Aditya Dendukuri

PhD Candidate
University of California, Santa Barbara

dendukuri.aditya123@outlook.com

Research Interests

Numerical simulations, mathematical modeling and scientific machine learning.

Education

University of California, Santa Barbara CA Sept 2021 — Present
PhD in Computer Science
Advisor: Linda R. Petzold

University of Arkansas, Fayetteville AR Aug 2018 — Jul 2020
MS in Computer Science
Advisors: David M. Ford and Matthew J. Patitz
Thesis: Nonlinear Dimensionality Reduction for the Thermodynamics of Small Clusters of Particles

University of Central Arkansas, Conway AR Aug 2018 — Jul 2020
BS in Computer Science (Minor in Physics)
Advisor: Tansel Halic

Experience

University of California, Santa Barbara Santa Barbara, CA
Graduate Research Assistant Sept 2021 — Present

- Efficient simulation and inference methods for discrete stochastic systems.
- Analyzing lab-grown neural tissue recordings using data-driven approaches.
- Teaching Assistant for undergraduate programming courses (Python, C++ and MATLAB) and scientific computing/applied mathematics.

NSF National Center for Atmospheric Research Boulder, CO
Graduate Student Intern *May 2024 — July 2024*

- Refactored NCAR's radiative transfer equation solver from Fortran to C++.
- Developed C++ code with comprehensive documentation on the mathematical principles underlying the solver algorithm.
- Implemented a tridiagonal linear system solver and compared its performance against the industry-standard LAPACKE library.
- Enhanced unit testing coverage for linear algebra functions using Google Test.
- Conducted benchmarking of linear algebra functions with Google Benchmark.
- Performed all experiments on NCAR's supercomputer, Derecho.

University of Arkansas, Fayetteville Fayetteville, AR
Research Associate Sept 2020 — Jun 2021

- Developed Monte Carlo simulation code for nucleation phenomena in C.

University of Arkansas, Fayetteville Fayetteville, AR
Graduate Research Assistant Aug 2018 — Jul 2020

- Developed novel methods for data-driven analysis of the thermodynamics of small colloidal clusters.
- Developed quantum computing simulations for machine learning purposes.
- Work published in the Computers & Chemical Engineering journal.

University of Central Arkansas Conway, AR
Undergraduate Research Assistant Aug 2018 — Jul 2020

- Developed a multi-physics numerical solver (fluid + heat) for virtual surgical simulations for training doctors.
- Shadowed multiple arthroscopic surgeries and collected data for hierarchical task analysis.
- Work accepted for the 23rd IEEE International Conference on Bioinformatics and Bioengineering (BIBE) for presentation and subsequent publication.

Publications

- A. Dendukuri, M. Tunc, D. Demirel, *et al.*, "Unified framework for real-time fluid simulation in virtual rotator cuff arthroscopic skill trainer (vircast)," in *Proceedings of the 23rd IEEE International Conference on BioInformatics and BioEngineering*, In Press, IEEE Computer Society. DOI: 10.1109/BIBE60311.2023.00063
- D. M. Ford, A. Dendukuri, G. Kalyoncu, *et al.*, "Machine learning to identify variables in thermodynamically small systems," *Computers & Chemical Engineering*, p. 106 989, 2020
- D. Demirel, A. Yu, S. Cooper-Baer, *et al.*, "A hierarchical task analysis of shoulder arthroscopy for a virtual arthroscopic tear diagnosis and evaluation platform (vatdep)," *The International Journal of Medical Robotics and Computer Assisted Surgery*, vol. 13, no. 3, e1799, 2017

Conference Presentations/Posters

- A. Dendukuri, M. Tunc, D. Demirel, *et al.*, *Unified framework for real-time fluid simulation in virtual rotator cuff arthroscopic skill trainer (vircast)*, 23rd IEEE International Conference on BioInformatics and BioEngineering (BiBE 2023). Presented by Doga Demirel, Oct 20-24, 2019
- A. Dendukuri, G. Kalyoncy, K. Luu, *et al.*, *Detecting subspaces for small lennard-jones clusters using spectral graph theory and machine learning*, 2021 SIAM Conference on Computational Science and Engineering, Poster., March 20-21, 2021
- D. M. Ford, A. Dendukuri, G. Kalyoncu, *et al.*, *Machine learning to identify variables in thermodynamically small systems*, Foundations of Process Analytics and Machine Learning. Poster, Aug 6-9, 2019
- A. Dendukuri, B. Keeling, A. Fereidouni, *et al.*, *Defining quantum neural networks via quantum time evolution*, Quantum Techniques in Machine Learning 2019, KAIST, Daejon, South Korea. Poster., Oct 20-24, 2019
- A. Dendukuri, T. Mustafa, T. Halic, *et al.*, *Modeling fluid and heat flow in virtual arthroscopic tear diagnosis and evaluation platform (vatdep)*, Arkansas IDeA Network of Biomedical Research Excellence poster symposium. Fayetteville, AR. Poster, Oct 25-26, 2017
- A. Dendukuri, T. Halic, S. Kockara, *et al.*, *Modeling fluid flow in virtual arthroscopic tear diagnosis and evaluation platform (vatdep)*, Sixth Annual Central Arkansas Undergraduate Summer Research Symposium. University of Arkansas for Medical Sciences, Little Rock, AR. Poster, Jul 26, 2017

Honors

- Best paper award. IEEE Bioinformatics and Bioengineering (BIBE) Conference 2023.
- Masters thesis nominated for the *Conference of Southern Graduate Schools (CSGS)* outstanding master's thesis award.
- Graduate Student Council Travel Grant ($500) for the Foundations of Process Analytics and Machine Learning Conference in Raleigh, North Carolina (Summer 2019).
- Advancement of Undergraduate Research in the Sciences (AURS) summer research fund (2016) (`http://www.aursfund.org`) Award Amount: $5000
- International Mobility Scholarship (University of Central Arkansas)

Selected Courses

PhD Courses (UCSB)

- Matrix Analysis and Computation
- Level Set Methods
- Finite Element Methods
- Numerical Simulation
- Graph Laplacians

MS Courses (UofA)

- Deep Learning
- Natural Language Processing
- Computer Vision

Skills (2-3 Years of Full-Time Experience)

- **Programming:** Julia, Python, C/C++
- **Software:** Tensorflow and PyTorch (Python), Modelling Toolkit (Julia), SciML (Julia), Linux, CMAKE.

References

Dr. Linda R. Petzold (petzold@engineering.ucsb.edu)
Mehrabian Distinguished Professor, Mechanical Engineering and Computer Science, University of California, Santa Barbara.

Jian Sun (sunjian@ucar.edu)

Soft Eng/Prog II, NSF National Center for Atmospheric Research

Dr. David Ford (ford3dm@cmich.edu)
Dean of Science and Engineering, Central Michigan University.
Past: Professor and Department Head. Ralph E. Martin Department of Chemical Engineering, University of Arkansas.

Dr. Tansel Halic (tanselhalic@gmail.com)
Senior Software Engineer, Intuitive Surgical.