Hao Liu

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Personal Profile

Hao Liu is a Ph.D candidate in the Accelerated Connected Computing Lab (ACCL, `https://cemse.kaust.edu.sa/accl`) at KAUST. He mainly works on Near-Edge Assisted DNN Inference, which is to optimize DNN inference by offloading computation from edge to near-edge accelerators. He also works on split computing, reconfigurable computing systems, and has explored machine learning model compression and physically unclonable functions.

He received his Bachelor's degree in Electronic and Information Engineering and his Master's degree in Cyber Science and Technology from Beihang University, Beijing, China in 2019 and 2021, respectively.

Education

King Abdullah University of Science and Technology (KAUST) *Jeddah, Makkah, Saudi Arabia*

PhD student in Computer Science *Jan 2022 - Current*

- Supervised by Prof. Suhaib Fahmy
- Working as teaching assistant for CS256 (Digital Design and Computer Architecture)
- **Courses:** Digital Design and Computer Architecture, Design and Analysis of Algorithms, Deep Learning for Visual Computing, Hardware Accelerator Architectures

Beihang University (BUAA) *Beijing, China*

Master of Cyber Science and Technology *Sept. 2019 - Jan. 2022*

- Supervised by Prof. Zhenyu Guan
- Served as teaching assistant in Digital Circuits and Systems
- **Courses:** Mathematical Statistics, Matrix Theory

Beihang University (BUAA) *Beijing, China*

Bachelor of Electronic and Information Engineering *Sept. 2015 - Jun. 2019*

- **Courses:** Digital Circuits and Systems, Mathematical Analysis for Engineering, Circuit Analysis, Electronic Circuit

Publications

Split DNN Inference for Exploiting Near-Edge Accelerators
Hao Liu, Mohammed E. Fouda, Ahmed M. Eltawil, Suhaib A. Fahmy
IEEE International Conference on Edge Computing Communications (IEEE EDGE), 2024

A Filter Rank Based Pruning Method for Convolutional Neural Networks
Hao Liu, Zhenyu Guan, Peng Lei
IEEE International Conference on Trust, Security and Privacy in Computing and Communications (TrustCom), 2021

A Wearable Ad Hoc Device for Situational Awareness and Trusted Collaboration
Zhenyu Guan, Jiawei Li, Hao Liu, Dawei Li
Smart Blockchain: Second International Conference, 2019

Physical unclonable functions for IoT device authentication
Zhenyu Guan, Hao Liu, Yuyao Qin
Journal of Communications and Information Networks 4.4 (2019) pp. 44–54. 2019

Research Experience

Split Computing for Deep Neural Network *Jeddah, Saudi Arabia*

King Abdullah University of Science and Technology *Oct. 2022 - Current*

- Supervised by Prof. Suhaib Fahmy
- Formulate the problem of multi-split on DNNs into an optimization problem considering the accuracy, computing and transmission overhead.
- Propose to insert multiple autoencoders to split DNNs and execute different partitions of DNNs on different devices to reach the trade-off between latency and energy.
- Experiment on ResNet50 and VGG16 with CIFAR100 and ImageNet dataset.

Network Architecture Search for Split Computing *Beijing, China*

Tsinghua University *Jun. 2023 - Sept. 2023*

- Supervised by Prof. Yu Wang
- Learn and extend an existing project of Network Architecture Search (NAS) aw_nas (`https://github.com/walkerning/aw_nas`)

Task Offloading and Resource Allocation *Jeddah, Saudi Arabia*

King Abdullah University of Science and Technology *Apr. 2022 - Current*

- Supervised by Prof. Suhaib Fahmy
- Extend an existing task offloading model for mobile edge cloud environment. Theoretically analyze the minimal latency, the amount of tasks and corresponding computing and transmission resources allocated to each devices under the MEC environment with different computing and transmission capacity. Specifically, we consider the extreme situations, including fully utilizing transmission or computing resources of the MEC environment, and fully utilizing all the resources of the MEC environment.
- Simulate the latency, the computing/transmission resource utilization and computing data percentage of each device under different MEC environment.

A Filter Rank Based Pruning Method for Convolutional Neural Networks *Beijing, China*

Beihang University *Jun. 2020 - Dec. 2021*

- Supervised by Prof. Zhenyu Guan
- Proposed a filter rank based pruning method to reduce the FLOPs and parameters of CNN.
- Used Bayesian Rank Prediction Algorithm to calculate the rank of filters. Filters of low rank can be removed with low decreased accuracy.

Physical Unclonable Functions for IoT Device Authentication *Beijing, China*

Beihang University *Mar. 2019 - Dec. 2019*

- Supervised by Prof. Zhenyu Guan
- Proposed an identity authentication protocol that can verify the devices and users identities to protect the integrity and authenticity of the information in the IoT.
- Used physical unclonable function to extract the uniqueness and tamper resistance of the randomness in the manufacturing process of the physical device as the identities of devices.
- The simulation results show that our protocol provides a strong security guarantee for IoT devices.

A Wearable Ad Hoc Device for Situational Awareness and Trusted Collaboration *Beijing, China*

Beihang University *Sept. 2018 - Feb. 2019*

- Supervised by Prof. Zhenyu Guan
- Proposed a wearable situational awareness and trusted collaboration architecture to build a system of trust and efficiency.
- The platform that provides functions of real-time space collaboration gains a wide range of application prospects such as earthquake rescue, anti-terrorism and firefighting.

Skills

Programming Verilog, Python (Pytorch), Matlab, C Programming Language

English IELTS Overall Band 7 (Academic, L7.5 R8.5 W6.5 S6.0; taken on 7/31/2021)

Achievements

2019, 2020 **Second class,** The Graduated Academic Scholarships *Beijing, China*

2018 **Second Prize,** RMB 30,000 funding supported by Student Research Training Program *Beijing, China*

2018 **Second prize,** The 11th National College Student Information Security Contest (Captain) *Wuhan, China*

2018 **Second prize,** The 28th Feng Ru Cup Student Academic Competition of Beihang University *Beijing, China*

2017 **Third prize,** The 8th Lan Qiao Cup in MCU Design and Development Competition *Beijing, China*

References available upon request.