ALISHA (LEE) SHARMA

Last Updated May 16, 2020

EDUCATION

University of Maryland, College Park — Present
Ph.D. Student, Computer Science
Focus: Scientific Machine Learning

University of Maryland, University College — Dec 2018
BS in Computer Science, Minor in Mathematical Sciences
Summa Cum Laude

RELATED EXPERIENCE

Computer Scientist — Apr 2019 – Present
Naval Research Laboratory, Laboratories for Computational Physics & Fluid Dynamics, Code 6042
Supervisor: Keith Obenschain

· Develop physics-informed machine learning models for cost-prohibitive unit physics problems
· Design efficient surrogate models for vehicle design optimization and autonomous control
· Integrate these AI/ML models into state-of-the-art CFD codes in a modular and performant way
· Serve as the group resource in modern AI/ML techniques

Recurser — Jan 2019 – Feb 2019
Recurse Center

· Created a domain-specific language in Julia for generating cellular automata on various manifolds
· Analyzed and implemented heuristic approaches to large-scale graph partitioning problems

REU Research Intern — May 2018 – Aug 2018
University of Colorado, Colorado Springs, Vision and Security Technology (VAST) Lab
Supervisor: Jonathan Ventura

· Developed self-supervised deep learning model for estimating scene depth from 360° cylindrical RGB panoramas
· Collected, processed, and published cylindrical panoramic street-level video dataset for unsupervised learning

Software Developer — Jan 2015 – May 2018
Freelance

· Worked with clients to create web applications, emphasizing well-tested code and clear documentation

Founder & CTO — Jan 2012 – Feb 2014
Project Nexus

· Led a team of software developers to design and build community-driven project management software

AWARDS & HONORS

Best Paper Award, IEEE Int. Conf. Artificial Intelligence and Virtual Reality	2019
Upsilon Pi Epsilon Computing Honor Society	2018
First Place, "Unhack The Vote" Data Science Hackathon	2017

PROFESSIONAL MEMBERSHIPS

Member, Association for Computing Machinery (ACM)
Member, American Institute for Aeronautics and Astronautics (AIAA)

CURRENT RESEARCH AREAS

Neural Chemistry Surrogate Models for Reacting Flow CFD

Simulating reacting flow with modern fuels and detailed chemistry is computationally prohibitive, with stiff chemistry integration taking up to 90% of the total compute time. We are exploring "physics-informed machine learning" techniques to develop fast, scalable, and robust surrogate models that can replace numerical chemistry solvers in real codes. We are integrating these models into our in-house computational fluid dynamics (CFD) code, providing a significant speedup, better load balancing, and reduced precision requirements.

Robust Surrogate Models for Bio-Inspired UUV Propulsion Systems

Fish-inspired propulsion systems for unmanned underwater vehicles (UUVs) perform well in low-speed, unsteady, or constrained conditions. However, modeling the fluid dynamics around the vehicle, particularly the complex multi-fin flow interactions, is expensive, slowing development progress. We are developing high-fidelity surrogate models capable of directly predicting quantities of interest from a set of design parameters. These surrogate models will be used for both design optimization and adaptive UUV control.

Evaluating HPC Systems for AI/ML Workloads

Our division works with the Department of Defense High-Performance Computing Modernization Program (DoD HPCMP) and industry partners to evaluate emerging and experimental high-performance computing (HPC) architectures. To support this mission, I profile code, run benchmarks, and develop containers and libraries for deep learning training and inference on various HPC architectures.

PUBLICATIONS

4. **A. Sharma**, R. Nett, and J. Ventura, "Self-Supervised Learning of Depth and Ego-Motion from Cylindrical Panoramic Video," *journal article in preparation.*

3. **A. Sharma**, R. Johnson, A. Moses, and D. Kessler, "Deep Learning for Scalable Chemical Kinetics," AIAA SciTech Forum, January 2020.

2. **A. Sharma** and J. Ventura, "Unsupervised Learning of Depth and Ego-Motion from Cylindrical Panoramic Video," IEEE International Conference on Artificial Intelligence and Virtual Reality (AIVR), December 2019. Best Paper Award.

1. K. Viswanath, **A. Sharma**, S. Gabbita, J. Geder, R. Ramamurti, and M. Pruessner, "Evaluation of Surrogate Models for Multi-fin Flapping Propulsion Systems," IEEE/MTS OCEANS Conference, October 2019.

POSTERS, ABSTRACTS, & OTHER WORK

4. K. Obenschain, D. Schwer, and **A. Sharma**, "Initial Assessment of the AMD MI50 GPGPUs for Scientific and Machine Learning Applications," International Supercomputing Conference (ISC-HPC), Frankfurt, Germany, June 2020, *accepted.* (Poster)

3. **A. Sharma**, K. Viswanath, R. Ramamurti, and J. Geder, "Representing Geometry and Materials Properties in Physics-Informed Modeling of Flapping Fin Propulsion Systems", AAAI Spring Symposium on Combining Artificial Intelligence and Machine Learning with Physical Sciences (AAAI-MLPS), March 2020, *accepted, withdrawn due to COVID-19.*

2. A. Moses, **A. Sharma**, "Learning the Hard Parts: Scaling Reacting Flow Simulations with Machine Learning," NVIDIA GPU Technology Conference (GTC), San Jose, CA, March 2020. (Abstract)

1. **A. Sharma** and J. Ventura, "Video Demo: Unsupervised Learning of Depth and Ego-Motion from Cylindrical Panoramic Video," IEEE International Conference on Artificial Intelligence and Virtual Reality (AIVR), San Diego, CA, December 2019. (Demo)

GRANT WRITING

Naval Research Laboratory New Start Grant (6.1)   2020 – 2023
Physics-Informed Machine Learning
Co-Principle Investigator (PI: Adam Moses, Co-PI: Ryan Johnson)