Matthew W. Repasky Jr.

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EDUCATION

Ph.D. in Machine Learning Aug 2021 – Present
H. Milton Stewart School of Industrial & Systems Engineering, Georgia Institute of Technology
Minor: Geophysics | GPA: 4.00/4.00

B.S. in Physics Aug 2017 – May 2021
School of Physics, Georgia Institute of Technology
Concentration: Astrophysics | Minor: Data Analysis | Highest Honor | GPA: 3.95/4.00

PUBLICATIONS & WORKING PAPERS

Journal Articles

1. Neural Stein Critics with Staged L^2-Regularization
   Matthew Repasky, Xiuyuan Cheng, Yao Xie
   IEEE Transactions on Information Theory, 2023.

Conference & Workshop Papers

1. Generative Modeling for Topography Super-Resolution on the Moon
   Matthew Repasky, Erwan Mazarico, Stefano Bertone, Michael Barker, Terence Sabaka
   Fourth Space Imaging Workshop, 2024.
2. Stage-Regularized Neural Stein Critics For Testing Goodness-Of-Fit Of Generative Models
   Matthew Repasky, Xiuyuan Cheng, Yao Xie
   IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP), 2024.
3. Deep Graph Kernel Point Process
   Zheng Dong, **Matthew Repasky**, Xiuyuan Cheng, Yao Xie
   Temporal Graph Learning Workshop, Thirty-seventh Conference on Neural Information Processing Systems (NeurIPS), 2023.
   **Oral Spotlight Paper*
4. Power Grid Faults Classification via Low-Rank Tensor Modeling
   Matthew Repasky, Yao Xie, Yichen Zhang, Feng Qiu
   Fifty-seventh Asilomar Conference on Signals, Systems, and Computers, 2023.
5. Streaming Low-Rank Matrix Data Assimilation and Change Detection
   Henry Yuchu, **Matthew Repasky**, Terry Ma, Yao Xie
   Fifty-seventh Asilomar Conference on Signals, Systems, and Computers, 2023.
6. Information Recovery via Matrix Completion for Piezoresponse Force Microscopy Data
   Kerisha Williams, Henry Yuchi, Kevin Ligonde, **Matthew Repasky**, Yao Xie, Nazanin Bassiri-Gharb
   AI for Accelerated Materials Design Workshop, Thirty-sixth Conference on Neural Information Processing Systems (NeurIPS), 2022.

Working Papers

1. Lunar Topography Super-Resolution Schrödinger Bridges

   Matthew Repasky, Erwan Mazarico, Stefano Bertone, Michael Barker, Terence Sabaka, Yao Xie

2. Heterogeneous Multi-Agent Reinforcement Learning for Joint Patrol and Dispatch

   Matthew Repasky, He Wang, Yao Xie

3. Marked Temporal Point Processes for Coating Degradation Modeling

   Matthew Repasky, Henry Yuchi, Lasya Akshara, Yao Xie

4. Posterior Sampling via Flow-Based Generative Models

   Matthew Repasky, Vishal Purohit, Qiang Qiu, Yao Xie, Jianfeng Lu, Xiuyuan Cheng

WORK EXPERIENCE

NASA Goddard Space Flight Center Jan 2024 – Aug 2024
Spring/Summer Intern
Advisor: Dr. Erwan Mazarico

- Developing deep generative models of planetary topography using diffusion models, normalizing flows, and Schrödinger bridges provided altimetry and optical data
- Leveraging these models for tasks such as super-resolution and inpainting for regions on the Moon and Mercury, adapting them to conditional generation

NASA Goddard Space Flight Center June 2023 – Aug 2023
Summer Intern
Advisor: Dr. Erwan Mazarico

- Implemented and evaluated an array of low-rank matrix decomposition approaches in the hierarchical compression of view factor matrices used for fast radiosity calculations
- Investigated hierarchical decomposition schemes for triangular meshes of planetary surfaces to construct a block-structured view factor matrix

Argonne National Laboratory May 2022 – July 2022
Technical Research Aide
Advisor: Dr. Feng Qiu

- Applied low-rank tensor models to sensor measurements of the power grid that represent types of fault event
- Used online classification techniques in conjunction with these models to identify and localize power grid faults in real-time

SELECTED RESEARCH EXPERIENCE

Reinforcement Learning for Fair Police Dispatch and Patrol March 2021 – Jan 2024
Conducted under the supervision of *Dr. Yao Xie* and *Dr. He Wang* at Georgia Tech H. Milton Stewart School of Industrial & Systems Engineering

- Using deep multi-agent reinforcement learning techniques to learn efficient and equitable police patrol policies
- Incorporating dynamic priority queueing for dispatch decisions to unify patrol and dispatch policies
- Building simulations to determine basic optimal patrol patterns in addition to realistic representations of the city of Atlanta

Data-Driven Corrosion Modeling to Reduce the Environmental Impact of National Assets July 2020 – Sept 2023
Conducted under the supervision of *Dr. Yao Xie* at Georgia Tech H. Milton Stewart School of Industrial & Systems Engineering

- Developing a predictive time series model to capture the degradation of aircraft paint coatings using a marked, temporal Hawkes process
- Applying sequential change point detection techniques such as CUSUM to detect changes in the protective status of coatings
- Collaborating with a Strategic Environmental Research and Development Program (SERDP) team, including experts at Luna Innovations, Southwest Research Institute, Boeing, and the Department of Defense

Neural Stein Critics with Staged L^2 Regularization Nov 2021 – Nov 2022

Conducted under the supervision of *Dr. Yao Xie* at Georgia Tech H. Milton Stewart School of Industrial & Systems Engineering and *Dr. Xiuyuan Cheng* at Duke University Department of Mathematics

- Created a new training scheme for neural Stein discrepancy critic functions bound to the space of square integrable functions
- Outlined a strategy for the staging throughout training of the regularization weight that bounds functions to L^2

SKILLS

Programming: Proficient in Python, MATLAB, R; Familiar with C, C++, Java
Tools: Pytorch, Tensorflow, High-Performance Computing, Linux, Jupyter Notebooks, Git
Concepts: Artificial Intelligence, Machine Learning, Deep Learning, Generative Modeling, Diffusion, Reinforcement Learning, Spatial-Temporal Modeling, Change Point Detection, Low-Rank Approximation

TEACHING

Graduate Teaching Assistant/Tutor at Georgia Tech Fall '21 – Spring '22
ISYE 2027: Probability with Applications
ISYE 4031: Regression and Forecasting