Zirou Qiu | Curriculum Vitae

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Research Interests

Graph algorithms, dynamical systems, combinatorial optimization;

Research Experience

University of Virginia Advisor: Prof. Madhav Marathe
Graduate Research Assistant Fall 2020 - Present

- **Multi-layer Multi-theory Dynamical Systems**
  - Proposed a two-contagion two-layer model to study the spread of Covid-19 and mask-wearing.
  - (Ongoing) Investigate the dynamics of the proposed model.
  - (Ongoing) Tackle theoretical problems related to the model.

Clemson University - Algorithms and Computational Science Lab Advisor: Prof. Ilya Safro
Graduate Research Assistant Jan 2019 - May 2020

- **MutualRank: A Network Centrality Measure for Bilateral Flow Processes**
  - Proposed *MutualRank*, a novel centrality measure for networks under bilateral flow models.
  - Studied the existing centrality measures and Markov chain extensively.
  - Collected real-world network datasets with ground-truth importance of vertices.
  - Investigated the typologies of underlying flow processes for various centrality measures.

- **Knowledge Discovery in Microbiome Networks**
  - Collaborated with scientists at *Biophysical Sciences Department* at *the University of Chicago* and *Data Science Division* at *Argonne National Laboratory*
  - Built a processing pipeline for analyzing biological networks (code on Github).
  - Identified the patterns of change in the community structures of the microbiome networks.
  - Discovered the node-level and cluster-level correspondences between microbiome networks.

Argonne National Laboratory Host: Christopher Henry & Yuri Alexeev
Graduate Research Aide Summer 2019

- **ELRUNA: A Network Alignment Algorithm based on Elimination Rules**
  - Developed *Elruna*, a topology-based network alignment algorithm that outperforms the state-of-the-art.
  - Proposed a novel selection rule *Rawsem* for local search which increases the convergence rate.
  - Studied existing network alignment algorithms and quadratic assignment problems extensively.
  - Conducted experiments on real-world datasets.
  - Submitted **a first-author paper** (see in-submission works below).

Publication

Zirou Qiu, Ruslan Shaydulin, Xiaoyuan Liu, Yuri Alexeev, Christopher S. Henry, Ilya Safro, "ELRUNA: Elimination Rule-based Network Alignment", *ACM Journal of Experimental Algorithmic*, 2021, preprint at: `https://arxiv.org/abs/1911.05486` .

Education

University of Virginia Charlottesville , VA
Ph.D. in Computer Science Aug 2020 - present
Overall GPA: 4.0/4.0

Clemson University Clemson, SC
Master of Science in Computer Science - Thesis Aug 2018 - May 2020
Overall GPA: 3.75/4.0

Southeast Missouri State University Cape Girardeau, MO
Bachelor of Science in Computer Science - Dean's List, Cum Laude Aug 2013 - May 2018
Major GPA: 3.878/4.0; Overall GPA: 3.708/4.0

Teaching Experience

Graduate Teaching Assistant Spring 2020
Clemson University, CPSC 8630: Multimedia Systems and Applications

Graduate Teaching Assistant Spring 2020
Clemson University, CPSC 8490: Principles of Scientific Computing

Graduate Teaching Assistant Fall 2019
Clemson University, CPSC 4200/6200: Computer Security Principles

Undergraduate Laboratory Teaching Assistant Spring 2018
Southeast Missouri State University, CS265: Computer Science II (C++ Programming)

Undergraduate Laboratory Teaching Assistant Fall 2017
Southeast Missouri State University, CS380: Computer Operating System

Select Projects

Tanghulu: A Seed-based Network De-anonymization Algorithm Advisor: Prof. Long Cheng
Clemson University Fall 2018
- Designed *Tanghulu*, a network de-anonymization algorithm. Tanghulu can efficiently identify anonymized nodes by aligning the target network with the auxiliary network.
- Conducted experiments on Facebook network datasets.

Enhancement of Algorithmic Efficiency Advisor: Prof. Ziping Liu
Southeast Missouri State University Spring 2017
- Designed and analyzed the enhanced heap sort. Achieved 20.85% performance improvement compared to the conventional implementation at the input size of 40,000,000.
- Designed and analyzed the enhanced Hierholzer's algorithm which starts with the vertex of the highest indegree, and uses the priority queue (Fibonacci heap) to keep track of vertices with unvisited edges.
- Preprint: `https://zirouqiu.github.io/algorithmic_enhancement.pdf`.

Fraud Detection for Banks Advisor: Prof. Suhair Amer
Southeast Missouri State University Fall 2016
- Built a system that analyzes bank transactions and detects suspicious activities.
- Designed an algorithm that builds models based on users' previous spending patterns.
- Coauthored one paper: `https://zirouqiu.github.io/fraud_detection.pdf`

Honors and Awards

- Recipient of the *UVA Computer Science Scholar Fellowship*.

Guest Talks

Introduction to Web Security Fall 2019
Clemson University, CPSC 6200

Branch Prediction Fall 2019
Clemson University, CPSC 6200

ELRUNA: Elimination Rule-based Network Alignment May 2020
Clemson Operational Research Institute: Link

Network Alignment & Local Search Mar 2021
SIGNET seminar, University of Delaware

Technical Skills

- **Proficient Programming Languages**: C/C++, Python
- **Software and Tools**: Linux, Gephi, MySQL, Matlab, R studio

Related Courses

- **Math**: Combinatorial Optimization, Graph Theory, Discrete Structure, Linear Algebra, Calculus, Statistics
- **Computer Science**: Convex Optimization, Network Science, Data Mining, Design and Analysis of Algorithms, Object-oriented Programming, Operating Systems, Computer Networks, Programming Languages & Compilers, Database, Software Engineering

Organizations & Extracurriculars

- **Institute of Electrical and Electronics Engineers** (IEEE) - Student member.
- **Association of Computing Machinery** (ACM) - Student member
- **Society for Industrial and Applied Mathematics** (SIAM) - Student member
- **World Wildlife Fund** (WWF) - Member