Mit Kotak

https://mitkotak.github.io Cambridge, Massachusetts, United States mitkotak0305@gmail.com

Education

Massachusetts Institute of Technology. Cambridge, MA July 2023-Present
PhD Computational Science and Engineering

University of Illinois at Urbana-Champaign, Champaign, IL August 2019-May 2023
Bachelor of Science in Engineering Physics (with Highest Honors)
Senior Thesis: Efficient Execution of DG-FEM workloads on GPUs via CUDAGraphs
Advisor: Dr. Andreas Klöckner
Minors: Computational Science and Engineering, Statistics
GPA: 3.91/4.0

Parkland College, Champaign, IL May 2020-May 2021
Associate in General Studies
GPA: overall 4.0/4.0;

Grants/Awards

2024-2029 National Science Foundation Research Fellowship
2023 ACCESS Explore Supercomputing Grant (5000 GPU hours)
2023 Office of Undergraduate Summer Research Support Grant
2022 National Center for Supercomputing Applications Student Pushing Innovation (SPIN)
2022 1st place in UIUC Image of Research Competition
2021 Philip J. and Betty M. Anthony Undergraduate Summer Research Award

Publications

High-performance training and inference for deep equivariant interatomic potentials
Chuin Wei Tan, Marc L. Descoteaux*, **Mit Kotak**, Gabriel de Miranda Nascimento, Sean R. Kavanagh, Laura Zichi, Menghang Wang, Aadit Saluja, Yizhong R. Hu, Tess Smidt, Anders Johansson, William C. Witt, Boris Kozinsky, Albert Musaelian*
arxiv:2504.16068

The Price of Freedom: Exploring Tradeoffs between Expressivity and Computational Efficiency in Equivariant Tensor Products
*YuQing Xie, Ameya Daigavane, **Mit Kotak**, Tess Smidt*
ICML'25, GRaM at ICML'24

Providing Accessible Software Environments Across Science Gateways and HPC
*Alexander Michels, **Mit Kotak**, Anand Padmanabhan, John Speaks, Shaowen Wang*
PEARC '24

CyberGIS-Compute: Middleware for Democratizing Scalable Geocomputation
*Alexander Michels, Anand Padmanabhan, Zimo Xiao, **Mit Kotak**, Furqan Baig, Shaowen Wang*
SoftwareX

What happens when Black Holes collide ?
***Mit Kotak**, Eric Yu, Jinghan Huang, Jing Zhou, Milton Ruiz, Antonios Tsokaros, Lunan Sun, Stuart L. Shapiro*
Coalition for Academic Scientific Computation 2023 Brochure, Page 14

Streamlined HPC Environments with CVMFS and CyberGIS-Compute
*Alexander Michels, **Mit Kotak**, Anand Padmanabhan, Shaowen Wang*
IGUIDE Forum 2023

Talks

Optimizing Equivariant Tensor Products (MIT Graphics Seminar 2023,

Tutorials

Symphony-Equivariant Point-Centered Spherical Harmonics for 3D Molecule Generation
AI + Science Summer School 2024)

Posters

Efficiently Executing NumPy on GPUs via the CUDAGraph API (UIUC URS 2022)

Analysis of bottle bioassay data: Creating an RShiny app to assist in insecticide resistance montioring (Entomology 2023)

Research Experience

Lawrence Berkeley National Lab *June 2024-September 2024*
Dr. Steven Farrell
Worked on Performance Modeling E(3) Equivariant Message Passing Networks for Neural-Network Interatomic Potentials via Roofline Toolkit

Research Lab for Electronics *July 2023-Present*
Dr. Tess Smidt
Working on Optimizing Eucledian Neural Networks through Domain Specific Languages

Center for Exascale-enabled Scramjet Design *May 2021-May 2023*
Dr. Andreas Klöckner
Worked on Efficient execution of array dataflow graphs on GPU hardware.

- ***Co-designed and Co-developed a multi-layered framework** with a graduate student for executing data flow graphs on GPUs via an array-based programming interface.*
- ***Benchmarked a speedup of upto 5x** for Finite-Element based Discontinuous Galerkin Operators.*
- ***Presented results** at semestrial lab funding reviews (CEESD AST Review 2022) and annual undergraduate research symposium (UIUC URS 2022).*

Center for Theoretical Astrophysics *June 2021-June 2023*
Dr. Stuart L. Shapiro
Worked on 3D Visualization of Relativistic Magnetohydrodynamics.

- ***Led a team of 4 undergraduates** to create 3D visualizations of neutron stars, black hole binaries and black holes disks using a VisIt-CLI based software package across 6 supercomputers.*
- ***Spearheaded** the usage of isosurface shell rendering (5-10 times faster than the conventional volume rendering) for visualizing the density profile.*
- ***Visualizations featured** in department news website and NCSA's award winning exhibit at Engineering Open House.*

CyberGIS Center for Advanced Digital and Spatial Studies *March 2022-May 2023*
Dr. Anand Padmanabhan
Worked on CyberGIS-Compute: Geospatial Middleware for Simplifying Access to High-Performance Computing.

- ***Provided continued software support** for a Python-based GUI and Typescript-based RESTful API server.*
- ***Integrated** the CyberGIS-Compute framework with CVMFS (Cern Virtual Machine File System).*

National Center for Supercomputing Applications *August 2022-June 2023*
Dr. Antonios Tsokaros
Worked on High Performance Computing for Magnetized Neutron Stars.

- ***In progress: Writing** a 100 page primer for 3D visualizations in numerical relativity.*

Work Experience

College of Veterinary Medicine *January 2023-May 2023*
Dr. Becky Smith

- *Built an R shiny web application for CDC-funded Midwest Center of Excellence in Vector-Borne Disease for monitoring pesticide usage which was presented at Entomology 2023.*

Office of Undergraduate Research *March 2021-May 2023*
Undergraduate Research Ambassador

- *Held **one-to-one peer mentoring sessions** with **50+ undergraduates**, **Led** "Getting Started with Research" workshops and helped organize the annual undergraduate research symposium (latest one had 500 presenters).*
- ***Developed** a chatbot that could answer commonly asked questions regarding finding research opportunities.*

Mischief

Muffin Monday Chair, Sidney-Pacific Graduate Hall Councilor, Rooftop and Tunnel Explorer