Suyanpeng Zhang

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Research Interest

Methods: dynamic programming; Markov decision processes; mixed-integer programming; optimization; dynamic systems modeling; deep learning; machine learning; causal inference; network analysis
Applications: health policy modeling; infectious disease control; medical decision making; vaccination; disease monitoring; healthcare analyticss

Current Employment

Postdoctoral Scholar, Northwestern University (Host: Dr. Sanjay Mehrotra) Jun 2024-present

Education

University of Southern California, Los Angeles, CA Aug 2019 - May 2024

- **Ph.D. in Industrial & Systems Engineering**
  Advisor: Dr. Sze-Chuan Suen
  Dissertation: Optimizing Healthcare Decision-Making: Markov Decision Processes for Liver Transplants, Frequent Interventions, and Infectious Disease Control
- **M.S. in Computer Science**

University of Michigan, Ann Arbor, Ann Arbor, MI Aug 2017 - May 2019

- **M.S. in Industrial & Operations Engineering**
  Advisor: Dr. Brian Denton

Rensselaer Polytechnic Institute, Troy, NY Aug 2013 - May 2017

- **B.S. in Mathematics**

Publications

Journal Papers:

1. **Zhang S**, & Suen SC. (2025). State Discretization for Continuous-State MDPs in Infectious Disease Control. *IISE Transactions on Healthcare Systems Engineering*, 15(1), 96-115.
2. **Zhang S**, Suen SC, Sundaram V, Gong CL. (2025). Quantifying the Benefits of Increasing Decision-Making Frequency for Health Applications with Regular Decision Epochs. *IISE Transactions*, 57(5), 469-483.
3. **Zhang S**, Jin J, Yu H, Hong Y, Sood N, & Suen SC. (2024). The impact of COVID-19 vaccination rate on traffic recovery. *Scientific Reports*, 14(1), p.22066.
4. **Zhang S**, Silverman A, Suen SC, Andrews C, & Chen BK. (2022). Differential patterns of opioid misuse between younger and older adults–a retrospective observational study using data from South Carolina's prescription drug monitoring program. *The American Journal of Drug and Alcohol Abuse*, 1-11.
5. **Zhang S**, Suen SC, Gong CL, Pham J, Trebicka J, Duvoux C, ... & Sundaram V. (2021). Early transplantation maximizes survival in severe acute-on-chronic liver failure: Results of a Markov decision process model. *JHEP Reports*, 3(6), 100367.

Working Papers:

1. **Zhang S**, Yu H, Suen SC, Dessouky M, Ordonez F. Optimizing Vaccine Site Locations While Considering Travel Inconvenience and Public Health Outcomes. (under major revision for *Health Care Management Science*)
2. Yu H, **Zhang S**, Suen SC, Dessouky M, Ordonez F. Extending Dynamic Origin-Destination Estimation to Understand Traffic Patterns During COVID-19. (submitted to *Journal of the Operational Research Society*)
3. **Zhang S**, Suen SC, Moucheraud C. Network Analysis of HPV Vaccine Attitudes in Kenyan Households. (under major revision for *Service Science*)
4. **Zhang S**, Mehrotra S. Training Large Discrete-State Markov Models Using Controllable Biased Stochastic Gradients. (in-perparation, aimed at *Operations Research*)
5. Three additional clinical journal articles are currently being prepared for submission.

Conference Proceedings:

1. Otles E, Wang HZ, **Zhang S**, Denton BT, Seymour J, Wiens J. (2019). Return to work after injury: a sequential prediction & prescription problem. Machine Learning for Healthcare (Clinical Abstract)

Conference Presentations (Speaker)

1. Jin J, **Zhang S**, Suen SC. Optimizing Vehicle Routing and Nurse Scheduling for Mobile Vaccine Team Units in Los Angeles, SMDM 2024. Boston, MA. **Lee B. Lusted Award Finalist**
2. **Zhang S**, Suen SC, Yu H, Dessouky M, Ordonez F. Optimizing Vaccine Site Locations While Considering Travel Inconvenience and Public Health Outcomes, INFORMS 2024. Seattle, WA.
3. **Zhang S**, Suen SC, Yu H, Dessouky M, Ordonez F. Optimizing Clinic Locations While Considering Commuting Patterns to Reduce Transportation Costs of Vaccination, SMDM 2023. Philadelphia, PA.
4. **Zhang S**, Suen SC. A Greedy Discretization for Continuous State Dynamic Programming in Infectious Disease Control, INFORMS 2023. Phoenix, AZ.
5. **Zhang S**, Yu H, Dai P, Suen SC, Dessouky MM, Ordonez F. Using Dynamic Origin Destination Estimation Using Road Traffic Sensor Data for Disease Control Insights. INFORMS Healthcare 2023. Toronto, ON.
6. **Zhang S**, Suen SC. Quantifying the Benefits of More Frequent Decision Making Opportunities. INFORMS Healthcare 2023. Toronto, ON.
7. **Zhang S**, Suen SC, Yu H, Nguyen A, Dessouky M. Understanding Quantifying the Health Impacts of COVID-19 Lockdown Policies in Los Angeles Using Traffic Data, SMDM 2022. Seattle, WA. **Lee B. Lusted Award Finalist**
8. **Zhang S**, Suen SC. An Approximate Algorithm for Optimizing Repeated Decisions in Infectious Disease Control, INFORMS 2022. Indianapolis, IN.
9. **Zhang S**, Suen SC. Optimizing Repeated Decisions In Infectious Disease Control, INFORMS 2021. Anaheim, CA and Virtual.
10. **Zhang S**, Suen SC, Yu H, Nguyen A, Dessouky M. Modeling the Dynamics of Covid-19 in Los Angeles Using Traffic Information, SMDM 2021. Virtual.
11. **Zhang S**, Suen SC, Yu H, Nguyen A, Dessouky M. Modeling the Dynamics of Covid-19 in Los Angeles Using Traffic Information, INFORMS Healthcare 2021. Virtual.
12. **Zhang S**, Suen SC, Sundaram V, Gong C, Pham J. Optimal Timing of Liver Transplantation for ACLF3 Patients. INFORMS Healthcare 2021. Virtual.
13. Chen B, **Zhang S**, Suen SC. Differential Patterns of Potential Opioid Misuse Between Younger and Older Adults: Evidence from The South Carolina's SCRIPTS Database. American Public Health Association (APHA) Annual Meeting and Expo 2021. Denver, CO and virtual.

14. **Zhang S**, Suen SC. Identifying the Optimal Timing of Liver Transplantation for ACLF-3 Patients, POMS 2021. Virtual.
15. **Zhang S**, Suen SC. Benefits of Making More Frequent Decisions Under a MDP Framework, INFORMS 2020. Virtual.
16. **Zhang S**, Suen SC, Gong C, Pham J, Sundaram V. Optimal Timing of Liver Transplantation for ALCF3 Patients Using a Dynamic Model. AASLD 2020. Virtual.
17. **Zhang S**, Suen SC, Gong C, Pham J, Sundaram V. Optimal Timing of Liver Transplantation for ALCF3 Patients Using a Dynamic Model, SMDM 2020. Virtual.
18. **Zhang S**, Wang HZ, Denton BT, Wiens J, Seymour J. A Latent Markov Model for Predicting Return to Work for Injured Workers, INFORMS 2018. Phoenix, AZ.

Skills

Python, Matlab, MySQL, R, AMPL, C++

Teaching

- **Teaching Assistant**, University of Southern California
  - ISE 530: Optimization Methods for Analytics
  - ISE 534: Data Analytics Consulting
- **Guest Lecturer**, University of Southern California
  - ISE 505: Modeling for Health Policy and Medical
  - ISE 530: Optimization Methods for Analytics
- **Book Chapters**, Northwestern University
  - Optimization-Based Data Imputation
  - Training Markov Chains

Mentorship

High School Mentees

- Sarah Brown (2022), through USC Viterbi's Summer High School Intensive in Next-Generation Engineering (SHINE) research program

Undergarduate Mentees

- Sanya Khattar (2023 - 2024), through the Center for Undergraduate Research in Viterbi Engineering (CURVE) research program
- Ying Hong (2021 - 2022)
- Jessica Pham (2019 - 2020)

Graduate Mentees

- Jing Jin (2022-2024)
- Kunyu Yu (2022)

Awards and Honors

Lee B. Lusted Award Finalist, SMDM, 2022, 2024

Bonder Award, INFORMS, 2021

Bonder Scholarship Top 3 Finalist, INFORMS, 2021

Viterbi Fellowship, USC, 2019

Professional Associations

Society for Medical Decision Making (SMDM) 2020 - Present

The Institute for Operations Research and the Management Sciences (INFORMS) 2018 - Present

- INFORMS 2023, Phoenix, AZ, Session Chair
- INFORMS 2024, Seattle, WA, Session Chair
- INFORMS 2025, Atlanta, GA, Session Chair

Research Experience

Postdoctoral Scholar, Northwestern University June 2024 - Current

- Developed approximate first-order methods for efficiently and effectively learning large-scale Markov models using longitudinal datasets
- Cleaned and processed large healthcare datasets from multiple sources
- Used statistical models to analyze multiple clinical problems

Research Assistant, University of Southern California Aug 2019 - May 2024

- Hands-on experience in applying dynamic/optimization/simulation/statistical models for health-related problems (COVID-19 disease transmission, vaccination allocation, opioid abuse, liver transplantation, etc.) that can be utilized to assess different policy scenarios and to search for optimal policies for better health outcomes.
- Developed dynamic algorithms and structural properties for medical decision-making problems. Topics include infectious disease control, organ transplantation, and treatment initiation

Research Data Analyst, University of California, Los Angeles June 2023 - August 2023

- Principal investigator: Dr. Corrina Moucheraud
- Employed network analysis and linear threshold models in the context of behavioral analysis to conceptualize and gain insights into the adoption of HPV vaccination across African regions.

Research Assistant, Univerisity of Michigan, Ann Arbor Jan 2018 - May 2019

- Advisor: Dr. Brian Denton
- Developed latent Markov models to dynamically predict the disability duration for lower back injured patients.
- Applied survival analysis on a large national health insurance dataset.

Undergraduate Researcher, Rensselaer Plytechnic Institute Jul 2015 - Dec 2016

- Advisor: Dr. Kristin Bennett
- Engaged in various projects involving data preprocessing, statistical analysis, machine learning, and data modeling in different domains. Topics include semiconductor manufacturing, children's growth, and acute kidney injury.

Industry Experience

Data Science Intern , Webank.com, Shenzhen, China Jun 2017 - Aug 2017

- Applied statistical analysis on a classification problem: Whether give a user coupon? Implemented data preprocessing methods like data scaling, the weight of evidence transformation, and principal component analysis. Employed major machine learning algorithms, including logistic regression, support vector machine, and ensemble methods. Achieved excellent performance.