Shuo Liu

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Education

- **Georgetown University** Washington, D.C.
  Doctor of Philosophy in Computer Science, Department of Computer Science *Aug. 2019 – May 2024 (Expected)*
- **Georgetown University** Washington, D.C.
  Master of Science in Computer Science, Department of Computer Science *Aug. 2017 – May 2019*
  With thesis *Understanding Relational Background Knowledge Attacks on Social Media.* Advisor: Dr. Lisa Singh
- **Fudan University** Shanghai, China
  Bachelor of Science in Information and Computing Science, School of Mathematical Sciences *Aug. 2013 – June 2017*

Skills

- **Preferred programming languages** (Ordered by proficiency)
  Python, Java, C++, MATLAB
- **Languages**
  English, Chinese (Mandarin)

Internships

- **Software Enginner Intern**
  Google LLC *June 2023 – Aug. 2023*
  - **Search Discover & ecosystems:** Worked on generating a signal to measure the staleness of any given url at any given content age. Proposed and implemented both mathematical and machine learning methods, including data preperation, model training and selection, evaluation, and analysis. Integrated the signal into existing internal tools. The project is mainly in Python, as well as SQL and R.
- **Software Enginner Intern**
  Meta Inc. *June 2022 – Aug. 2022*
  - **Machine learning components:** Worked on an internal machine learning package using Python: adding a new component related to transfer learning to increase ML job stability and efficiency, with object oriented programming. Tested and deployed the code at the end of the internship.
- **Data Analyst Intern, Operation Center**
  METEK Mobile Embedded Technology Co. Ltd., Shanghai, China *Aug. 2016 – Nov. 2016*
  - **Data analysis:** Analyzed numerical growth model of a mobile game before launching using Excel and MATLAB.
  - **Application:** Developed a web-based operation data evaluation system for operation analysis and feedback for mobile games.

Research experience

- **Graduate research assistant: Resilient distributed optimization**
  Advisor: Dr. Nitin Vaidya (Georgetown University) *Sept. 2019 - Present*
  - Studying resilient distributed optimization algorithms and other related questions. Publications [1,2,3,4], pre-print [6-11].
  - Implemented a Resilient fault-tolerant simulatior for experimental purpose using *PyTorch*.
- **Master's Thesis: *Understanding Relational Background Knowledge Attacks on Social Media***
  Advisor: Dr. Lisa Singh (Georgetown University) *Sept. 2018 - May 2019*
  - **Main work:** Proposed possible privacy attacks on attribute values of social media accounts based on population information from target accounts' groups or communities on social medias. Analyzed proposed methods. Also published as [5].
- **Graduate research assistant: Massive Data Institute at Georgetown University**
  Advisor: Dr. Lisa Singh (Georgetown University) *March 2018 - May 2019*
  - Worked on *webfootprint*, a social media privacy project. The project intended to develop an application that simulates several methods of social media privacy attacks, helping users checking if they are leaking personal information across social medias.

- **Main work:** Fixed and implemented new parts of an application using *Java*, *Python*, and *PostgreSQL*. Investigated other possible privacy attacks.

- **Undergraduate Thesis: *Estimation of sparse graph with* lifecycle**
  Advisor: Dr. Yun Xiong (Fudan Univ.), Dr. Xiangnan Kong (Worcester Polytechnic Institute) *Sept. 2016 – May 2017*
  - **Main work:** Proposed a new kind of sparse graph estimation problem, based on domain knowledge of periods of node activities. Addressed the estimation problem with altered pathway graphical lasso algorithm.

Publications

- **Conference and workshop papers**

[1] **Shuo Liu**, Nirupam Gupta, and Nitin H Vaidya. Impact of Redundancy on Resilience in Distributed Optimization and Learning. In *24rd International Conference on Distributed Computing and Networking (ICDCN 2023)*, 2023. (Best paper at ICDCN 2023)

[2] **Shuo Liu**, Nirupam Gupta, and Nitin H Vaidya. Redundancy in cost functions for Byzantine fault-tolerant federated learning. In *Workshop on Systems Challenges in Reliable and Secure Federated Learning*, 2021.

[3] **Shuo Liu**, Nirupam Gupta, and Nitin H Vaidya. Approximate Byzantine fault-tolerance in distributed optimization. In *Proceedings of the 2021 ACM Symposium on Principles of Distributed Computing (PODC'21)*, 2021. DOI: 10.1145/3465084.3467902.

[4] Nirupam Gupta, **Shuo Liu**, and Nitin H Vaidya. Byzantine fault-tolerant distributed machine learning with norm-based comparative gradient elimination. In *2021 51th Annual IEEE/IFIP International Conference on Dependable Systems and Networks Workshops (DSN-W)*, 2021.

[5] **Shuo Liu**, Lisa Singh, and Kevin Tian. Information exposure from relationalbackground knowledge on social media. In *2020 IEEE International Conferenceon Data Science and Advanced Analytics (DSAA)*, 2020. DOI: 10.1109/DSAA49011.2020.00041.

- **Pre-prints**

[6] **Shuo Liu**, Nitin H Vaidya. Byzantine Fault-Tolerant Min-Max Optimization. *arXiv preprint arXiv:2205.14881*, 2022.

[7] **Shuo Liu**, Nirupam Gupta, and Nitin H Vaidya. Utilizing Redundancy in Cost Functions for Resilience in Distributed Optimization and Learning. *arXiv preprint arXiv:2110.10858*, 2021.

[8] **Shuo Liu**. A Survey on Fault-tolerance in Distributed Optimization and Machine Learning. *arXiv preprint arXiv:2106.08545*, 2021.

[9] **Shuo Liu**, Nirupam Gupta, and Nitin H Vaidya. Asynchronous Distributed Optimization with Redundancy in Cost Functions. *arXiv preprint arXiv:2106.03998*, 2021.

[10] **Shuo Liu**, Nirupam Gupta, and Nitin H Vaidya. Approximate Byzantine fault-tolerance in distributed optimization. *arXiv preprint arXiv:2101.09337*, 2021.

[11] Nirupam Gupta, **Shuo Liu**, and Nitin H Vaidya. Byzantine fault-tolerant distributed machine learning using stochastic gradient descent (SGD) and norm-based comparative gradient elimination (CGE). *arXiv preprint arXiv:2008.04699*, 2020.

Selected course projects

- **Chatbot Using Reinforcement Learning and Movie Dialogs**
  Instructor: Dr. Grace Hui Yang (Georgetown University) *April 2019 – May 2019*
  - **Main work:** Build and train reinforcement-learning-based chatbot using movie dialogs using Python. Analyze performance and compare with retrieval-based chatbots.
- **Streaming Algorithms: Study on Streaming Model of Entropy Approximation**
  Instructor: Dr. Justin Thayler (Georgetown University) *Nov. 2018 – Dec. 2018*
  - **Main work:** Compare and contrast different methods of streaming algorithms for entropy approximation based on frequent items. Implement and analyze performance of methods. Write report on summary and analysis.
- **Data Privacy: Study on Locally Private Heavy Hitters**
  Instructor: Dr. Kobbi Nissim (Georgetown University) *Nov. 2018 – Dec. 2018*

- **Main work:** Summarize recent researches on locally private heavy hitters. Implement algorithms and analyze performance.

- **Text Mining: Emoji Prediction with Feature-Based Methods**
  Instructor: Dr. Nazli Goharian (Georgetown University) *Sept. 2017 – Dec. 2017*
  - In group of 3. Studied performance of different feature-based methods on predicting emojis for social media texts.
  - **Main work:** Studied on possible methods for the task. Conducted experiments using Python and analyzed results. Finished the write-up.
- **Intro to Data Analysis: Prediction of Movie Box-office Performance**
  Instructor: Dr. Lisa Singh (Georgetown University) *Sept. 2017 – Dec. 2017*
  - In group of 3. Data analytic project on possible factors that would infect box-office performance of movies. Present the results in report on interactive web pages.
  - **Main work:** Proposed possible indicators of box-office performance of movies. Conducted experiments and analyzed the results mainly using Python. Finished the write-up.
- **Numerical Methods on Integral Equation**
  Instructor: Dr. Yunxin Zhang (Fudan University) *Sept. 2016 – Dec. 2016*
  - **Main work:** Implemented a general interface integrating multiple numerical methods solving integral equations using MATLAB. Made a report presenting the calculation results and analysis of performances of different methods.
- **Big Data Research on Scholar Cooperations in Academic Publications**
  Instructor: Dr. Yun Xiong (Fudan University) *Sept. 2016 – Dec. 2016*
  - In group of 7.
  - **Main work:** Collected data of publications by Fudan University from academic resource websites and built a database with the data. Presented the cooperation changes through time via visualization methods using JavaScript and CSS.

Teaching experience

- **Teaching Assistant** *COSC 5200*: Algorithms, *Graduate level*
  Department of Computer Science, Georgetown University *Sept. 2023 – Dec. 2023*
- **Teaching Assistant** *COSC 242*: Distributed Systems, *Undergraduate level*
  Department of Computer Science, Georgetown University *Jan 2023 – May 2023*
- **Teaching Assistant** *COSC 030*: Math Methods in Computer Science, *Undergraduate level*
  Department of Computer Science, Georgetown University *Sept. 2022 – Dec 2022*
- **Teaching Assistant** *COSC 280*: Intro to Database, *Undergraduate level*
  Department of Computer Science, Georgetown University *Jan. 2021 – May 2021*
- **Teaching Assistant** *COSC 587*: Introduction to Data Analytics, *Graduate level*
  Department of Computer Science, Georgetown University *Sept. 2019 – Dec. 2019*
- **Teaching Assistant** *COSC 282*: Big Data Analytics, *Undergraduate level*
  Department of Computer Science, Georgetown University *Jan. 2019 – May 2019*
- **Lecturer in Olympiad in Informatics**
  Kaifeng High School, Henan, China *March 2014 – Aug. 2014*
  - Organized a weekly lecture for high school students in competitive programming.

Fellowships and honors

- **Best paper at ICDCN 2023** *2023*
- **Fritz Family Fellowship**
  Georgetown University *2021 – 2022*
- **Fritz Family Fellowship**
  Georgetown University *2020 – 2021*
- **Annual scholarship for excellent academic performance**
  School of Mathematical Sciences, Fudan University *2016 – 2017*
- **Annual scholarship for excellent academic performance**
  School of Mathematical Sciences, Fudan University *2014 – 2015*