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Yuncong Hong

PhD Candidate, Computer Science, The University of Hong Kong

Education

Southern University of Science and Technology (SUSTech)
Bachelor of Engineering in **Communication Engineering**, *Sep ’14 - Jul ’18*
GPA: 3.77/4.00 (Major) **Ranking: 3/30**

The University of Hong Kong (HKU)
Doctor of Philosophy in **Computer Science**, *Sep ’18 - Jul ’22* (expected)

Research Interests

Edge Computing, Application-Centric Network Optimization, and Applications of Markov Decision Process (MDP).

Research Skills

Core Courses: Convex Optimization, Polynomial Optimization, Stochastic Process, Wireless Communications, and Information Theory.

Programming Languages: Python, Rust, C/C++, Nodejs, TypeScript, and LabVIEW.

Toolboxes: Numba + SciPy + Numpy, PyTorch/TensorFlow.

Awards & Achievements

Awarded **Second-class Scholarship and “Execellent Student”** from 2016 to 2017.
Awarded **Best Track Paper of Algorithm Track** in IEEE MSN, 2020.

Selected Publications

[1] **Y. Hong**, B. Lv, R. Wang, H. Tan, Z. Han, H. Zhou, F. C. M. Lau, “Online Distributed Job Dispatching with Outdated and Partially-Observable Information,” in *Proc. IEEE MSN, 2020* **Best Track Paper Award**.

[2] **Y. Hong**, B. Lv, R. Wang, H. Tan, Z. Han, F. C. M. Lau, “Distributed Job Dispatching in Edge Computing Networks with Random Transmission Latency: A Low-Complexity POMDP Approach,” in *IEEE Internet of Things Journal*, doi: 10.1109/JIOT.2021.3103798.

[3] L. Zhou, **Y. Hong**, S. Wang, R. Han, D. Li, R. Wang, and Q. Hao, “Learning centric wireless resource allocation for edge computing: Algorithm and experiment,” *IEEE Transactions on Vehicular Technology*, Jan. 2021.

Academic Researches

Job Dispatching with Outdated-and-Partial Information in Edge Computing System
Supervisors: Prof. R. Wang, Prof. H. Tan, and Prof. F. C. M. Lau *Nov ’18 - Feb ’21*

– We formulated the distributed and cooperative job dispatching in edge computing system with outdated and partial information as a POMDP problem.
– We proposed a novel low-complexity approximate MDP solution framework via alternative policy iteration, and derived an analytical performance lower bound and a tighter semi-analytical lower bound.
– We conducted extensive simulations based on the Google Cluster trace, and compare our approach with three heuristic benchmarks. The evaluation results show that our proposed algorithm can achieve as high as 20.67% reduction in average job response time and consistently perform well under various parameter settings of information staleness.

Online Federated Learning on Mobile Vehicles for 3D Object Detection

Supervisors: Prof. R. Wang and Prof. F. C. M. Lau *Nov '19 - Present*

– We defined a scenario where multiple vehicles equipped with a SECOND network cooperatively collect the 3D object information to the edge server.

– We developed a semi-supervised federated learning framework, where the fused knowledge at the edge server is transferred to the vehicles with knowledge distillation for model accuracy improvement.

– We implemented the experiment based on a high-fidelity autonomous driving simulator CARLA, and generated some datasets conformed to the KITTI dataset format. The source code is available on Github.

– In the extended work, we formulate a resource allocation problem in the above scenario, to achieve both communication and computation efficiency (Hybrid Utilization Maximization) in online federated training.

Projects

Manipulation of Networking Stack in Linux Kernel

Oct '16 - Oct '18

– **MAC Layer (L2)**: (Github Link)

- This project aims at providing a faster and reliable access to the wireless NIC driver from userspace. We design one kernel module to **hijack the function entry** of the driver, and use "mmap" to establish a shared-memory communication between kernel and userspace.
- The experiment results show that we could alter a set of **IEEE 802.11e** parameters (related to the channel access priority) within 10 millisecond for 1000 accesses.

– **IP Layer (L3)**: (Github Link)

- This project implements an in-stack network data encryption trial based on Linux Netfilter subsystem. It uses asynchronous encryption method **AES-128** provided by Linux kernel, to encrypt the payload of L3 (i.e., content of an IP packet) and decrypt it correspondingly at the receiver's side.
- This project would be extended with an identification mechanism which allows the tx/rx to negotiate the enabling of en(de)cryption, and a userspace tool based on **Linux Netlink subsystem** for key management.

VLC-WiFi Integrated Communication Platform

Sep '17 - Dec '18

– In this project, we implemented a hybrid VLC-WiFi communication system, where the VLC link bears the high-throughput downlink, and Wi-Fi link servers as uplink.

– We implemented the system on **NI instruments** with out-of-shelf **Wi-Fi NIC**, and the retransmission mechanism is implemented over IP layer. The source code of the system implementation is provided on Github. We also have one granted patent (CN110429979B) over this platform.

SerDe-based Inter-Process Communication (IPC) Framework

Apr '21 - Present

– This IPC framework is writen in Rust language and the source code is available on Github. (**SerDe** stands for serializing and deserializing)

– This IPC framework borrows the paradigms from *Android Binder* and *gRPC*, which aims at providing unified FFI access for **any typed-function signatures in any languages**. It currently supports Rust/CPP/Python services.

– This IPC framework is designed in C/S model, and the backend is in modular design. More specifically, it could support different IPC protocols (e.g., socket, binder) and different SerDe methods (e.g., json, ProtoBuf).