Pengchao Han

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RESEARCH INTERESTS

Collaborative machine learning
Scheduling and optimization of federated learning and data-free knowledge distillation

Mobile edge cloud networks
Task offloading, Quality of Service (QoS) guarantee and energy conservation

Wireless and optical technologies
Resource allocation and optimization of 5G cellular networks, converged fiber-wireless access networks and heterogeneous networks

EDUCATION

The Chinese University of Hong Kong (Shenzhen) **2021 - current**
Posedoctor | Supervisor: Prof. Jianwei Huang

Northeastern University, China **2016 - 2021**
Ph.D. student in Communication & Information Systems | Supervisor: Prof. Lei Guo

Imperial College London, UK **2018 - 2019**
Visiting student in Electrical and Electronic Engineering | Supervisor: Prof. Kin K Leung

Northeastern University, China **2014 - 2016**
M.S. in Communication and Information Systems | Supervisor: Prof. Lei Guo

Northeastern University, China **2010 - 2014**
B.S. in Communication Engineering | Rank: 1/150

RESEARCH EXPERIENCES

Data-free knowledge distillation

- Designed a new loss function for the generator to produce samples with high authenticity, class diversity, and inter-sample diversity to facilitate data-free knowledge distillation with higher accuracy and more robustness to different hyperparameter settings

Collaborated with Jihong Park (Deakin University, Australia) and Shiqiang Wang (IBM T.J. Watson Research Center, USA)

Service placement in mobile edge cloud networks

- Formulated the interference in terms of delay among services coexisting on the same infrastructure and designed algorithms to minimize overall resource cost for multi-component service placement to achieve interference awareness and delay guarantee
- Defined the equivalent bandwidth for the resource allocation of an edge in a service and designed methods for joint optimization of small cell zooming and multi-component service placement with reduced resource fragments and guaranteed QoS aiming at power consumption minimization

Communication-efficient federated learning

- Automatically determined the degree the sparsity of gradient sparsification enabled federated learning with non-i.i.d. local datasets to minimize the overall training time

Collaborated with Shiqiang Wang (IBM T.J. Watson Research Center, USA) and Kin K Leung (Imperial College London, UK)

Capacity of distributed computing systems

- Derived theoretical formulas for the capacity of distributed systems with multiple resource types, where the power of d choices is considered as the task scheduling strategy in the analysis

Collaborated with Kin K Leung (Imperial College London, UK) and Shiqiang Wang (IBM T.J. Watson Research Center, USA)

WORK EXPERIENCES

Alibaba DAMO Academy **Aug. 2020 - Sept. 2020**

Algorithm Engineer Intern | Hangzhou, China

Speeding up distributed representation learning

- Designed a framework based on (1) sparse communication without sacrificing any performance and (2) the parallelism between back-propagation and grouped communication with adaptively searched group size

HONORS & AWARDS

National scholarship of China for Ph.D. student	2016
Natural science academic achievement third award from Liaoning province, China	2016
National scholarship of China (twice) for B.S. student	2012 & 2013
Outstanding master's thesis award from Liaoning province, China	2017
Outstanding master's thesis award from China Association of Metallurgical Education	2018
China Scholarship Council Scholarship	2018
Huawei Scholarship from Northeastern University, China	2015
Outstanding student Communist Party member of Northeast University, China	2017
Excellent graduate student cadre of Northeastern University, China	2017

PROJECT EXPERIENCES

Fundamental Research Funds of Northeastern University, China **Jul. 2016 to Dec. 2016**

Excellence in Innovation Research | Role: Project Co-leader

DAIS-ITA **Feb. 2018 to Sept. 2019**

International Technology Alliance in Distributed Analytics & Information Sciences funded by the US and the UK governments to study future communications and computing infrastructures, (while visiting Imperial College) | Role: Project member

National Natural Science Foundation of China **Jan. 2016 to Dec. 2018**

Resource Scheduling in Virtualized Fiber-Wireless Broadband Access Networks | Role: Project member

National Natural Science Foundation of China **Jan. 2015 to Dec. 2018**

Resource Allocation and Optimization in OFDM-PON Supported Heterogeneous Access Networks | Role: Project member

PROFESSIONAL SERVICES

Reviewer

- IEEE International Conference on Communications (ICC)
- IEEE Wireless Communications & Networking Conference (WCNC)
- IEEE Communications Letter
- Journal of Parallel and Distributed Computing
- IEEE Internet of Things Journal
- ...

TECHNICAL SKILLS

- Over two years of international collaboration with both industrial and academic partners in the UK, USA and Australia
- Programming Languages: Python | C/C++ | Java | C#
- Mathematical problem solving tools: IBM CPLEX | MATLAB | CVX
- Network evaluation platform: OPNET
- Machine learning frameworks: Pytorch | Tensorflow
- Good English presentation and writing skills

PUBLICATIONS

Conferences

1. **P. Han**, J. Park, S. Wang, Y. Liu, Robustness and diversity seeking data-free knowledge distillation, in *Proc. IEEE International Conference on Acoustics, Speech and Signal Processing* (*ICASSP*), *2021*.
2. **P. Han**, S. Wang, K. K. Leung, Adaptive gradient sparsification for efficient federated learning: an online learning approach, in *Proc. IEEE International Conference on Distributed Computing Systems* (*ICDCS*), Nov. 2020 (acceptance rate: 18.0%).
3. **P. Han**, L. Guo, Y. Liu, VNE^2: A virtual network embedding framework Based on equivalent bandwidth in fiber-wireless enhanced 5G networks, in *Proc. IEEE International Conference on Transparent Optical Networks* (*ICTON*), July 2020, pp. 1-4 (invited).
4. **P. Han**, S. Wang, K. K. Leung, Capacity analysis of distributed computing systems with multiple resource types, in *Proc. IEEE Wireless Communications & Networking Conference* (*WCNC*), May 2020, pp. 1-6.
5. **P. Han**, Y. Liu, L. Guo, Interference-aware task assignment in edge cloud-enhanced 5G fiber-wireless access networks, in *Proc. IEEE/OSA Asia Communications and Photonics Conference* (*ACP*), Nov. 2019, pp. 1-3.
6. Y. Liu, Y. Liu, N. Yan, **P. Han**, L. Guo, Standard-compliant dynamic bandwidth allocation in OFDM-PON supporting multiservice, in *Proc. IEEE/OSA Asia Communications and Photonics Conference* (*ACP*), Nov. 2018, pp.1-3.
7. **P. Han**, L. Guo, Y. Liu, Green virtual network embedding framework based on zooming small cells in fiber-wireless access network for 5G, in *Proc. IEEE International Conference on Transparent Optical Networks* (*ICTON*), July 2017, pp. 1-4 (invited).
8. X. Han, **P. Han**, L. Guo, Y. Liu and J. Hou, Green Virtual network embedding with periodical sleep mechanism for fiber-wireless access network, in *Proc. IEEE/OSA Asia Communications and Photonics Conference* (*ACP*), Nov. 2016, pp. 1-3.
9. J. Hou, Y. Liu, L. Guo, **P. Han**, X. Han, Survivable virtual network embedding based on connection availability in fiber-wireless access network, in *Proc. IEEE/OSA Asia Communications and Photonics Conference* (*ACP*), Nov. 2016, pp. 1-3.
10. **P. Han**, L. Guo, Y. Liu, X. Wei, J. Hou and X. Han, A new virtual network embedding framework based on QoS satisfaction and network reconfiguration for fiber-wireless access network, in *Proc. IEEE International Conference on Communications*(*ICC*), July 2016, pp. 1-7.

11. **P. Han**, L. Guo and Y. Liu, Virtual network embedding in SDN/NFV based fiber-wireless access network, in *Proc. IEEE International Conference on Software Networking* (*ICSN*), June 2016, pp. 1-5.
12. **P. Han**, Y. Liu, L. Guo, J. Hou and X. Han, Novel virtual network embedding algorithm based on QoS satisfaction for fiber-wireless access network, in *Proc. IEEE/OSA Asia Communications and Photonics Conference* (*ACP*), Nov. 2015, pp. 1-3.
13. Y. Liu, L. Guo, **P. Han** and Y. Zhou, Joint wireless and optical resources allocation based on connection availability in FiWi access network, in *Proc. IEEE International Conference on Optical Communications and Networks* (*ICOCN*), Aug. 2015, pp. 1-3.
14. **P. Han**, Y. Liu, L. Guo, Y. Yu and L. Zhang, Novel energy-saving design to enable green multi-radio fiber-wireless access networks, in *Proc. IEEE/OSA Asia Communications and Photonics Conference* (*ACP*), Nov. 2014, pp. 1-3.
15. Y. Liu, L. Guo, **P. Han** and Y. Yu, Failure dependency-based protection scheme for multi-segment fiber-wireless (FiWi) access network, in *Proc. IEEE/CIC International Conference on Communications in China* (*ICCC*), Oct. 2014, pp. 141-145.
16. Q. Cai, W. Hou, C. Yu, **P. Han**, L. Zhang and L. Guo, Design and OPNET implementation of routing algorithm in 3D optical network on chip, in *Proc. IEEE/CIC International Conference on Communications in China* (*ICCC*), Oct. 2014, pp. 112-115.

Journals

1. **P. Han**, Y. Liu, L. Guo, Interference-aware online multi-component service placement in edge cloud networks and its AI application, *IEEE Internet of Things Journal*, 2021.
2. Y. Liu, **P. Han**, J. Hou, J. Zheng, Resource-efficiently survivable IoT services provisioning via virtual network embedding in fiber-wireless access network, *IEEE ACCESS*, Vol. 7, pp. 65007-65018, May 2019.
3. Y. Liu, Y. Yang, **P. Han**, Z. Shao, C. Li, Virtual network embedding in fiber-wireless access networks for resource-efficient IoT service provisioning, *IEEE ACCESS*, Vol. 7, pp.65506-65517, May 2019.
4. **P. Han**, Y. Liu, L. Guo, QoS satisfaction aware and network reconfiguration enabled resource allocation for virtual network embedding in fiber-wireless access network, *Computer Networks*, vol.143, pp. 30-48, Oct. 2018.
5. L. Guo, X. WANG, Y. Liu, **P. Han**, Y. Xie, Y. Tan, Directional routing algorithm for deep space optical network, *China Communications*, Jan. 2017.
6. Y. Liu, Y. Yu and **P. Han**, Joint wireless and optical resources allocation for availability-guaranteed service in survivable fiber-wireless access network, *IEEE/ACM Photonic Network Communications*, vol. 32, no. 2, pp. 310-319, Oct. 2016.
7. Y Tan, Y Liu, L Guo, **P. Han**, Joint relay selection and link scheduling in cooperative free-space optical system, *Optical Engineering*, vol. 55, no. 11, pp. 111604-1-111604-8, Aug. 2016.
8. Y. Yu, Y. Liu, **P. Han** and Y. Zhou, Survivable deployment of cloud-integrated fiber-wireless networks against multi-fiber failure, *IEEE/ACM Photonic Network Communications*, vol. 31, no. 3, pp. 559-567, June 2016.
9. **P. Han**, L. Guo, Y. Liu, J. Hou and X. Han, Joint wireless and optical power states scheduling for green multi-radio fiber-wireless access network, *IEEE/OSAJournal of Lightwave Technology*, vol. 34, no. 11, pp. 2610-2623, June 2016.
10. X. Zhang, **P. Han**, Y. Yu, Y. Zhou and Y. Xie, Comparison and analysis of ONU sleep mechanism based on OPNET for green fiber-wireless access network, *Applied Mechanics and Materials*, vol. 700, pp. 181-184, Dec. 2014.
11. X. Zhang, Y. Zhou, Y. Yu, **P. Han** and X. Wang, Comparison and Analysis of DCO-OFDM, ACO-OFDM and ADO-OFDM in IM/DD systems, *Applied Mechanics and Materials*, Vols. 701-702, pp. 1059-1062, Dec. 2014.
12. Y. Yu, Y. Liu, Y. Zhou and **P. Han**, Planning of survivable cloud-integrated Wireless-Optical broadband access network against distribution fiber failure, *Optical Switching and Networking*, vol.14, no.3, pp.217-225, Aug. 2014.

13. X. Zhang, W. Hou, **P. Han** and L. Guo, Design and implementation of the routing function in the NOX controller for software-defined networks, *Applied Mechanics and Materials*, Vols. 635-637, pp. 1540-1543, Sept. 2014.
14. X. Gong, H. Li, **P. Han** and Y. Zhou, Optical OFDM for downstream transmission in long-reach PON, *Applied Mechanics and Materials*, Vols. 631-632, pp. 860-863, Sept. 2014.

Patents

1. L. Guo, **P. Han**, Y. Liu, S. Song, A method for constructing ultra-dense small cell networks in 5G, *ZL 201710845051.8*, 2020.
2. L. Guo, S. Song, Y. Liu, **P. Han**, A method for adaptive FSO backhaul network construction for ultra-dense small cell base stations in 5G, *ZL 201710844972.2*, 2020.