Mit Kotak

https://mitkotak.github.io Champaign, Illinois, United States mitkotak0305@gmail.com

Education

Massachusetts Institute of Technology. Cambridge, MA — July 2023-Present
Master of Science in Computational Science and Engineering — Graduation June 2025

University of Illinois at Urbana-Champaign, Champaign, IL — August 2019-May 2023
Bachelor of Science in Engineering Physics (with Highest Honors)
Senior Thesis: 'A case study on the effectiveness of graph APIs'
Advisor: Dr. Andreas Klöckner
Minors: Computational Science and Engineering, Statistics
GPA: 3.91/4.0
Dean's List: Fall 2019, Spring 2020, Fall 2020, Spring 2021

Parkland College, Champaign, IL — Summer 2020-Fall 2020
Associate in General Studies — Received: May 2021
GPA: overall 4.0/4.0;
Dean's List: Fall 2020

Presentations

Efficiently Executing NumPy on GPUs via the CUDAGraph API. (UIUC URS 2022)
Task Graph Parallelism on GPUs via CUDAGraphs.(CEESD AST Review 2022)

Research Experience

Research Lab for Electronics — July 2023-Present
Dr. Tess Smidt
Working on optimizing tensor product operation in e3nn framework through domain specifc computing.

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.
  - Extended *PyCUDA*, a python-based GPU scripting language, to provide runtime code generation for NVIDIA's *CUDAGraph* API.
  - Implemented a *CUDAGraph* backend for *Pytato*, a lazy-evaluating array interface that lowers *n-d* array programs to computation graphs.
  - Developed a *CUDAGraph* backend for *Arraycontext*, an array abstraction for mapping *numpy-like* operations onto *CUDAGraph* driver API calls.
- **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).
- **Senior Thesis: Modeling the performance** of CUDAGraph API's runtime scheduler through a set of microbenchmarks and writing the paper.

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 supercomputing clusters .
- **Spearheaded** the usage of isosurface shell rendering (5-10 times faster than the conventional volume rendering) for visualizing the density profile.
- **Co-developed a set of *Python* scripts** for efficiently measuring the circumference of a black hole disk at a given density.
- **Visualizations featured** in 2 *Phys. Rev. Journal articles, CASC 2023 and department news website*.

- **Applied for and received** undergraduate research support grants for summer research (RSG 2022, RSG 2023).

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.
- **In progress: Integrating** 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: Developing** the *Einstein Toolkit* and *COCAL* code to perform full magneto-hydrodynamics (GRMHD) simulations of magnetized neutron stars (NSs) and examine their astrophysical signatures in a variety of scenarios.
- **In progress: Writing** a 50-60 page manual for 3D visualizations in numerical relativity.

Published Visualizations

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
Available at https://casc.org/researchpub/brochures/

Grants/Awards

2021 Philip J. and Betty M. Anthony Undergraduate Summer Research Award – $3,000
2022 Office of Undergraduate Summer Research Support Grant – $2,000
2022 1st place in UIUC Image of Research Competition — $300
2022 National Center for Supercomputing Applications Student Pushing Innovation (SPIN) – $7,200
2023 Office of Undergraduate Summer Research Support Grant – $1,000

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.*

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

- *Held **one-to-one peer mentoring sessions** with **40+ 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.*

Illinois Technology Services *March 2020-March 2022*
Data and Technology Innovation Group - Student Success Team

- ***Built several machine learning models** to predict students at risk of performing poorly in core classes. Average recall: 90%. Average precision: 90%*
- ***Built a web interface** where academic advisors can view the predicted performance of students in core classes. Helped advisors understand courses other than prerequisites that determine student success.*

Illinois ATLAS Teaching and Learning with Technology *January 2021-July 2021*
Department of Economics & School of Literatures, Culture & Linguistics

- ***Implemented job application bot** using Selenium, Beautiful Soup and Django for the Department of Economics.*
- ***Analyzed data for 11 departmental websites** using Google Analytics API & Python packages (pandas, Numpy) for the School of Literatures, Culture & Linguistics.*