

Bingbing Rao (He/Him/His)

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Skills

Deep Learning: Transformer, Attention, MLP, GNN, NLP, Pytorch, Tensorflow

Software Engineering: Apache Spark, Hadoop & HDFS, MapReduce, Program & Performance Analysis, AWS

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

Proven Record Of Research: Published nine papers in AAAI, ACM TMIS, IEEE BigData & Cloud etc

Experience

Citibank, N.A.

New York, NY, USA

VP, Risk Analytics, Modeling, and Validation, Quant Risk Libraries (QRL)

May 2022 - Present

- Design and implement a framework for model driven computations using knowledge of graph and grid computing
- Optimize and improve performance of data model and platform to handle the sheer size of data
- Leverage knowledge in compilers and optimization to help QRL team craft efficient numerical pipelines
- Work on the translation logic to convert symbolic model representation into implementations

Unknot.id

Orlando, Florida, USA

Software Engineer Intern, AI Research

July 2020 - July 2021

- Investigated a Transformer-based model to exploit spatial and temporal features of IMU measurements for inertial navigation, being accepted as a research paper by AAAI-22 due to its novelty and the performance improvement of over 30%
- Developed a GAN-based data pipeline to synthesize tabular data, reducing risks of leaking sensitive information from 33% to 4% while keeping most properties of the real data

University of Central Florida

Orlando, Florida, USA

Graduate Research Assistant, Big Data Lab

May 2016 - May 2022

- Innovating Transformer/GNN models to learn contextual and structural code representations for automated program repair
- Optimized performance and scalability of big data systems by leveraging program analysis and machine learning techniques
- Proposed two theory-based dynamic graph models using GraphX to characterize temporal trends in a large social-media (Twitter) community consisting of 790,462 users and 3,055,797 links
- Published nine related research papers in AAAI, ACM TMIS, IEEE Bigdata & Cloud etc, submitted one for peer review

System Engineer, Cyber Intelligence Lab (CiLab)

May 2019 - Aug. 2019

- Singlehandedly designed and developed a data analysis pipeline to analyze Twitter datasets efficiently
- Deployed and maintained big data (e.g., Apache Spark) and deep learning infrastructures for researchers
- Trained 5 individuals in developing efficient algorithms of big data and deep learning to perform social media analytics tasks

Elivebuy Co., Ltd.

Shenzhen, Guangdong, China

Director, IT Department

Mar. 2014 - Aug. 2015

- Analyzed requirements of all departments to improve their business processes and determine the technology needs
- Coordinated IT technicians to develop warehouse and finance management systems, a stock-keeping unit encoder, etc
- Designed and provided training programs about IT resources and development support to all staffs
- Received the outstanding staff award in 2014 for coordinating IT resources to increase employee efficiency

MacroSAN Technologies Co., Ltd.

Shenzhen, Guangdong, China

Linux kernel developer, R & D Department

Feb. 2012 - Mar. 2014

- Developed and maintained Linux kernel modules: direct memory access (DMA) and general-purpose input/output (GPIO)
- Collaborated with Linux kernel upstream on providing efficient solutions to the Linux kernel issues
- Awarded 22nd R & D Honor due to developing a new DMA model and strong problem-solving skills

Education

University of Central Florida

Ph.D. in Computer Science (Advisor: Dr. Liqiang Wang)

Orlando, Florida, USA

August 2022

Research area: Towards Efficient Graph-based Computing and Analytics using program analysis and deep learning

M.S. in Computer Science

May 2017

Wuhan University of Science and Technology

B.S. in Electrical and Information Engineering

Wuhan, Hubei, China

June 2012

Huazhong University of Science and Technology

B.A. in Public Administration (Minor)

Wuhan, Hubei, China

June 2012

Selected Projects

CTIN: A robust contextual Transformer network for Inertial Navigation

Jan. - July 2021

Mentor: Devu M Shila, Liqiang Wang

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- Extended ResNet-18 to encode spatial knowledge of an IMU measurement by applying a novel attention mechanism
- Leveraged Transformer decoder to capture temporal information among IMU observations
- Fused spatial and temporal information for inertial navigation by using encoder-decoder attention mechanism
- Leveraged multi-task learning techniques to improve learning efficiency and to reduce the model's uncertainty
- Code (written in **Python**): <https://github.com/bingrao/ctin>

Key achievement: Paper accepted to AAAI Conference on Artificial Intelligence 2022 (Oral)

GTable: Generating synthetic tabular data by an improved GAN-based model

June - Dec. 2020

Mentor: Devu M Shila, Liqiang Wang

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- Designed a model-specific encoder to transform category and continuous data into meaningful feature representations
- Developed a GAN-based algorithm with information loss to learn real data distribution and then generate synthetic data
- Built a comprehensive evaluation tool to assess the performance in terms of data, utility, and privacy qualities
- Code (written in **Python**): <https://github.com/bingrao/gtable>

Key achievement: This work is received high appreciation and facilitated Unknot.id to pursue further funding

An Enhanced Graph Transformer model for automated program repair

Oct. 2020 - June 2021

Mentor: Liqiang Wang

University Of Central Florida

- Designed a novel abstraction approach atop of AST to extract structural features and reduce vocabulary size
- Developed a Transformer-based network to learn neural code translations from buggy to fixed code
- Established context-aware alignments by exploiting attention to contextual path information of each token in an AST
- Achieved optimal weights of code translation and context-aware alignment tasks by performing multi-task learning
- Abstraction Code (written in **Scala**): <https://github.com/bingrao/code2abs>
- Translation Code (written in **Python**): <https://github.com/bingrao/Bug-Transformer>

Key achievement: Paper accepted to JCSC 2022 (Journal); Paper submitted to IEEE TAC 2022 (Journal)

SODA: Semantics-aware Optimizations for Data-Intensive Applications

Jan. - Dec. 2020

Mentor: Liqiang Wang

University Of Central Florida

- Analyzed code using offline Scala-Refactor tool to construct a graph-based representation of an application
- Integrated metrics and log components in Spark with a dedicated online ASM tool to profile the execution of an application
- Established multiple optimizations atop of offline and online acquiring data to scrutinize performance bugs

Key achievement: Papers accepted to IEEE CyberSciTech 2017 and Cloud 2021

Dynamic Graph Model to Detect Trends in Dynamic Social Media Networks

May 2016 - Dec. 2018

Mentor: Winyan Chung, Liqiang Wang

University Of Central Florida

- Proposed two novelty and robustness theory-based models for temporal social network activity detection
- Designed and validated their performance atop of Apache Spark GraphX in large-scale social networks (e.g., Twitter)
- Developed a new metric to evaluate social network trend detection for researchers and practitioners

Key achievement: Papers accepted to I/ITSEC 2016 and ACM TMIS 2019 (Journal)

Selected Publications

- [1] **Rao Bingbing**, Yao J., Xing W., and Wang L. Bug2Fix: An enhanced transformer model with context-aware alignment for automated program repair. *IEEE Transactions on Affective Computing*, 2022 (Submitted).
- [2] **Rao Bingbing**, Yao J., Xing W., and Wang L. Bug-transformer: Automated program repair using attention-based deep neural network. *Journal of Circuits, Systems and Computers*, 2022 (Accepted).
- [3] **Rao Bingbing**, Kazemi E., Ding Y., Devu S., Frank T., and Wang L. CTIN: Robust contextual transformer network for inertial navigation. In *Proceedings of the AAAI Conference on Artificial Intelligence (Oral)*, 2022.
- [4] **Rao Bingbing**, Liu Z., Zhang H., Lu S., and Wang L. 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.

[5] Chung W., **Rao Bingbing**, and Wang L. Interaction models for detecting nodal activities in temporal social media networks. *ACM Transactions on Management Information Systems (TMIS)*, 10(4):1–30, 2019.

[6] **Rao Bingbing** and Wang L. A survey of semantics-aware performance optimization for data-intensive computing. In *IEEE Cyber Science and Technology Congress (CyberSciTech)*, pages 81–88, 2017.

Leadership Experience

University of Central Florida

Graduate Teaching Assistant, COP4020: Functional Programming Languages

Orlando, FL, USA

Aug. 2017 - Dec. 2018