Marc Tunnell Email : mtunnell—at—purdue.edu

Education

Purdue University
PhD Computer Science Started August 2023
Current Coursework: Numerical Optimization, Data Communication & Computer Networks

Grand Valley State University
B.S. Computer Science & Applied Mathematics April 2023

Grand Rapids Community College
Associate of General Studies April 2020

Research Experience

- **PhD Research** Dr. David Gleich
  PhD Student at Purdue University *Fall 2023 — Present*
  - **Project**: This research focuses on evaluating the efficacy of preconditioners in solving real-world problems. The project aims to understand the gap between theoretical efficiency and practical performance by applying these methods to real data.
- **Collaborative Research** Dr. Erik Boman
  Sandia National Laboratory Collaboration *Fall 2023 — Present*
  - **Project**: This project involves the development of a novel in-memory accelerated preconditioner, in collaboration with Dr. Erik Boman at Sandia National Laboratories. The focus is on creating a preconditioner that can be efficiently generated via GPU acceleration or multithreading paradigms.
- **Applied Computing Institute** Drs. Erin Carrier & Zachary DeBruine
  ACI Resident at Grand Valley State University. *Fall 2022 — Summer 2023*
  - **Project**: Value-Compressed Sparse Column (VCSC): Sparse Matrix Storage for Redundant Data
  - **Details**: We developed two novel methods of sparse matrix storage for data that is highly redundant. VCSC is optimized for compute performance given a compressed footprint and IVCSC is optimized for compression.
- **Applied Computing Institute** Drs. Erin Carrier, Nathaniel Bowman, & Zachary DeBruine
  ACI Resident at Grand Valley State University. *Fall 2022 — Summer 2023*
  - **Project**: Accelerating Large Scale Non-negative Matrix Factorizations with CUDA.
  - **Details**: I developed high-performance code for rank determination in Non-negative Matrix Factorizations. This work was supported by the Van Andel Institute and the Chan Zuckerberg Initiative.
- **LANL Parallel Computing Summer Research Internship** Dr. Darren Engwirda
  Los Alamos National Laboratory. *Summer 2022*
  - **Project**: Generating Very Large-Scale Unstructured Meshes for Storm-Surge Modelling: Parallelizing the JIGSAW Library.
  - **Details**: I developed the parallel implementation of JIGSAW, the unstructured mesh generation software utilized by the ocean modeling team at LANL.
- **Undergraduate Research** Drs. Erin Carrier & Nathaniel Bowman
  School of Computing at Grand Valley State University. *Fall 2021 — Summer 2022*
  - **Project**: Fast Gaussian Process Emulation for Mars Global Climate Model.
  - **Details**: I developed a domain-specific method for Gaussian Process emulation of the NASA Ames Mars Global Climate model that scales linearly in time and memory complexity. This work was supported by the Kindschi Foundation competitive undergraduate fellowship.
- **National Science Foundation REU** Dr. Yuchou Chang
  College of Engineering at University of Massachusetts, Dartmouth. *Summer 2021*
  - **Project**: A Novel Convolutional Neural Network for Emotion Recognition Using Neurophysiological Signals.
  - **Details**: I developed a novel Deep Neural Netwok for the classification of emotion using EEG signals. This network takes advantage of features extracted using Thomson Multitaper PSD estimation, a first in this subdomain of EEG-BCI research.

Work Experience

- **Graduate Teaching Assistant**
  Purdue University, West Lafayette *Fall 2023, Spring 2024, Fall 2024*
  - **Fall 2024**: CS 515 *Numerical Linear Algebra* (Graduate). Lead office hours and online discussion forums, create homework questions, and grade assignments
  - **Fall 2023, Spring 2024**: CS 240 *Programming in C*. Lead discussion sections, labs, office hours, and online discussion forums.
- **Math Center Tutor**
  Grand Valley State University *Winter 2020 — Winter 2023*
  - **Details**: Assisted students with mathematics and computer science concepts in most undergraduate courses.

Papers

- **Marc Tunnell**, Erik Boman. Parallel Incomplete LU Factorizations Based on Alternating Triangle Solves. *In progress*
- **Marc Tunnell**, Zachary DeBruine, Erin Carrier. Rank Suggestion in Non-negative Matrix Factorization via Sensitivity Analysis. *In submission*
- **Marc Tunnell**, Nathaniel Bowman, Erin Carrier. Fast Gaussian Process Emulation of Mars Global Climate Model. *September 2023 in AGU Earth & Space Science*
- **Marc Tunnell**, Huijin Chung, Yuchou Chang. A Novel Convolutional Neural Network for Emotion Recognition Using Neurophysiological Signals. *2022 International Conference on Robotics and Automation (ICRA) May 2022*

Abstracts & Summaries

- Skylar Ruiter, Seth Wolfgang, **Marc Tunnell**, Timothy Triche, Erin Carrier, Zachary DeBruine. Value-Compressed Sparse Column (VCSC): Sparse Matrix Storage for Redundant Data.
  Accepted as One-Page Summary DCC 2024. Full Preprint at https://arxiv.org/abs/2309.04355
- **Marc Tunnell**, Darren Engwirda. Generating Very Large-Scale Unstructured Meshes for Storm-Surge Modelling: Parallelizing the JIGSAW Library.
  AGU Fall Meeting 2022. https://ui.adsabs.harvard.edu/abs/2022AGUFMOS52B0516T/abstract

Technical Reports

- **Marc Tunnell**, Erik Boman. Parallel Incomplete LU Factorizations Based on Alternating Triangle Solves

Honors and Grants

- **Purdue Science Excellence Scholarship** *2023*
- **GVSU Undergraduate Research Scholar** *2023*
- **GVSU Excellence in a Discipline Award, Computer Science** *2023*
- **GVSU Outstanding Senior Award, Mathematics** *2023*
- **Kindschi Undergraduate Research Fellowship in the Sciences** *Winter 2022*
- **Michigan Competitive Scholarship** *Winter 2020 — Winter 2020*
- **Dean's List Recipient** *Winter 2019 — Winter 2023*

Technical Skills

- **Languages**: C++, C, Julia, Python, R, MATLAB, Java, SQL.
- **Miscellaneous**: Git, Linux, Slurm, LaTeX.
- **Frameworks & Libraries**: MPI, CUDA, Cusparse, Cublas, Kokkos, Thrust, OpenMP, Eigen, NumPy, pandas, SciPy, Matplotlib, scikit-learn.

Presentations

- **Americal Geophysical Union Fall Meeting 2022** — Poster Presentation
  Generating Very Large-Scale Unstructured Meshes for Storm-Surge Modelling: Parallelizing the JIGSAW Library. — *Dec 2022*
- **West Michigan Regional Undergraduate Science Conference** — Poster Presentation
  Accelerating Large Scale Non-Negative Matrix Factorizations with CUDA. — *Nov 2022*
- **LANL Student Symposium 2022** — Oral Presentation
  Generating Very Large-Scale Unstructured Meshes for Storm-Surge Modelling: Parallelizing the JIGSAW Library. — *Jul 2022*
- **IEEE International Conference on Robotics and Automation 2022** — Oral Presentation
  Novel Convolutional Neural Network for Emotion Recognition Using Neurophysiological Signals. — *May 2022*
- **Midwest Numerical Analysis Day 2022** — Poster Presentation
  Fast Gaussian Process Emulation for Mars Global Climate Model. — *May 2022*
- **26th Annual Student Scholars Day** — Poster Presentation
  Fast Gaussian Process Emulation for Mars Global Climate Model. — *May 2022*
- **Undergraduate Research Panel Participant** — Panel Participant
  Panel on Involvement in Undergraduate Research — *Oct 2021*
- **Summer 2021 Final Presentation, UMass, Dartmouth (NSF REU)** — Oral Presentation
  A Novel Convolutional Neural Network for Emotion Recognition Using Neurophysiological Signals. — *Aug 2021*

Service & Volunteer Work

- **Graduate Student Senate**
  Purdue University — *Aug 2024 — Present*
  - **Fall 2024**: Board Constitution Review Committee Member
- **Graduate Student Interview with Prospective Computer Science Heads**
  Purdue University — *Jan 2024*
  - **Details**: I was selected to engage with the final three candidates for the CS department head position and provide input to the direction of the department.
- **Undergraduate Research Fair**
  Dept. of Mathematics at Grand Valley State University — *Oct 2021, 2022, 2023*
  - **Details**: I represented the Department of Mathematics (2021) and school of Computer Information Systems (2022, 2023) at the annual undergraduate research fair. This fair seeks to increase engagement of undergraduates in research.

Membership

- **IEEE** — *Feb 2022 — Present*
- **Pi Mu Epsilon Mathematics Society** — *Feb 2022 — Present*
- **Society for Industrial and Applied Mathematics** — *Oct 2021 — Present*
- **Mathematical Association of America** — *Dec 2021 — Present*

Conferences & Workshops Attended

- **Workshop on Sparse Tensor Computations** | In-Person | Chicago (UIUC) *Oct 18-19, 2023*
- **American Geophysical Union Fall Meeting** | In-Person | Chicago (AGU) *Dec 12-16, 2022*
- **West Michigan Regional Undergraduate Science Conference** | In-Person | Van Andel Institute *Nov 5, 2022*
- **International Conference on Robotics and Automation 2022** | In-Person | Philadelphia (IEEE) *May 23-27, 2022*
- **Midwest Numerical Analysis Day 2022** | In-Person | University of Michigan, Ann Arbor *May 2021, 2022*
- **Mathematical Association of America, West Michigan Meeting** | In-Person | Grand Rapids *Apr 8-9, 2022*
- **Mars Global Climate Model Workshop** | Virtual | NASA Ames *Nov 2-4, 2021*
- **Data Science Day 2021** | Virtual | Columbia University *Apr 21, 2021*