

Bingbing Rao (He/Him/His)

4000 Central Florida Blvd, Orlando, FL 32816

☎ +1 (407) 978 3685 • ✉ robin.rao@knights.ucf.edu • 🌐 bingrao.github.io
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Education

University of Central Florida <i>Ph.D. in Computer Science</i> Research area: Towards efficient and intelligent big data systems using program analysis and deep learning techniques	Orlando, FL, USA <i>Expected May 2022</i>
University of Central Florida <i>M.S. in Computer Science</i>	Orlando, FL, USA <i>May 2017</i>
Wuhan University of Science and Technology <i>B.S. in Electrical and Information Engineering</i>	Wuhan, Hubei, China <i>June 2012</i>
Huazhong University of Science and Technology <i>B.A. in Public Administration (Minor)</i>	Wuhan, Hubei, China <i>June 2012</i>

Research and Work Experience

University of Central Florida <i>Graduate Research Assistant, Big Data Lab</i> <ul style="list-style-type: none">Designed novel dynamic models atop of <i>Apache Spark</i> to characterize temporal trends in a large social-media networkOptimized performance and scalability of big data systems using <i>program analysis</i> and <i>machine learning</i> techniquesInvestigated neural models (e.g., <i>Transformer</i>) to learn contextual representations for repairing program bugs automatically Key achievement: Published eight research papers and submitted one paper for peer review	Orlando, FL, USA <i>May 2016 - Present</i>
<i>System Engineer, Cyber Intelligence Lab (CiLab)</i> <ul style="list-style-type: none">Deployed Apache Spark, Hadoop clusters, and Deep Learning develop environmentsImproved redundancy and efficiency of the cluster network by designing new topology and bonding interfacesDeveloped Apache Spark data analytic applications (e.g., TF-IDF) for processing social media data (i.e. <i>Twitter</i>) Key achievement: Provided systematic technical support for researchers to develop big data and deep learning algorithms	<i>May 2019 - Aug. 2019</i>
Unknot.id <i>Software Engineer Intern, AI Research</i> 1. CTIN: A robust contextual Transformer network for Inertial Navigation: <ul style="list-style-type: none">Innovated a robust Transformer-based model for inertial navigation using IMU measurements onlyDesigned a ResNet-based encoder to exploit spatial knowledge of IMU observations by applying attention mechanismExtended Transformer decoder to capture temporal information within IMU observationsLeveraged multi-task learning techniques to improve learning efficiency and to reduce the model's uncertainty Key achievement: CTIN is formed as a research paper accepted by AAAI-22 due to its novelty and outperforming performance	Orlando, FL, USA <i>July 2020 - July 2021</i>
2. An improved GAN model to synthesize tabular data without leaking any sensitive information: <ul style="list-style-type: none">Designed a model-specific encoder to transform category and continuous data into vector representationsDeveloped an enhanced GAN algorithm with information loss to learn data distributionGenerated fake data for downstream tasks from the learned distribution without leaking any sensitive informationBuilt a comprehensive evaluation tool to assess the performance in terms of data, utility, and privacy qualities Key achievement: The developed GAN-based synthesizer has been adopted by multiple projects at Unknot.id	
Elivebuy Co., Ltd. <i>Director, IT Department</i> <ul style="list-style-type: none">Analyzed requirements of all departments to improve their business processes and determine the technology needsCoordinated IT technicians to develop warehouse and finance management systems, a stock-keeping unit encoder, etcProvided training programs about IT resources and development support to all staffs Key achievement: Received the outstanding staff award in 2014 for coordinating IT resources to increase employee efficiency	Shenzhen, Guangdong, China <i>Mar. 2014 - Aug. 2015</i>
MacroSAN Technologies Co., Ltd. <i>Linux kernel developer, R & D Department</i>	Shenzhen, Guangdong, China <i>Feb. 2012 - Mar. 2014</i>

- Developed Linux kernel modules including direct memory access (DMA), general-purpose in/out, and network bonding
 - Participated in the project of trim and transplant Linux kernel to maintain all product-related driver modules
 - Worked with Linux kernel upstream to provide efficient solutions to problems and errors related to the kernel
- Key achievement:** Awarded 22nd R & D Honor due to developing a new DMA model and strong problem-solving skills

Wuhan University of Science and Technology

Undergraduate Research Assistant, Control Theory Laboratory

Wuhan, Hubei, China

Sept. 2010 - June 2012

- Developed algorithms atop of microcontroller to generate arbitrary waveform using DDS chip
- Designed FPGA algorithms to measure precise frequencies of input signals
- Developed a digital storage oscilloscope (DSO) atop of FPGA to analyze input signals
- Designed a digital circuit to perform Manchester decoding for encoded digital signals and tested transmission performance

Key achievement: Won the provincial third prize at 2011 National Undergraduate Electronics Design Contest

Leadership Experience

University of Central Florida

Graduate Teaching Assistant, COP4020: Functional Programming Languages

Orlando, FL, USA

Aug. 2017 - Dec. 2018

- Developed course materials including visual aids, answer keys, supplementary notes, and class projects
- Held office hours, led class discussions, and answered student questions to assist them with understanding complex concepts
- Evaluated student projects, homework, exams, and other assignments

Skills

Deep Learning: Transformer, RNN, ResNet (CNN), Generative Adversarial Network (GAN), Pytorch

Software Engineering: Parallel Computing, Apache Spark, Hadoop, HDFS, Amazon Web Services, MySQL, Jupyter

Programming Languages: Proficient in Python and Scala; Project Experience in C, Java, Assembly, R, and Shell

Publications

- [1] **Bingbing Rao**, Jie Yao, Weiwei Xing, and Liqiang Wang. Bug2Fix: An enhanced transformer model with context-aware alignment for automated program repair. In *IEEE International Conference on Software Testing, Verification and Validation (ICST)*, 2022 (Under Review).
- [2] **Bingbing Rao**, Ehsan Kazemi, Yifan Ding, Devu M Shila, Frank M. Tucker, and Liqiang Wang. CTIN: Robust contextual transformer network for inertial navigation. In *Proceedings of the AAAI Conference on Artificial Intelligence*, 2022.
- [3] **Bingbing Rao**, Zixia Liu, Hong Zhang, Siyang Lu, and Liqiang Wang. SODA: A semantics-aware optimization framework for data-intensive applications using hybrid program analysis. In *IEEE 14th International Conference on Cloud Computing (CLOUD)*, pages 433–444, 2021.
- [4] Wingyan Chung, **Bingbing Rao**, and Liqiang Wang. Interaction models for detecting nodal activities in temporal social media networks. *ACM Transactions on Management Information Systems (TMIS)*, 10(4):1–30, 2019.
- [5] Siyang Lu, Xiang Wei, **Bingbing Rao**, Byungchul Tak, Long Wang, and Liqiang Wang. LADRA: Log-based abnormal task detection and root-cause analysis in big data processing with spark. *Future Generation Computer Systems*, 95:392–403, 2019.
- [6] Zixia Liu, Hong Zhang, **Bingbing Rao**, and Liqiang Wang. A reinforcement learning based resource management approach for time-critical workloads in distributed computing environment. In *IEEE International Conference on Big Data (Big Data)*, pages 252–261, 2018.
- [7] **Bingbing Rao** and Liqiang Wang. A survey of semantics-aware performance optimization for data-intensive computing. In *2018 IEEE Cyber Science and Technology Congress (CyberSciTech)*, pages 81–88, 2017.
- [8] Siyang Lu, **Bingbing Rao**, Xiang Wei, Byungchul Tak, Long Wang, and Liqiang Wang. Log-based abnormal task detection and root cause analysis for spark. In *IEEE International Conference on Web Services (ICWS)*, pages 389–396, 2017.
- [9] Wingyan Chung, **Bingbing Rao**, and Liqiang Wang. Dynamic trend detection in us border security social-media networks. In *Simulation and Education Conference (I/ITSEC), Interservice/Industry Training*, 2016.