Zirou Qiu | Curriculum Vitae

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Research Interests

Graphs, discrete dynamical systems, combinatorial optimization;

Research Experience

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

- **Dueling Social-Disease Dynamics on Networks**
  - Collaboration with *Princeton*, *Cornell*, *University of Amsterdam* and *Stockholm School of Economics*.
  - Proposed a multiplex network model to study the concurrent spread of social and biological contagions.
  - Conducted extensive simulations to investigate the dueling dynamics.
  - Discovered a non-monotonic correlation between the disease infectiousness and disease attack rate, characterized by an abrupt phase transition.
  - A first-author paper accepted at `PNAS`.

- **Fixed Points in Discrete Dynamical Systems**
  - Studied a new problem of finding nontrivial minimum fixed points of discrete dynamical system, motivated by influence minimization for undesirable contagions.
  - Investigate the problem from a theoretical perspective, including hardness of approximation, parameterized complexity, solvability under special cases, and fixed parameter tractablility.
  - Proposed a family of heuristic on tackling the problem.
  - A first-author paper accepted at `AAAI 2022` (acceptance rate 15%).

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

- **Knowledge Discovery in Microbiome Networks**
  - Collaborated with *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 - Data Science Division Host: Christopher Henry & Yuri Alexeev
Graduate Research Aide Summer 2019

- **Network Alignment & Combinatorial Optimization**
  - Proposed *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 of network alignment.
  - A first-author paper accepted at ACM Journal of Experimental Algorithmics, 2021.

Publication

- *Finding Nontrivial Minimum Fixed Points in Networked Dynamical Systems*
  Zirou Qiu, Chen Chen, S.S. Ravi, Daniel Rosenkrantz, Richard Stearns, Madhav Marathe
  AAAI 2022 (Acceptance rate: 15%). Link

- *Understanding the co-evolution of mask-wearing and epidemics : a network perspective*
  Zirou Qiu, Baltazar Espinoza, Vitor V. Vasconcelos, Chen Chen, Sara M. Constantino, Stefani A. Crabtree, Luojun Yang, Anil Vullikanti, Jiangzhuo Chen, Jörgen Weibull, Kaushik Basu, Avinash Dixit, Simon Levin, Madhav Marathe.
  Proceedings of the National Academy of Sciences (PNAS), 2022. Link

- *Efficiently Learning the Topology and Behavior of a Networked Dynamical System Via Active Queries*
  Daniel Rosenkrantz, Abhijin Adiga*, Madhav Marathe*, Zirou Qiu*, S.S. S Ravi*, Richard Stearns*, Anil Vullikanti*
  ICML, 2022. Link
- *ELRUNA: Elimination Rule-based Network Alignment*
  Zirou Qiu, Ruslan Shaydulin, Xiaoyuan Liu, Yuri Alexeev, Christopher S. Henry, Ilya Safro
  ACM Journal of Experimental Algorithmics (JEA), 2021. Link

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

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**: Theory of Computation, Convex Optimization, Network Science, Data Mining, Design and Analysis of Algorithms, Cloud Computing, 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