

Pengchao Han

Postdoc Research Associate — The Chinese University of Hong Kong, Shenzhen
hanpengchao@cuhk.edu.cn — 86-18506910616

RESEARCH INTERESTS

Distributed machine learning

Optimization of federated learning and data-free knowledge distillation

Mobile edge computing

Service placement, Quality of Service (QoS) guarantee, and energy conservation

Wireless and optical technologies

Resource allocation and optimization of 5G heterogeneous networks and converged fiber-wireless access networks

EDUCATION

The Chinese University of Hong Kong, Shenzhen	2021 - current
<i>Postdoc Research Associate — Supervisor: Prof. Jianwei Huang</i>	
Northeastern University, China	2016 - 2021
<i>Ph.D. student in Communication & Information Systems — Supervisor: Prof. Lei Guo</i>	
Imperial College London, UK	2018 - 2019
<i>Visiting student in Electrical and Electronic Engineering — Supervisor: Prof. Kin K Leung</i>	
Northeastern University, China	2014 - 2016
<i>M.S. in Communication and Information Systems — Supervisor: Prof. Lei Guo</i>	
Northeastern University, China	2010 - 2014
<i>B.S. in Communication Engineering — Rank: 1/150</i>	

RESEARCH EXPERIENCES

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)

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 5G mobile edge computing networks

- Formulated the interference in terms of delay among services coexisting on the same infrastructure; 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 flexible resource allocation of an edge in a service; Formulated and resolved the joint optimization of small cell zooming and multi-component service placement with reduced resource fragments and guaranteed QoS

Capacity of distributed computing systems

- Derived theoretical formulas for the capacity of distributed systems with multiple resource types, where the power of 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)

Resource allocation in converged fiber-wireless (FiWi) access networks

- Virtual Network Embedding (VNE) with best-effort QoS satisfaction
- Power state control of network devices for energy-efficient FiWi design

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

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

PROJECT EXPERIENCES

GuangDong Basic and Applied Basic Research Foundation

Oct. 2022 to Sept. 2025

Research on Theory and Key Technologies of Federated Learning with Black-Box and Heterogeneous Models — Role: Project Leader — CNY 100,000

Fundamental Research Funds of Northeastern University, China

Jul. 2016 to Dec. 2016

Excellence in Innovation Research — Role: Project Co-leader

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

Fundamental Research Funds for central universities**Jan. 2017 to Dec. 2019**

Major Scientific and Technological Innovation Projects: Reseach on Framework and Key Technologies of Software Defined Industrial Internet of Things — Role: Project member

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

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
- IEEE Transactions on Mobile Computing
- ...

TECHNICAL SKILLS

- 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, VNE²: 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 (ICOON)*, 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. Q. Wei, **P. Han** and Y. Liu, Mobility-Aware Multi-Instance VNF Placement in Mobile Edge Computing Networks, in *Proc. International Wireless Communications and Mobile Computing Conference (IWCMC)*, Harbin, China, 2021, pp. 1303-1308.
16. B. Yang, **P. Han**, C. Feng, Y. Liu and L. Guo, Service Migration with High-Order MDP in Mobile Edge Computing, in *Proc. International Conference on Communication Software and Networks (ICCSN)*, Chongqing, China, 2021, pp. 206-212.
17. J. Han, **P. Han** and Y. Liu, Survivable Wavelength-Division-Multiplexed Passive Optical Network for Fronthaul in 5G and Beyond, in *Proc. International Conference on Intelligent Computing and Wireless Optical Communications (ICWOC)*, Chongqing, China, 2021, pp. 5-10.
18. 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.
19. 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 (*coresponding author)

1. B. Luo, X. Ouyang, P. Sun, **P. Han**, N. Ding, J. Huang, Optimization Design for Federated Learning in Heterogeneous 6G Networks, *IEEE Network*, 2022(major revision).
2. **P. Han**, Y. Liu, X. Zhang, L. Guo, Energy-efficient service placement based on equivalent bandwidth in cell zooming enabled mobile edge cloud networks, *IEEE Transactions on Vehicular Technology*, 2022 (JCR Q1).
3. C. Feng, **P. Han***, X. Zhang, Q. Zhang, Y. Zong, Y. Liu, L. Guo, Cost-minimized computation offloading of online multi-function services in collaborative edge-cloud networks, *IEEE Transactions on Network and Service Management*, 2022 (JCR Q1).
4. C. Feng, **P. Han***, X. Zhang*, B. Yang, Y. Liu, L. Guo, Computation offloading in mobile edge computing networks: A survey, *Journal of Network and Computer Applications*, vol. 202, 2022 (JCR Q1).
5. **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*, vol. 8, no. 13, pp. 10557-10572, July 2021 (JCR Q1).
6. 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.
7. 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.
8. **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 (JCR Q1).
9. L. Guo, X. WANG, Y. Liu, **P. Han**, Y. Xie, Y. Tan, Directional routing algorithm for deep space optical network, *China Communications*, Jan. 2017.
10. 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.
11. 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.
12. 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.
13. **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/OSA Journal of Lightwave Technology*, vol. 34, no. 11, pp. 2610-2623, June 2016 (JCR Q1).
14. 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.
15. 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.
16. 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.
17. 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.
18. 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. C. Feng, Y. Liu, L. Guo, **P. Han**, X. Zhang, Q. Zhang, Y. Zong, A low-cost computation offloading method for online multi-function tasks in edge-cloud networks, *ZL 202110182630.5*, 2022.
3. 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.
4. **P. Han**, J. Huang, A method and equipment for federated knowledge distillation, 2022 (Accepted).