

# Kai Ling

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## EDUCATION

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### Purdue University

*PhD(expected) Department of Computer Science*

**West Lafayette, USA**

Aug. 2019 – Present

### Huazhong University of Science and Technology (HUST)

*Bachelor of Science in Computer Science and Technology*

**Wuhan, China**

Aug. 2015 – July 2019

GPA: 3.8/4.0

## SELECTED WORK & SELECTED RESEARCH EXPERIENCES

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### Research Assistant | Kihara Lab | Purdue

**West Lafayette, US**

Advisor: Daisuke Kihara, Professor, Purdue University

#### Project Leader | Distance-AF Multimer Project

Feb. 2024 – Now

- Pioneered Distance-AF Multimer, a revolutionary deep learning framework that dramatically enhances protein complex structure prediction by strategically integrating experimental distance constraints with AlphaFold2-Multimer, solving previously intractable molecular modeling challenges.
- Engineered innovative solutions to critical structural prediction challenges through distance range constraints and conformer sampling strategies, demonstrating exceptional problem-solving skills in computational biology.
- Delivered remarkable 60Å RMSD improvement in challenging quaternary structure predictions, transforming the capability of molecular modeling tools and enabling new opportunities for drug discovery and protein engineering.

#### Project Leader | Daq Refine Web Tool Project

Aug. 2023 – Dec. 2023

- Built a full-stack web application for refining protein models from cryo-EM data using React.js frontend and Python/Flask backend.
- Designed and implemented RESTful APIs that handle complex multi-chain protein models with up to 50,000 atoms.
- Deployed application on AWS using Docker containers and implemented CI/CD pipeline for automated testing and deployment.
- Engineered distributed computing framework that reduced processing time by 40% through parallel execution of refinement algorithms.

### Research Assistant | MSSN Lab | Purdue

**West Lafayette, US**

Advisor: Chunyi Peng, Associate Professor, Purdue University

#### Project Leader | Delta Analysis Project

Dec. 2021 – Dec. 2022

- Proposed a lightweight, fast, efficient formal method for C-IoT security analysis which streamlines formal methods to check partial models without missing insecurity issues raised by the changes from MBB to C-IoT.
- Conducted  $\Delta$ -analysis for C-IoT technologies specified by 3GPP Release-17, the latest 5G standard; Disclosed 53 changes and 4 vulnerabilities in C-IoT control-plane procedures out of 2392 change requests.
- Devised 12 proof-of-concept attacks.

#### Project Member | 5G Indy Project

April 2021 – Aug. 2022

- Carried on a in-depth measurement study of 5G experience with major operators in US; Characterized 5G coverage, availability and performance (over both mmWave and Sub-6GHz bands); Identified several performance issues and analyze their root causes.
- Revealed several astonishing findings: (1)Despite huge speed potentials (say, up to several hundreds of Mbps), more than half are not realized in practice; (2)Such underutilization is mainly rooted in current practice and policies that manage radio resource in a performance-oblivious manner; (3)5G over mm Wave and Sub-6GHz bands hurt each other, so that doing more gets less (more 5G underutilization in AT&T and Verizon because they support both but T-Mobile supports one); (4)Transisently missing 5G is not uncommon and its negative impacts last much longer.
- Designed a patch solution called 5GBoost, validated its effectiveness to realize more 5G potentials.

#### Project Leader | Cellular-Connected UAVs measurement Project

July 2020 – Oct 2020

- Conducted the first city-scale what-if study to examine feasibility and potential issues of flying UAVs over the existing cellular networks.
- Ran extensive flying measurements (45 hour, 1010 km) over representative(urban, suburban, rural) regions in the metropolitan area.
- Compared data performance and mobility support on the fly and on the drive, and quantitatively assess how latency and failures

vary when LTE extends its support from the ground to the sky with deep RAN analysis in RAN layers' data traces.

- Made several new findings and gained insights to improve performance and even the roll-out of cellular-operated UAVs.

### **Project Leader | Mobility Management Map**

July 2018 – Nov. 2018

- Enabled the instant processing and instant echo of huge data containing handoff configurations from more than 32,000 cells and over 18,700 handoff instances worldwide.
- Reorganized the database and designed a brand new way to show data to make the process of analyzing and displaying data run ten times faster than before; developed an automatic online service which visualizes handoff configuration data and the data analysis to better support mobility research.
- Prepared a poster which was adopted by the ACM Internet Measurement Conference (IMC 2018) as their official Poster.

### **CS577 NLP Course | Purdue**

#### **Project Leader | Image Captioning with Multi-task Learning**

Jan. 2022 – April 2022

- Constructed a groundbreaking image captioning system using multi-task learning that achieved a 16.4% performance improvement over baseline models, demonstrating exceptional innovation in computer vision and natural language processing integration.
- Designed a novel object-attention alignment mechanism that significantly enhanced object localization accuracy, implementing it with EfficientNet-B0 architecture to outperform existing state-of-the-art approaches in benchmark evaluations.
- Constructed an end-to-end deep learning pipeline using PyTorch that processed 330K images from the MSCOCO dataset, incorporating CNN encoders (ResNet50, EfficientNet) with LSTM decoders to create a production-ready system with commercial applications.

### **Kingsoft**

Beijing, China

#### **Software Engineer Intern**

July 2017 – Oct. 2017

- Contributed to the software side development of WPS office by implementing important features.
- Fixed a critical bug causing cache overflow and implement checks.

### **PUBLICATIONS**

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#### **Conference Papers**

- 1. Haotian Deng, **Kai Ling**, Junpeng Guo, Chunyi Peng, *Unveiling the Missed 4.5G Performance In the Wild*, ACM Hotmobile 2020, accepted.
- 2. Yuanjie Li, Chunyi Peng, Zhehui Zhang, Zhaowei Tan, Haotian Deng, Jinghao Zhao, Qianru Li, Yunqi Guo, **Kai Ling**, Boyan Ding, Hewu Li, Songwu Lu, *Experience: A Five-Year Retrospective of MobileInsight*, Mobicom'21, accepted.

#### **Posters**

- 1. **Kai Ling\***, Jiaqi Xu\*, Zhuo Jiang\*, Haotian Deng, Chunyi Peng, *MMMap: Mobility Management Map of Global Carriers Networks At Your Hands*, ACM Internet Measurement Conference (IMC'18) Poster, accepted. (\*co-first authors)
- 2. **Kai Ling**, Haotian Deng, Junpeng Guo, Chunyi Peng, *Poster: Unveiling the Missed 4.5G Performance In the Wild*, ACM Hotmobile 2020, accepted.

### **LEADERSHIP AND ACTIVITIES**

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#### **Piano Pedagogy | Chorus of HUST**

Sept. 2016 - July 2019

- Performed at more than 20 concerts.
- Praised by many professors including Gregory Wait, Dean of the Department of Music at Stanford University.
- Entered the national competition finals during the University Students Arts Festival in China.
- Volunteered for the Internet Innovation and Entrepreneurship Competition in 2016 in China.

### **AWARDS**

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- 1. Freshmen Scholarship (1 out of 120), HUST 2015
- 2. National Scholarship (2 out of 120), HUST 2017
- 3. Model Student of Academic Records (5 out of 120), HUST 2017
- 4. Awarded Outstanding Student (4 out of 120), HUST 2017

### **SKILLS**

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- **Programming Languages:** Proficient in C++/JAVA/Python; Familiar with Assembly Language, Android, SQL;
- **Expertise:** Deep Learning, Machine Learning, PyTorch, TensorFlow, scikit-learn, Hugging Face Transformers, AlphaFold;
- **DevOps & Cloud:** Docker, Git, CI/CD, AWS (EC2, S3, Lambda), Google Cloud;
- **Web Development:** Flask, FastAPI, React.js, Node.js, RESTful API design