Junpeng Guo (**guo567@purdue.edu**) *Phone:* **(734) 882-9677** *Homepage:* **https://jpkuo24.github.io/**

Education

Purdue University, West Lafayette, Indiana USA **Jun. 2019 – Now**
Ph.D., Computer Science
Advisor: Chunyi Peng
Research Interests: Mobile systems, Edge computing, Autonomous, and connected drones

University of Michigan, Ann Arbor, Michigan USA **Sep. 2017 – Apr. 2019**
M.S., Electrical and Computer Engineering

Beijing University of Posts and Telecommunications (BUPT), Beijing, China
Queen Mary University of London (QMUL), London, UK **Sep. 2013 – Jun. 2017**
B.E., Telecommunications Engineering with Management
(International dual degrees, a joint program at BUPT and QMUL)

Selected Publications

[C1] Shengqing Xia, **Junpeng Guo**, and Chunyi Peng. *"SSS: Towards Autonomous Drone Delivery to Your Door Over House-Aware Semantics"*, in HotMobile 2024.

[C2] Yanbing Liu, **Junpeng Guo**, and Chunyi Peng. *"Demystifying Secondary Radio Access Failures in 5G"*, in HotMobile 2024.

[C3] **Junpeng Guo**, Shengqing Xia, and Chunyi Peng. *"OPA: One-Predict-All For Efficient Deployment"*, in IEEE INFOCOM 2023.

[C4] **Junpeng Guo**, Shengqing Xia, and Chunyi Peng. *"VPPlus: Exploring the Potentials of Video Processing for Live Video Analytics at the Edge"*, in IEEE IWQoS 2022.

[C5] Haotian Deng, Kai Ling, **Junpeng Guo**, Chunyi Peng, *"Unveiling the missed 4.5G performance in the Wild"*, in HotMobile 2020.

[C6] Yikai Lin, Yuru Shao, Xiao Zhu, **Junpeng Guo**, Kira Barton, Z. Morley Mao, *"ADD: Application and Data-Driven Controller Design"*, in SOSR 2019.

[P1] **Junpeng Guo**, Chunyi Peng, *"Poster: Towards Drone-Sourced Live Video Analytics via Adaptive-yet-Compatible Compression"*, in HotMobile 2021.

[P2] Jiachen Sun, Xumiao Zhang, **Junpeng Guo**, *"Poster: Enabling Multi-device Collaboration Using Distributed Mobile Multipath"*, UMich EECS Poster Session, Apr. 2019.

[D1] Shengqing Xia*, **Junpeng Guo*** (Co-primary authors), Chen Peng and Chunyi Peng. *"Demo: Towards Autonomous Drone Delivery to Your Door Over House-Aware Semantics"*, in HotMobile 2024, **Best Demo Award**.

Research Highlight

Purdue University, Research Assistant West Lafayette, IN
Advisor: Prof.Chunyi Peng

- Designed and implemented a full stack of sensing, computing, and control systems for autonomous drone delivery to the door.
  - Goal: Progressively locate and fly towards a waypoint until it finally lands close to the door safely, precisely (at a meter-level) and quickly (says, within tens of seconds).
  - Designed a structural **semantic segmentation**-based approach to identify waypoint along with view changes. Unlike focusing on pixel-wise performance, the approach emphasizes key house structures and leverages fixed positioning relationships between structures to reduce the time required for semantic segmentation and enhance its performance.
  - Built a real drone prototype by developing an **Android** app to control DJI drones, supporting live video streaming and real-time control command execution. The computing algorithm is implemented using **Tensorflow** and **Python**, integrated with Android through **Chaquopy**.
  - Worked collaboratively with a teammate to develop a web-based demo showcasing the optimization of the entire drop-off process using pre-recorded video footage captured from a drone. The implementation utilized **Javascript** and **Flask**
  - Results: Conducted a field test over 10 houses, all successfully landing at door. Check our recording. Developed APK and demo are released, and the paper is accepted at HotMobile'24 [C1, D1]

- Designed a subnet selection paradigm (**neural architecture search**) for a full DNN to handle runtime environment dynamics given different source data and computing power.
  - Goal: Given the latency requirement, select the subnet that can yield a high analytics accuracy by considering the complexity of analytics on the source data and the computing resources.
  - Proposed OPA (One-Predict-All) mechanism, which only needs to run a single pioneer subnet (a shallow subnet) and leverage its outcomes to predict the performance of other subnets (the supersets of the pioneer subnet), thereby avoiding the need to run them all. The subnet with the highest predicted performance is then selected as the final choice.
  - Results: Implemented OPA on top of **PyTorch**. Selected **image classification** as a showcase example, OPA has achieved up to 26% higher Top-1 accuracy for a given latency requirement compared to the state-of-the-arts. The paper is accepted at INFOCOM'23 [C3].
- Designed video analytics systems to make mobile vision efficient with **video compression**.
  - Goal: Adapt to input contexts and reduce the volume of video data as much as possible without sacrificing visual inference accuracy.
  - Proposed ACC (Adaptive-yet-Compatible Compression) to investigate three compression dimensions (resolution, inter-frame prediction, and quantization) for drone-sourced **object detection**. Utilized far-near effects to dynamically partition video frames into slices downscaled to varying resolutions at the device, which are then upscaled and integrated at the edge for detection. Designed global motion-compensated encoding to encode only the change caused by the actual movement of the target object for inter-frame encoding. Employed previously detected bounding boxes to establish Regions of Interest (RoI) and applied RoI-aware quantization for enhanced compression.
  - Proposed VPPlus to enlarges the configuration space during on-device processing to achieve greater compression for general object detection tasks. It provides immediate feedback in real-time to facilitate the collaborative adjustment of over 8 parameters (such as brightness, saturation, sharpness, etc.) based on the confidence scores of the object under test. Specifically, it dynamically fine-tunes these parameters by evaluating fluctuations in the scores to prevent excessive compression (if the score decreases).
  - Results: ACC has reduced transmission volume by average $9.53x$ with comparable detection accuracy for vehicle detection. Accepted at HotMobile'21 [P1]. VPPlus achieves 20-50% higher than compression gain compared to the state-of-the-art with only a 3-6% accuracy drop. Accepted at IWQoS'22 [C4]
- Conducted a city-scale measurement over today's cellular network (LTE, 5G) to characterize performance gaps between what mobile devices received and what they potentially could have received [C2, C5].

University of Michigan, Research Assistant Ann Arbor, MI

Advisor: Prof.Z. Morley Mao

- Built a data-driven **SDN** controller to process on-demand data and tested it on a smart manufacturing system to enable more flexible reconfigurations when anomalies are detected [C4].
- Designed a a pipe-aware multipath scheduler to allow multiple mobile devices to collaboratively fetch content from the Internet [P2].

Services and Activities

- Program Committee for ACM S3 2021
- Reviewer for IEEE TMC, ToN, INFOCOM'24
- Teaching Assistant, CS536 Data Communication and Computer Networks (Fall 2021, Spring 2023 - Spring 2024)

Honors and Awards

2023 INFOCOM Travel grant
2017 Best Thesis Award, BUPT
2017 Dual Bachelor's degree with First Class Honors, QMUL
2016 Meritorious Winner, Mathematical Contest in Modeling (MCM)

Technical Skills

- Languages: Java, Python, C/C++, Julia, MATLAB, Javascript, SQL/NoSQL, HTML
- Frameworks and tools: Android, PyTorch, TensorFlow, SDN (ONOS, RYU), FFMPEG, Video codec (H.264, H.265), WebRTC, Flask, MongoDB, RESTful API