

Dachuan Song

Fairfax, Virginia, 22030 | dsong25@gmu.edu | (571) 530-8724

[Google Scholar](#) | [GitHub](#) | [LinkedIn](#) | [Personal Website](#)

Education

-
- George Mason University**, Fairfax, Virginia, USA Jan 2024 – Present
College of Engineering and Computing
Ph.D. in Electrical and Computer Engineering, Current GPA: 3.91
Advisor: Prof. Xuan Wang
- **Major Courses:** *Linear Systems, Random Processes, Kalman Filtering, Distributed Control and Optimization, System Identification, Advanced learning from data*
- University of Southampton**, Southampton, United Kingdom Sept 2022 – Sept 2023
School of Electronics and Computer Science
M.Sc. in Computer Science, GPA: 3.8 (Top 3%)
- **Major Courses:** *Advanced Machine Learning, Advanced Deep Learning, Computer Vision, Bayesian, Active & Reinforcement Learning*
- Xinjiang University**, Xinjiang, China Sept 2017 – Jun 2021
School of Software
B.Eng. in Software Engineering, GPA: 3.4 (Top 5%)

Publications

PREPRINTS (ARXIV):

- Elastic Spectral State Space Models for Budgeted Inference** Feb 2026
Dachuan Song, Xuan Wang
<https://arxiv.org/abs/2601.22488>
arXiv preprint arXiv:2601.22488, 2026.
- Mergeable Model-Side Aggregation States for Long-Context Language Models** Jul. 2026
Dachuan Song, Junyu Yin, Zechen Hu, Xuan Wang
<https://arxiv.org/abs/2607.26448>
arXiv preprint arXiv:2607.26448, 2026.

CONFERENCE PAPERS:

- Causality-based Subject and Task Fingerprints using fMRI Time-series Data** Nov 2024
Dachuan Song, Li Shen, Duy Duong-Tran, Xuan Wang
<https://doi.org/10.1145/3698587.3701342>
BCB '24: Proceedings of the 15th ACM International Conference on Bioinformatics, Computational Biology and Health Informatics, Article No.: 13, Pages 1–10, 2024. (Oral Presentation)

JOURNAL ARTICLES:

- Reconstructing brain causal dynamics for subject and task fingerprints using fMRI time-series data** Oct 2025
Dachuan Song, Li Shen, Duy Duong-Tran, Xuan Wang
Health Information Science and Systems, 13, 70, 2025.
<https://doi.org/10.1007/s13755-025-00388-w>

Research Projects

Mergeable Model-Side Aggregation States for Long-Context Language Models Jul. 2026 – Aug. 2026

- Introduced SketchOps, a model-side aggregation interface that maintains compact, mergeable sketch states alongside frozen language models for fixed-budget long-context processing.
- Used HyperLogLog-style sketches to summarize and merge evidence across input chunks, avoiding repeated processing of the full history while preserving useful long-context information.

Elastic Spectral State Space Models for train-once Budgeted Inference Jan. 2026 – Present

- Developed ES-SSM as a train-once, export-many spectral SSM that converts one full-capacity model into independently deployable compact models by directly truncating ordered Hankel spectral-channel prefixes and their associated parameters.
- Designed input-adaptive, channel-wise gates that modulate the contribution of retained spectral components based on the current representation, enabling dynamic spectral mixing while preserving the prefix structure required for compact-model export.
- Trained with budget dropout that samples runtime budgets during training, optimizing the same spectral prefixes used by exported compact models and allowing early channels to form useful predictors before later channels provide higher-budget refinements.

Machine Learning for Brain Activity Patterns using EEG (Master Final Project) Apr. 2023 – Oct. 2023

- Developed a deep learning pipeline that combines CNNs for spatial extraction with LSTMs for temporal modeling, boosting EEG-based brain pattern recognition.
- Integrated an autoencoder-based pretraining module with attention mechanisms for enhanced feature learning and precise identification of neural signatures.
- Applied transfer learning using ResNet50 to refine feature extraction and improve model generalization on limited EEG datasets, increasing system robustness.

Internship Experience

Machine Learning Engineer Intern, Optosurgical May 2026 – Aug. 2026

- Developed video models for surgical phase and instrument-action recognition in robot-assisted procedures, providing workflow-state information for downstream surgical systems.
- Compressed and fine-tuned Depth Anything 3 to 29% of its original size while retaining near-full model performance for monocular depth estimation.

Technical Skills

- **Sequence Models & Efficiency:** spectral/Mamba-style SSMs, long-context modeling, budget-aware and elastic inference, model compression, attention/Transformers, FFT-based convolution, CUDA.
- **Research Engineering:** PyTorch, large-scale training and debugging, multi-GPU training, ablation design, benchmark and metric design, reproducible evaluation.
- **Modeling & Control:** linear dynamical systems, Kalman filtering/smoothing, system identification, LQR/MPC, VAR/autoregressive models.