ph.D. in Computer Science from the University of Massachusetts at Amherst in 2011. His research interests span reinforcement learning, multi-agent systems, and robotics.

**Mobile Crowdsensing in Instant Delivery**

Yunhuai Liu
Peking University

15:20-15:55, January 6, 2020
Room 1-202, FIT Building

**Abstract:** With the rapid development of mobile Internet and O2O businesses, new service models based on instant delivery are becoming increasingly popular, which enables many new applications such as instant takeaway delivery, supermarket freshexpress[26], and city express. In 2017, mainland China has over 10 billion instant delivery orders with a 314% year-on-year increase, accounting for 25% of the logistic volume. With these O2O business, many new human mobility data can be collected in a non-intrusive manner with extremely low cost. In this talk, we will introduce our recent collaboration works with a major instant delivery service provider, showing many new opportunities and unique challenges in this new service model. We will show how to exploits the crowdsensing techniques to solve the emerging problems and point out some future work directions.

**Bio:** Dr. Yunhuai Liu is now a professor with Peking University, P.R. China. He received his B.E in Computer Science from Tsinghua University, and PhD degree in Computer Science and Engineering from Hong Kong University of Science and Technology in 2008. In the year 2010, he joined Shenzhen Institutes of Advanced Technology, Chinese Academy of Sciences. From 2011 to 2016, he was with the Third Research Institute of Ministry of Public Security, China. He is the receipt of National Distinguish Young Scientists Foundation, and National Talented Young Scholar program. He received the third-class personal medal of Ministry of Public Security. He is now serves as the Vice chair of ACM China Council, and served as the Associate Editor for IEEE TPDS， IEEE TNSE, and TPC members of ACM Sensys, IEEE INFOCOM and etc. He received the Outstanding Paper Award at the 2008 the 28th IEEE ICDCS, and 2018 the 25th SANER. He has published over 100 peer-reviewed technical papers with over 3200 citations (google scholar).

**Advances of Deep Learning and Reinforcement Learning on Recommender Systems**

Weinan Zhang
Shanghai Jiao Tong University

15:55-16:30, January 6, 2020
Room 1-202, FIT Building

**Abstract:** Personalized recommender system is one of the most important scenarios of big data mining. During last five years, recommender system techniques obtain fast growth with the emergence of deep learning and reinforcement learning. In this talk, I will first briefly review the recent 15-year road map of recommender systems. Then I will focus on deep learning techniques on discrete data and the corresponding applications on recommender systems. Also I will discuss the recent progress of deep reinforcement learning techniques on interactive recommender systems and the key factors and challenges to successful interactive recommendation.

**Bio:** Weinan Zhang is now a tenure-track assistant professor in Department of Computer Science and John Hopcroft Center for Computer Science, Shanghai Jiao Tong University. His research interests include deep reinforcement learning, unsupervised learning and the applications on various big data mining scenarios. Weinan earned his Ph.D. from University College London in 2016 and B.Eng. from ACM Class of Shanghai Jiao Tong University in 2011. He was selected as one of the 20 rising stars of KDD research community in 2016 by Microsoft Research and won the ACM rising star award (Shanghai chapter) and DAMO young scholar award in 2018. His papers won the best paper honorable mention award in SIGIR 2017 and the best paper award in DLP-KDD 2019.

**Adaptive Databases**

Yihan Gao
Tsinghua University

16:30-17:05, January 6, 2020
Room 1-202, FIT Building

**Abstract:** During the last year, several groups of database researchers have attempted to utilize AI techniques to address classical database problems, with varying degree of success. Despite not showing particularly impressive results, their works have received a lot of attention due to the possibility that this new design philosophy can potentially overcome the bottleneck of traditional database systems, pushing the performance of DB systems beyond the current limit. In this talk, I will talk about the general idea of DB/AI integration, review some of the recent advances on this direction, and list some other database applications that might also benefit from AI techniques.

**Bio:** Yihan Gao is an assistant professor in Tsinghua University, IIIS. His research interest is primarily on applying machine learning techniques to solve database problems.

**Formal Verification of Probabilistic Programs: Termination, Cost Analysis and Sensitivity**

Hongfei Fu
Shanghai Jiao Tong University

15:20-15:55, January 6, 2020
Lecture Hall, FIT Building

**Abstract:** Formal verification is the study to ensure correctness of systems through rigorous mathematical approaches. Probabilistic programs are classical programs extended with random number generators that capture a large class of application scenarios with probability, such as artificial intelligence, random walks, randomized algorithms, stochastic systems, etc. Formal verification of probabilistic programs aims at developing methodologies that can prove correctness of fundamental probabilistic properties such as termination with probability one, expected resource consumption, and expected sensitivity against slight perturbation of inputs, etc. In the talk, I will introduce our theoretical results on verifying termination, cost and sensitivity of probabilistic programs.

**Bio:** Dr. Hongfei Fu obtained his PhD at RWTH Aachen, supervised by Prof. Joost-Pieter Katoen. He is currently an assistant professor at John Hopcroft Center for Computer Science, Shanghai Jiao Tong University. His main research interest lies in developing automated approaches for solving model-checking and program-verification problems in the broad sense.

**Quantum Adversarial Machine Learning**

Dongling Deng
Tsinghua University

15:55-16:30, January 6, 2020
Lecture Hall, FIT Building

**Abstract:** Adversarial machine learning is a growing field that focuses on studying vulnerabilities of machine learning approaches in adversarial settings and developing techniques accordingly to make learning robust to adversarial manipulations. In this talk, I will introduce an emerging field of quantum adversarial machine learning. On the one hand, I will show the extreme vulnerability of machine learning phases of matter--- adding a tiny amount of carefully-crafted noises into the original legitimate data (such as time-of-flight images obtained in cold-atom experiments) will cause the classifiers to make incorrect predictions at a notably high confidence level. On the other hand, I will show that the vulnerability properties carry over to quantum classifiers as well.

Reference:
[1] Si Jiang, Sirui Lu, and Dong-Ling Deng, arXiv: 1910.13453v1 (2019)

[2] Sirui Lu, L. M. Duan, and Dong-Ling Deng, unpublished

**Bio:** Dong-Ling Deng is an assistant professor at the Institute for Interdisciplinary Information Sciences, Tsinghua University. He graduated from Nankai University with two Bachelor degrees, one in physics and the other in mathematics. He then studied at the Chern Institute of Mathematics and got a master degree in theoretical physics. After that, he moved to the University of Michigan and obtained his Ph.D. in physics. He did his postdoctoral work as a JQI (Joint Quantum Institute) postdoctoral fellow at the University of Maryland. Prof. Deng' s current research interest mainly concerns quantum machine learning/artificial intelligence.

**Adversarial Quantum Learning**

Nana Liu
Shanghai Jiao Tong University

16:30-17:05, January 6, 2020
Lecture Hall, FIT Building

**Abstract:** The success of the modern internet relies in no small part on understanding the interplay between computation and security. More recently this area has also seen contributions from machine learning, including spam filters and malware detection. With the rising prevalence of machine learning algorithms, it is also important to address whether new security issues arise. Machine learning applications often require training or test data that originate from remote data centres or sensors. This decentralised set-up opens the door to adversaries that could exploit existing vulnerabilities in those algorithms. Evidence suggests that these vulnerabilities can grow with the dimensionality of the data. As quantum technologies become more accessible, these same concerns for quantum data is expected to become more important in a future quantum internet, especially as the most classically-intractable quantum systems of interest are usually high-dimensional. In this area which we call adversarial quantum learning, we ask some basic questions: How do we verify high-dimensional quantum data with less resources? How do errors or adversarial changes in quantum data affect the probability of misclassification? How can we protect these quantum machine learning algorithms against adversaries? We take some first key steps in addressing these questions and look towards the future of this intersection between computation and security on quantum data.

**Bio:** Nana Liu is currently an Assistant Professor at the John Hopcroft Centre for Computer Science at Shanghai Jiao Tong University. She is leading the only theory group at Shanghai Jiao Tong University that specialises in quantum algorithms. She received her doctorate in 2016 from the University of Oxford as a Clarendon Scholar. Her focus is on employing quantum resources for quantum advantages in both quantum computation and quantum sensing. Her research also lies at the interface between quantum computation and security, including ideas from machine learning, which will be useful in building a future quantum internet.

**Dominantly Truthful Multi-task Peer Prediction with a Constant Number of Tasks**

Yuqing Kong
Peking University

17:05-17:40, January 6, 2020
Lecture Hall, FIT Building

**Abstract:** In the setting where participants are asked multiple similar possibly subjective multi-choice questions (e.g. Do you like Panda Express? Y/N; do you like Chick-fil-A? Y/N), a series of peer prediction mechanisms are designed to incentivize honest reports and some of them achieve dominantly truthfulness: truth-telling is a dominant strategy and strictly dominate other "non-permutation strategy" with some mild conditions. However, a major issue hinders the practical us- age of those mechanisms: they require the participants to perform an infinite number of tasks. When the participants perform a finite number of tasks, these mechanisms only achieve approximated dominant truthfulness. The existence of a dominantly truthful multi-task peer prediction mechanism that only requires a finite number of tasks remains to be an open question that may have a negative result, even with full prior knowledge. This paper answers this open question by proposing a new mechanism, Determinant based Mutual Information Mechanism (DMI-Mechanism), that is dominantly truthful when the number of tasks is $\geqslant 2C$. C is the number of choices for each question (C = 2 for binary-choice questions). DMI-Mechanism also pays truth-telling higher than any strategy profile and strictly higher than uninformative strategy profile (informed truthfulness). In addition to the truthfulness properties, DMI-Mechanism is also easy to implement since it does not require any prior knowledge (detail-free) and only requires $\geqslant 2$ participants. The core of DMI-Mechanism is a novel information measure, Determinant based Mutual Information (DMI). DMI generalizes Shannon's mutual information and the square of DMI has a simple unbiased estimator. In addition to incentivizing honest reports, DMI-Mechanism can also be transferred into an information evaluation rule that identifies high-quality information without verification when there are $\geqslant 3$ participants. To the best of our knowledge, DMI-Mechanism is both the first detail-free informed-truthful mechanism and the first dominantly truthful mechanism that works for a finite number of tasks, not to say a small constant number of tasks.

**Bio:** Yuqing Kong is currently an assistant professor at The Center of Frontier Computing Science (CFCS), Peking University. She obtained her Ph.D. degree from the Computer Science and Engineering Department at University of Michigan in 2018 and her bachelor degree in mathematics from University of Science and Technology of China in 2013.

Her research interests lie in the intersection of theoretical computer science and the areas of economics: information elicitation, prediction markets, mechanism design, and the future applications of these areas to crowdsourcing and machine learning. Her papers were published in several conferences include WINE, ITCS, EC, SODA, AAAI, NeurIPS, ICLR.

**Serikos: a Platform for Electronic Design Algorithm Development and Execution**

Guojie Luo
Peking University

15:20-15:55, January 6, 2020
Room 1-222, FIT Building

**Abstract:** Electronic design automation (EDA) flow consists of multiple steps to complete the design from a system-level description to layout data. The open-source EDA flow will not only help EDA experts to evaluate the end-to-end impact of advanced algorithms but also reduce the barrier for chip designers and semiconductor process researchers to develop customized design flows. However, the current open-source EDA codes are either a collection of outdated algorithms or isolated point tools, which cannot meet the needs of cutting-edge research and advanced production. Therefore, we propose the end-to-end open-source EDA framework Serikos to solve the integrity and quality problems of open source tools for developing the most advanced algorithms.

**Bio:** Guojie Luo received his B.S. degree at Peking University in 2005 and the PhD degree at UCLA in 2011, respectively. And he is currently an Associate Professor at Peking University. He has won the 2013 ACM SIGDA Outstanding PhD Dissertation Award in Electronic Design Automation and the 2017 ASP-DAC Ten-Year Retrospective Most Influential Paper Award. His research interests include electronic design automation for domain-specific computing and processing in memory.

**Algorithm and Architecture Co-design for Robust and Low-latency Computer Vision**

Jingwen Leng
Shanghai Jiao Tong University

15:55-16:30, January 6, 2020
Room 1-222, FIT Building

**Abstract:** Deep neural network has achieved enormous success in computer vision tasks such image classification and object detection. Two critical issues in today' s computer vision systems are their vulnerability two unseen/adversarial input and long end-to-end frame latency. The former hinders the adoption of DNN based model in mission critical domains such as autonomous driving and robotics, and the latter significantly impacts the system agility and user experience. To address those challenges, we follow the methodology of algorithm-architecture co-design. First, we study architecture-friendly adversarial input detection algorithm and demonstrate it on-line detection capability, as opposed to the 10x overhead in the conventional redundancy based detection algorithm. Second, we propose a new proactive vision execution model that breaks the sequential execution of the vision pipeline. Specifically, we propose to allow the pipeline front-end (sensing and imaging) to predict future frames; the pipeline back-end (vision algorithms) then predictively operates on the future frames to reduce frame latency. Through our work, we demonstrate a careful co-design of algorithmic framework, compiler optimizations, and hardware architecture could facilitate the practical adoption of DNN models. We hope that the concepts of important neuron and activation path exploited in our work complement existing explainable ML efforts, and could shed new light on interpreting DNNs.

**Bio:** Jingwen Leng is a tenure-track Assistant Professor in the John Hopcroft Computer Science Center and CS Department at Shanghai Jiao Tong University. He received his Ph.D. from the University of Texas at Austin, where he focused on improving the efficiency and resiliency of general-purpose GPUs. He is currently interested at taking a holistic approach to optimizing the performance, efficiency, and reliability for heterogeneous computing systems.

**Understanding and Optimizing Hierarchical Dataflow Scheduling for Scalable NN Accelerators**

Mingyu Gao
Tsinghua University

16:30-17:05, January 6, 2020
Room 1-222, FIT Building

**Abstract:** The use of increasingly larger and more complex neural networks (NNs) makes it critical to scale the capabilities and efficiency of NN accelerators. Tiled architectures provide a scalable hardware solution that supports many types of parallelism in NNs, including data parallelism, intra-layer parallelism, and inter-layer pipelining. In this talk, I will discuss how to orchestrate the software-level dataflow scheduling schemes to achieve the best utilization of such highly parallel hardware. First, I will present a comprehensive and unified hierarchical taxonomy for NN dataflow scheduling, which is able to cover a rich set of existing dataflow schemes, from inter-layer and intra-layer parallelism to loop transformation and spatial unrolling. The taxonomy highlights the tight coupling across different dataflow levels. Then, I will introduce several intra-layer and inter-layer dataflow optimizations, including sharing the distributed buffers to eliminate excessive data duplication within a single layer, and a fine-grained data forwarding scheme between adjacent layers to reduce the buffer requirements and pipeline delays. The results show that these optimizations significantly improve the performance and energy efficiency of tiled NN accelerators across a wide range of NNs.

**Bio:** Mingyu Gao is a tenure-track assistant professor of computer science in the Institute for Interdisciplinary Information Sciences (IIIS) at Tsinghua University in Beijing, China. His research interests lie in the fields of computer architecture and systems, including efficient memory architectures, scalable data processing, and hardware system security, with a special emphasis on data-intensive applications. He has won the paper award of IEEE Micro 2016 Top Picks in Computer Architecture. Mingyu received his PhD in Electrical Engineering at Stanford University in June, 2018. He also received a Master of Science degree at Stanford University in 2014, and a Bachelor of Science degree at Tsinghua University in China in 2012.

**Smart Content Delivery and Adaptive Rate Selection for Video Streaming at Network Edge**

Kaigui Bian
Peking University

15:20-15:55, January 6, 2020
Reception Hall, FIT Building

**Abstract:** 360-degree videos have gained more popularity in recent years, owing to the great advance of panoramic cameras and head-mounted devices. However, as 360-degree videos are usually in high resolution, transmitting the content requires extremely high bandwidth. To protect the Quality of Experience (QoE) of users, researchers have proposed tile-based 360-degree video streaming systems that allocate high/low bit rates to selected tiles of video frames for streaming over the limited bandwidth. It is challenging to determine which tiles should be allocated with a high/low rate. We present a Deep Reinforcement Learning (DRL) based framework for 360-degree video streaming, named DRL360. The DRL360 framework helps improve the system performance by jointly optimizing multiple QoE objectives across a broad set of dynamic features. The DRL-based model adaptively allocates rates for the tiles of the future video frames based on the observations collected by client video players.

**Bio:** Kaigui Bian received his Ph.D. degree in Computer Engineering from Virginia Tech in 2011, and his B.S. degree in Computer Science from Peking University, Beijing, China in 2005. He was a visiting researcher at Microsoft Research Asia in 2013. He is currently an Associate Professor, and Associate Director of Institute of Network Computing and Information Systems, and the Assistant Chair of Department of Computer Science and Technology, School of EECS Peking University. He is a senior member of IEEE, and a member of ACM, IET, and CCF. He received best paper awards of five international conferences. He was the recipient of IEEE Communication Society Asia-Pacific Board (APB) Outstanding Young Researcher Award in 2018. He received the Intel-CCF Young Faculty Researcher Award in 2014. He was a Japan Society for the Promotion of Science (JSPS) invitational research fellow in 2019. He currently serves as an Editor for IEEE Transactions on Vehicular Technology and IEEE Access.

**Data-Driven Design for Smart Transportation Systems**

Haiming Jin
Shanghai Jiao Tong University

15:55-16:30, January 6, 2020
Reception Hall, FIT Building

**Abstract:** The recent proliferation of information technology has revolutionized the way people travel and commute, as indicated by the rapidly increasing number of urban residents that adopt various emerging transportation services, such as shared cars, online ride-hailing, etc. In this talk, I will primarily introduce two of our recent work on data-driven design for smart transportation systems.

Nowadays, the urban car sharing (UCS) service offered by online platforms such as Car2Go and Zipcar has become an attractive choice for short-term mobility demands of city residents. Such way of shared mobility also demonstrates its potential in addressing various urban traffic problems (e.g., congestion, exhaust gas emission). However, the power of UCS systems could not be fully unleashed, unless the demand-supply gaps, incurred by the uneven spatial-temporal distributions of car sharing orders and available cars, are effectively bridged. The first part of this talk introduces our design of a robust optimization-based joint order dispatch and repositioning scheme that addresses the aforementioned issue in UCS system. Next, in the second part of this talk, I will discuss a distributed electric taxi (e-taxi) fleet management mechanism based on multi-agent mean field hierarchical reinforcement learning. This work addresses effectively the challenge in deciding the order-serving schedules of e-taxis caused by their long charging time, which came up when integrating existing ride-hailing platforms with the urban e-taxi system.

**Bio:** Haiming Jin received the B.S. degree from Shanghai Jiao Tong University, Shanghai, China, in 2012, and the Ph.D. degree from the University of Illinois at Urbana-Champaign (UIUC), Urbana, IL, USA, in 2017. He is currently a tenure-track Assistant Professor at the John Hopcroft Center for Computer Science, Shanghai Jiao Tong University. Before this, he was a Post-Doctoral Research Associate with the Coordinated Science Laboratory, UIUC. He is broadly interested in addressing unfolding research challenges in the general areas of urban computing, cyber-physical systems, crowd and social sensing systems, network economics and game theory, reinforcement learning, and mobile pervasive and ubiquitous computing. His research results have been published widely in journals and conferences, including TON, TMC, TOMM, MobiHoc, INFOCOM, UbiComp, ICDCS, ICNP, and RTSS. He is the winner of the CCF-DIDI GAIA Young Scholar Research Award, and the Dean' s Fellowship offered by the Engineering School of UIUC from 2017 to 2018.

**A DevOps Framework for Network Functions**

Wenfei Wu
Tsinghua University

16:30-17:05, January 6, 2020
Reception Hall, FIT Building

**Abstract:** Network functions (NFs) are software appliances that improve the performance and security of networks, and they are transparent to the network users. NFs improves the network dataplane performance but also introduce complexity in network management, the essential reason is that the NF developer and NF operators are two groups of people. To fill in the gap, we introduce a framework for NF DevOps. We design a common abstraction layer between the network operators and the NF implementation. With this layer, NF development and delivery can be accelerated and NF operations can be based on the concrete implementation.

**Bio:** Wenfei Wu is an assistant professor in IIIS at Tsinghua University. He got his Ph.D. degree from the University of Wisconsin-Madison in 2015. Dr. Wu's research interests are in networked systems and cybersecurity. He has several papers published in SIGCOMM, NSDI, INFOCOM, CoNEXT, SoCC, etc. He got SoCC13 best student paper and IPCCC19 best paper runner up. Currently, Dr. Wu is working on the following areas: Network Function Virtualization, Distributed Machine Learning Systems, and Trusted Execution Environment Based Applications.

**Some Theoretical Aspects of Blockchain Design**

Andrew C. Yao
Tsinghua University

09:30-10:20, January 7, 2020
Lecture Hall, FIT Building

**Abstract:** There has been much interest in the application of blockchain technology to Fintech and other domains. On the scientific side, the foundation of blockchain is still being explored and developed. In this talk, we will discuss some fundamental issues regarding the security and incentive of blockchain design, such as consistency, fairness and revenue maximization.

**Bio:** Andrew Chi-Chih Yao is Dean of the Institute for Interdisciplinary Information Science at Tsinghua University, member of the Chinese Academy of Sciences, and foreign member of the US Academy of Sciences.

Professor Yao is a world-renowned computer scientist and pioneer in analysis of algorithms, cryptography and quantum computing. He was recipient of the Turing Award in 2000 and to date the only Chinese scientist receiving this highest honor in computer science. Professor Yao was previously on the faculty at MIT, Stanford, UC Berkeley and Princeton University before joining Tsinghua in 2004. He initiated the CS Pilot Class in 2005 (praised by some as the world's best undergraduate CS program); founded the Center for Quantum Information, Institute for Interdisciplinary Information Sciences in 2011 and AI Pilot Class in 2019.

**Game Theoretical Analysis in Economies of Sharing**

Xiaotie Deng
Peking University

10:50-11:40, January 7, 2020
Lecture Hall, FIT Building

**Abstract:** We present a game theoretical study of some sharing economy models enabled by the emergence of information and communication technologies. We discussed recent works in the issues of resource allocation and pricing, agent incentive analysis in the market, as well as competitive and cooperative strategy design among market players. Our will Today focus on a network bandwidth resource sharing model for an Internet wide successful application problem. For this problem with a nice combinatorial characterization of a market equilibrium and a distributed protocol converging to the market equilibrium, we show its truthful properties against agent manipulative behavior, as well as a bounded incentive ratio against the Sybil attack.

**Bio:** Xiaotie Deng got his BSc from Tsinghua University, MSc from Chinese Academy of Sciences, and PhD from Stanford University in 1989.

He is currently a chair professor at Peking University. He taught in the past at Shanghai Jiaotong University, University of Liverpool, City University of Hong Kong, and York University. Before that, he was an NSERC international fellow at Simon Fraser University. Deng's current research focuses on algorithmic game theory, with applications to Internet Economics and Finance including sponsored search auction, p2p network' s economics such as BitTorrent network, sharing economics, and blockchain.

His other works cover online algorithms, parallel algorithms, and combinatorial optimization.

He is an ACM fellow for his contribution to the interface of algorithms and game theory, and an IEEE Fellow for his contributions to computing in partial information and interactive environments.

**Knowledge Self-distillation and Scalable Neural Networks: Towards Accurate, Efficient and Robust Neural Networks**

Kaisheng Ma
Tsinghua University

14:00-14:35, January 7, 2020
Room 1-315, FIT Building

**Abstract:** The training period of deep neural networks can be formulated as a non-convex optimization problem which involves the training samples (X, Y) and model weights (W). However, we find that both inputs X and labels Y in conventional training process have their problems. To address this issue, we have proposed a series of techniques by refining the training samples and training process. Experiments show that these methods can significantly improve model accuracy, robustness and efficiency.

**Bio:** Kaisheng Ma is now an Assistant Professor in Institute for Interdisciplinary Information Sciences (IIIS), Tsinghua University.

He got Ph.D. in Department of Computer Science and Engineering, The Pennsylvania State University. His research focuses on computer architecture, implanted devices, AI Algorithms Design, focusing on interpretation, robustness and compact model design.

Dr. Ma has won many awards, including: 2015 HPCA Best Paper Award, 2016 IEEE MICRO Top Picks, 2017 ASP-DAC Best Paper Award. 2018 EDAA Best Dissertation Award. Dr. Ma has many honors, including 2016 Penn State CSE Department Best Graduate Research Award (Among ~170 Ph.D. students), 2016 Cover Feature of NSF ASSIST Engineering Research Center Newsletter (Among 40 graduate students across four participating universities.), 2011 Yang Fuqing & Wang Yangyuan Academician Scholarship (1/126, Peking University.).

**AI Characters – Bring 3D Characters to Life**

Ye Pan
Shanghai Jiao Tong University

14:35-15:10, January 7, 2020
Room 1-315, FIT Building

**Abstract:** AI characters - taking an agent approach to modeling characters' beliefs and goals in the context of their story worlds, we will develop fundamental building blocks to enable natural, emotionally engaging, personal and persistent interactions with guests, tools for our storytellers to craft their stories and preserve character integrity, and an engine to drive the interactions that is agnostic to the character embodiment.

**Bio:** Ye Pan is a tenure-track Associate professor in John Hopcroft Center for Computer Science, Shanghai Jiao Tong University. Her research interests include: AR/VR, characters, avatars, HCI, computer graphics. She received her PhD in Computer Science from University College London (UCL) in 2015. She previously graduated from UCL in 2011 with an MRes in Virtual Environments, Imaging and Visualization, and from Purdue/UESTC in 2010 with a BSc in Communication and Information Engineering. She was worked at Disney Research, Digital Catapult, and Virtual Environment and Computer Graphics group at UCL. She was selected as Forbes China 30 under 30 on Science in 2019.

**Learning Based Optimization**

Zhouchen Lin
Peking University

15:10-15:45, January 7, 2020
Room 1-315, FIT Building

**Abstract:** Optimization is a core computational technique for many areas, including machine learning, communication, signal processing, etc. However, in the traditional ways the complexity of solving particular types of problems has lower bounds, which are unbreakable if we confine ourselves to traditional ways. In recent years, there emerge a new optimization strategy, called learning based optimization, that can achieve much faster convergence rates for particular types of data. In this talk, I will introduce the basic ideas, related work, and our recent work.

**Bio:** Zhouchen Lin is a professor with School of EECS, Peking University. His research areas include machine learning, pattern recognition, computer vision, image processing, and numerical optimization. He is an area chair of ACCV 2009/2018, CVPR 2014/2016/2019/2020, NeurIPS 2015/2018/2019, AAAI 2019/2020, ICML 2020, and IJCAI 2020. He is an associate editor of IEEE Transactions on Pattern Recognition and Machine Intelligence and International Journal of Computer Vision. He is a recipient of NSF Fund for Distinguished Young Scholar. He is a Fellow of IAPR and IEEE.

**Deep Learning: Interpretability, Capacity, and Evaluation**

Quanshi Zhang
Shanghai Jiao Tong University

16:05-16:40, January 7, 2020
Room 1-315, FIT Building

**Abstract:** Although deep neural networks (DNNs) have achieved superior performance in different visual tasks, the knowledge representation inside a DNN is still considered as a black box. In this talk, I mainly introduce several core issues in the semantic interpretation of deep feature representations and the quantification of the representation capacity of DNNs, which include

1. Learning a deep coupling of semantic graphs and DNNs;
2. Learning disentangled and interpretable feature representations in DNNs;
3. Learning DNNs with interpretable modular architectures;
4. Mathematically explanation of representation capacity of DNNs;
5. Evaluation of explanation methods.

**Bio:** Quanshi Zhang is an associate professor at the Shanghai Jiao Tong University. Before that, he received the BS degree in machine intelligence from the Peking University, China, in 2009 and M.S. and Ph.D. degrees in the center for spatial information science at the University of Tokyo, Japan, in 2011 and 2014, respectively. From 2014 to 2018, he was a postdoctoral researcher at the University of California, Los Angeles, under the supervision of Prof. Song-Chun Zhu. His research interests range across computer vision and machine learning. Now, he is leading a group for explainable AI. He is also a co-chair of CVPR 2020 Workshop on Explainable AI and AAAI 2019 Workshop on Network Interpretability.

**A Stratified Approach to Robustness for Randomly Smoothed Classifiers**

Yang Yuan
Tsinghua University

16:40-17:15, January 7, 2020
Room 1-315, FIT Building

**Abstract:** Strong theoretical guarantees of robustness can be given for ensembles of classifiers generated by input randomization. Specifically, an $\ell_2$ bounded adversary cannot alter the ensemble prediction generated by an isotropic Gaussian perturbation, where the radius for the adversary depends on both the variance of the perturbation as well as the ensemble margin at the point of interest. We build on and considerably expand this work across broad classes of perturbations. In particular, we offer guarantees and develop algorithms for the discrete case where the adversary is $\ell_0$ bounded. Moreover, we exemplify how the guarantees can be tightened with specific assumptions about the function class of the classifier such as a decision tree. We empirically illustrate these results with and without functional restrictions across image and molecule datasets.

**Bio:** Yang Yuan is now an assistant professor at IIIS, Tsinghua. He finished his undergraduate study at Peking University in 2012, ranked #2 in the computer science department. Afterwards, he received his PhD at Cornell University in 2018, advised by Professor Robert Kleinberg. During his PhD, he was a visiting student at MIT/Microsoft New England (2014-2015) and Princeton University (2016 Fall). Before joining Tsinghua, he spent one year at MIT Institute for Foundations of Data Science (MIFODS) as a postdoc researcher, advised by Professor Piotr Indyk and Professor Aleksander Madry. He works on machine learning theory and algorithm design, including optimization, neural network analysis, hyperparameter tuning, etc. He was on the list of Forbes China 30 Under 30 (2019).

**Theoretical Understanding of Stochastic Gradient Descent in Deep Learning**

Zhanxing Zhu
Peking University

14:00-14:35, January 7, 2020
Room 1-202, FIT Building

**Abstract:** Stochastic gradient descent (SGD) is currently a standard workhorse for training deep learning models. Besides its computational benefits, its theoretical understanding and analysis is rather limited, remaining as a mystery. Recently, we discover that SGD has implicit regularization effects, i.e. the noise introduced by SGD helps to find the minima that generalize better. We provide two new perspectives for modeling this noise, additive and multiplicative ones. Based on the additive noise type, we discover that the SGD noise is anisotropic. And it aligns well with curvature of the loss function such that it can help to escape from sharp minima towards flatter ones much more efficiently than isotropic equivalence. From the multiplicative perspective, we interpret the regularization effects of SGD through minimizing local Gaussian/Radamacher complexity. This understanding also provides us new insights for implementing large-batch training without loss of generalization performance. These new findings shed some light on understanding the learning dynamics of deep learning towards opening this black-box.

**Bio:** Dr. Zhanxing Zhu, is currently assistant professor at School of Mathematical Sciences, Peking University, also affiliated with Center for Data Science, Peking University. He obtained Ph.D degree in machine learning from University of Edinburgh in 2016. His research interests cover machine learning and its applications in various domains. Currently he mainly focuses on deep learning theory and optimization algorithms, reinforcement learning, and applications in traffic, computer security, computer graphics, medical and healthcare etc. He has published more than 40 papers on top AI journals and conferences, such as NIPS, ICML, CVPR etc. He was awarded "2019 Alibaba Damo Young Fellow", and obtained "Best Paper Finalist" from the top computer security conference CCS 2018.

**Scalable and General Privacy-Preserving Data Mining: From Research to Production**

Wei Xu
Tsinghua University

14:35-15:10, January 7, 2020
Room 1-202, FIT Building

**Abstract:** Privacy is a big hurdle for collaborative data mining across multiple parties. In this talk, we present our multi-party computation (MPC) system, PrivPy designed for large-scale data mining tasks. Although MPC is a well-known technique in cryptography, it is still unclear to engineer a general and scalable MPC platform for real-world data mining tasks. PrivPy combines easy-to-use Python programming interface with state-of-the-art secret-sharing-based MPC backend. With essential data types and operations (such as NumPy arrays and broadcasting), as well as automatic code-rewriting, programmers can write modern data mining algorithms conveniently in familiar Python. In this talk, we introduce of our main results from our paper in KDD' 19. Also, we will summarize our one-year experience on making it a real product.

**Bio:** Wei Xu is an associate professor and assistant dean at the Institute for Interdisciplinary Information Sciences (IIIS) of Tsinghua University in Beijing. He is also an associate director of the Tsinghua's Institute of Financial Technology and director of its blockchain research center. His research interest includes distributed system design, data science, especially their applications in financial technology. He has published 40+ research papers in leading venues. He received faculty research awards from Google and IBM, graduate student advising award and top-performance employee award from Tsinghua and multiple best paper awards at leading academic conferences. He received his B.S.E. from Univ. of Penn and Ph.D. from UC Berkeley. Before Tsinghua, he worked for Google as a software engineer.

**Abstraction in Theorem Proving**

Qinxiang Cao
Shanghai Jiao Tong University

14:00-14:35, January 7, 2020
Room 1-312, FIT Building

**Abstract:** Interactive theorem provers like Coq has been used for formalizing different math objects. Research projects like Verified Software Toolchain (VST) and CompCert have used such methods to certify programs' correctness. However, verfication by proof is expensive; the proof can be as 100 times long as the verified program. In this talk, I will show some new progresses about proof reusing. Our methodology enables researchers to formalize important theorems very abstractly and apply them in different concrete instances.

**Bio:** Qinxiang Cao is an assistant professor of John Hopcroft Center in Shanghai Jiao Tong University. He got his bachelor degree in Peking University and his PhD in Princeton University. Qinxiang Cao mainly works on research projects about formal methods, program logic and program correctness verification.

**Coreset: A Technique to Turn BIG DATA into Tiny Data**

Jian Li
Tsinghua University

14:35-15:10, January 7, 2020
Room 1-312, FIT Building

**Abstract:** Coresets have become more relevant in the era of big data as they can drastically reduce the size of a dataset while guaranteeing that answers for certain queries are provably close.

In particular, given a large dataset P and a class C of queries, a coreset S is a dataset of much smaller size such that for every query $r \in C$, the answer r(S) for the small dataset S is close to the answer r(P) for the original large dataset P. In this talk, I will survey some techniques for constructing coreset for a variety of optimization problems, and briefly mention some of our results on constructing coresets for more general metric spaces and for stochastic data points.

**Bio:** Jian Li is currently an associate professor at Institute for Interdisciplinary Information Sciences (IIIS, previously ITCS), Tsinghua University, headed by Prof. Andrew Yao. He got his BSc degree from Sun Yat-sen (Zhongshan) University, China, MSc degree in computer science from Fudan University, China and PhD degree in the University of Maryland, USA. His major research interests lie in algorithm design and analysis, machine learning, databases and finance. He co-authored several research papers that have been published in major computer science conferences and journals. He received the best paper awards at VLDB 2009 and ESA 2010. He is also a recipient of the "221 Basic Research Plan for Young Faculties" at Tsinghua University, the "new century excellent talents award" by Ministry of Education of China, and the National Science Fund for Excellent Young Scholars.

**A Fast Algorithm for Sampling k-SAT Solutions in the Local Lemma Regime**

Chihao Zhang
Shanghai Jiao Tong University

15:10-15:45, January 7, 2020
Room 1-312, FIT Building

**Abstract:** In this talk, I will introduce a Markov chain based algorithm for sampling and counting the solutions of k-CNF formula while the parameters are within the Lovász local lemma regime. The sampling algorithm runs in close to linear time and the counting algorithm runs in close to quadratic time. This is by far the fastest algorithm for the problem with the best parameter dependency. Based on joint work with Weiming Feng, Heng Guo and Yitong Yin.

**Bio:** Chihao Zhang is an assistant professor at Shanghai Jiao Tong University. He obtained a Ph.D. degree from Shanghai Jiao Tong University in 2016. He mainly works on counting and sampling algorithms.

**Accelerating IC Backend Design with Deep learning**

Yibo Lin
Peking University

14:00-14:35, January 7, 2020
Room 1-222, FIT Building

**Abstract:** Modern integrated circuit (IC) design flow is long and complicated. Especially in the backend design, iterating between multiple stages such as placement and routing is required for design closure. Recent booming in deep learning brings new opportunities for IC design automation, where the classical problems can be reformulated and solved efficiently. In this talk, we will introduce how deep learning helps to speedup critical backend design stages and the general insights of applying machine learning in design automation.

**Bio:** Yibo Lin is an assistant professor in the Department of Computer Science at Peking University associated with the Center for Energy-Efficient Computing and Applications (CECA). Yibo received the Ph.D. degree in Electrical and Computer Engineering from the University of Texas at Austin in 2018 and the B.S. degree in Microelectronics from Shanghai Jiaotong University in 2013. His research interests include physical design, machine learning applications, GPU/FPGA acceleration in VLSI CAD. He is a recipient of the Best Paper Awards at DAC 2019, Integration, the VLSI Journal 2018, and SPIE Advanced Lithography Conference 2016.

**Beyond Fourier Transform: Super-solving Optical Coherence Tomography via Optimization**

Yuye Ling
Shanghai Jiao Tong University

14:35-15:10, January 7, 2020
Room 1-222, FIT Building

**Abstract:** Optical coherence tomography (OCT) is a volumetric imaging modality that empowers the clinicians and scientists to noninvasively visualize and examine the microscopic cross-sectional architectures of biological samples. By taking advantages of the coherence gating, OCT could achieve micrometer-level axial sectioning with high sensitivity. In the past decade, substantial efforts have been made to push the axial resolution of Fourier-domain OCT (FD-OCT) further into the sub-micron regime via physically extending the system' s spectral bandwidth. Here, we would like to offer a new perspective on this problem. We argue that the coupling between the axial resolution and the spectral bandwidth in FD-OCT is induced by the conventional Fourier transform-based reconstruction algorithm. To surpass this limitation, we present a novel optimization-based reconstruction algorithm to recover the image from ordinary FD-OCT measurement with proper assumptions. We retrieved images at a resolution higher than the theoretical prediction in both numerical simulations and proof-of-concept experiments.

**Bio:** Dr. Yuye Ling is currently an assistant professor in John Hopcroft Center for Computer Science at Shanghai Jiao Tong University. Before joining SJTU, Dr. Ling was a postdoctoral research scientist at Columbia University. He received his Ph.D. from Columbia, M.S. from UCLA, and B.E from SJTU. His research interest is focused on biophotonics and image processing, particularly developing high-performance biomedical imaging platform for clinical settings.

**Sparse-aware DNN Architecture Design: Insights from Resource Utilization and Memory Bandwidth**

Kaisheng Ma
Tsinghua University

15:10-15:45, January 7, 2020
Room 1-222, FIT Building

**Abstract:** Deep learning requires massive computation and storage. Fortunately, the inherent redundancy provides us with the chance to perform approximate computing by pruning to introduce higher sparsity. However, we find that there exist gaps between algorithm optimization and hardware implementation, including simultaneous detecting sparsity of weights and activations, sparsity index overhead, hardware resource underutilization, and higher bandwidth requirement. Firstly, we deployed a calculation mask-based detection method to achieve simultaneous detection in our first chip. Later, we proposed a novel granularity of pruning, which can obtain high accuracy and full speedup in the hardware. We further discovered that sparsity destroys data reuse, leading to higher off-chip bandwidth requirements. Accordingly, two sparsity-aware dataflows are proposed to release the bandwidth requirement. Our target is to have insight into deep learning to fill in the gaps between the algorithm and hardware.

**Bio:** Kaisheng Ma is now an Assistant Professor in Institute for Interdisciplinary Information Sciences (IIIS), Tsinghua University.

He got Ph.D. in Department of Computer Science and Engineering, The Pennsylvania State University. His research focuses on computer architecture, implanted devices, AI Algorithms Design, focusing on interpretation, robustness and compact model design.

Dr. Ma has won many awards, including: 2015 HPCA Best Paper Award, 2016 IEEE MICRO Top Picks, 2017 ASP-DAC Best Paper Award. 2018 EDAA Best Dissertation Award. Dr. Ma has many honors, including 2016 Penn State CSE Department Best Graduate Research Award (Among ~170 Ph.D. students), 2016 Cover Feature of NSF ASSIST Engineering Research Center Newsletter (Among 40 graduate students across four participating universities.), 2011 Yang Fuqing & Wang Yangyuan Academician Scholarship (1/126, Peking University.).

**Bitrate Adaptation for Scalable Video Coding**

Bo Jiang
Shanghai Jiao Tong University

14:00-14:35, January 7, 2020
Reception Hall, FIT Building

**Abstract:** In streaming services videos at different quality levels are typically encoded independently of each other. Adaptive bitrate (ABR) algorithms then decide which quality level to download for each video chunk in the order they are to be played back, with the goal of optimizing users' Quality of Experience (QoE). However, when the network bandwidth varies significantly over time and are hard to predict, existing ABR algorithms can fall short. In this talk, we will explore the potential of using a multi-layered coding scheme called Scalable Video Coding (SVC) to improve QoE. In particular, we will see how to design an ABR algorithm for SVC using reinforcement learning and how to deal with the intrinsic coding overhead of SVC.

**Bio:** Bo Jiang is currently an associate professor at Shanghai Jiao Tong University in the John Hopcroft Center for Computer Science. He received his B.S. degree in electronic engineering from Tsinghua University, Beijing, China, in 2006. He received his M.S. degree in electrical and computer engineering, M.S. degree in applied mathematics, and Ph.D. degree in computer science from the University of Massachusetts Amherst in 2008, 2012, and 2015, respectively. Prior to joining Shanghai Jiao Tong, he was a postdoctoral research associate in the College of Information and Computer Sciences at the University of Massachusetts Amherst. His research interests include network modeling and optimization, and artificial intelligence for network management and applications. He is a recipient of the ACM SIGMETRICS 2016 Best Paper Award. He served on the organizing committee of IEEE ICNP 2019, and the Technical Program Committee of ACM SIGMETRICS 2020, IEEE JSAC 2018 Special issue on Caching for Communication Systems and Networks, IFIP Performance 2017, 2018, and the International Teletraffic Congress 2017.

**Elastic Sketch: Adaptive and Fast Network-wide Measurements**

Tong Yang
Peking University

14:35-15:10, January 7, 2020
Reception Hall, FIT Building

**Abstract:** When network is undergoing problems such as congestion, scan attack, DDoS attack, etc., measurements are much more important than usual. In this case, traffic characteristics including available bandwidth, packet rate, and flow size distribution vary drastically, significantly degrading the performance of measurements. To address this issue, we propose the Elastic sketch. It is adaptive to currently traffic characteristics. Besides, it is generic to measurement tasks and platforms. We implement the Elastic sketch on six platforms: P4, FPGA, GPU, CPU, multi-core CPU, and OVS, to process six typical measurement tasks. Experimental results and theoretical analysis show that the Elastic sketch can adapt well to traffic characteristics. Compared to the state-of-the-art, the Elastic sketch achieves 44.6 ~ 45.2 times faster speed and 2.0 ~ 273.7 smaller error rate.

**Bio:** Tong Yang received his PHD degree in Computer Science from Tsinghua University in 2013. He visited Institute of Computing Technology, Chinese Academy of Sciences (CAS) China from 2013.7 to 2014.7. Now he is an associate professor in the Department of Computer Science and technology, Peking University. His research interests focus on networking algorithms, such as sketches, IP lookups, Bloom filters. He published papers in SIGCOMM, SIGKDD, SIGMOD, ToN, etc.

**Power the Future Energy System with Computer Science**

Chenye Wu
Tsinghua University

15:10-15:45, January 7, 2020
Reception Hall, FIT Building

**Abstract:** The legacy power system, though it has worked admirably over a century, is in a dramatic shift for a more sustainable future. The shift is stimulated by the new components in the system, including storage systems, renewable energies, smart meter devices, etc. These new components are important for the sustainable grid, but they also challenge the control paradigm as well as the business model for the legacy grid. The theme of my research is to contribute a computer science perspective to power the future energy system.

Many of my research seem counterintuitive in light of commonly held beliefs. For example, is local clustering property enough to guarantee the global robustness for data-driven pricing schemes? Is one simple threshold policy able to handle the uncertainties in the dynamic prices? Can we design an efficient energy sharing mechanism facing the regulatory obstacles? Inherent in these questions is my pursuit of the most reliable and effective design for the future electricity sector. In this talk, I will share two stories to highlight the chemistry between computer science and energy.

**Bio:** Chenye Wu is an Assistant Professor at IIIS, Tsinghua University. Dr. Wu recieved his PhD from Tsinghua in 2013, under the supervision of Professor Andrew Yao. He participate actively in two broad areas of "CS/AI+X" type research: 1) AI+Energy Economics, with an emphasis on studying the vulnerability of AI based pricing schemes, limitation of AI with extremely imbalanced sample sets; 2) CS+Urban Systems, i.e., to understand many real world phenomenon through computational (very often stochastic) modeling, ranging from the sharing economy for the electricity sector to the optimal online game matchmaking mechanism design. He is the co-reciepent of the best paper award of IEEE SmartGridComm 2012, and the best of best paper award of IEEE PES General Meeting 2013.

**The First Step Towards Optical Circuit Switched Data Center**

Shizhen Zhao
Shanghai Jiao Tong University

16:05-16:40, January 7, 2020
Reception Hall, FIT Building

**Abstract:** With the ever gowing bandwidth demand in data centers, optical circuit switching has become highly attractive due to its low cost, high capacity, and low energy consumption. Unfortunately, even after decades of research efforts, optical circuit switching has not been really deployed in commercial data centers. This is because the off-the-shelf optical circuit switches (OCS) incurs non-negligible switching latency, making it difficult to react to the bursty traffic in data centers. Existing literatures often attemp to reduce the optical circuit switching latency. However, these new optical switching technologies are still far from mature. We tackle this problem from a completely different angle. By analysing the core layer traffic matrices in 12 different data centers, we find that although the core-layer traffic matrices are bursty, they do exhibit a weaker form of stability. Specifically, for any new traffic matrix, we can always find a similar traffic matrix in the past few weeks. This observation motivates us to compute a robust configuration for OCSs based on the past traffic matrix history. With a robust OCS configuration, the OCSs do not have to be reconfigured upon every traffic change, thus reducing the barrier for commercial deployment.

**Bio:** Shizhen Zhao, Tenure-track Associate Professor in the John Hopcroft Center of Shanghai Jiao Tong University. He got his bachelor's degree from Shanghai Jiao Tong University in 2010 and his PhD degree from Purdue University in 2015. From September 2015 to January 2019, he worked in Google's networking team. His main reasearch interest is network optimization, and its application in real networking systems. He has published papers in top-tier conferences and journals including NSDI, MOBICOM, INFOCOM, IEEE TAC, IEEE/ACM TON, etc. His NSDI work has been productionized in Google's data centers. He is a reviewer of many top tier conferences and journals, including NSDI, INFOCOM, MOBIHOC, IEEE/ACM TON, IEEE TPS, IEEE TSG. He is also a TPC member of ACM MobiHoc 2020.