Karan Vombatkere

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Education

Boston University — Boston, MA
Ph.D. Computer Science — *Aug 2021 - present*
- *Algorithmic Data Mining, Computational Social Science*, (GPA: 3.86)

University of Rochester — Rochester, NY
M.S. Data Science — *May 2018*
- *Computational & Statistical Methods*, (GPA: 3.83)

B.S. Electrical & Computer Engineering — *May 2017*
B.A. Physics
- *Highest Distinction, Magna Cum Laude*, (GPA: 3.92)

Research and Work Experience

Boston University, Boston, MA — *Aug 2021 - present*
PhD Researcher — Advisor: Dr. Evimaria Terzi
Approximation algorithms for team formation
- Design efficient approximation methods for the team formation problem, with provable guarantees.

Max Planck Institute-SWS, Saarbrücken, Germany — *May - Aug 2022*
Research Intern — Advisor: Dr. Krishna Gummadi
Personalization in social media feeds
- Framework to audit personalization on TikTok's short format video content recommendations.

IBM, Cambridge, MA — *Sep 2018 - Jun 2021*
Data Scientist — Supervisor: Dr. Mark Freeman
Optimizing bid pricing using machine learning
- Developed a novel method for bid price optimization in Python for a B2B competitive pricing setting. Implemented a custom gradient ascent algorithm to solve the constrained revenue maximization, and integrated SQL functionality into the train-test pipeline to improve run time by over 100%.
- Built a REST API framework to handle real-time pricing requests in under 2 seconds. Successfully released pricing engine as a microservice for *Verizon Communications*.

Pre-authorization for surgical procedures
- Developed a rules engine in Python and extracted contextual language features from patient clinical data. Deployed natural language model framework on AWS for *CVS Health*.

Data engineering for dashboards
- Wrote SparkSQL code for large datasets, to enhance dashboard capabilities for *Apple Media Products*.

Brand Networks, Rochester, NY — *Jan - May 2018*
Master's Capstone Practicum — Mentor: Dr. Ajay Anand
- Researched Facebook ad-campaign success drivers and identified optimal campaign configurations using SQL scripts. Developed classification models in Python to predict campaign-optimizing key performance indicators and presented a metric-driven, ad-campaign configuration process to the company.

Audio Information Research Lab, University of Rochester — *May - Aug 2016*
Research Fellow (Sponsored by Xerox) — Mentor: Prof. Zhiyao Duan
- Developed an automatic lyric display system and GUI for live music performances in Java. Used a real-time implementation of the dynamic time warping algorithm to align annotated and live temporal sequences, based on their harmonic similarity.

Teaching Experience

Boston University
- CS 565: Algorithmic Data Mining, *Teaching Assistant* — *Spring 2023*
- BU CS Summer Challenge Course, *Instructor* — *Summer 2023*

University of Rochester
- ECE 231: Applied Electromagnetism, *Teaching Assistant* — *Fall 2016, Fall 2017*
- ECE 111: Analysis & Design of Electrical Circuits, *Teaching Assistant* — *Fall 2015*
- ECE 112: Logic Circuit Design, *Teaching Assistant* — *Spring 2018*

- MTH 161: Differential Calculus, *Teaching Assistant* — *Fall 2014 - Fall 2015*
- MTH 162: Integral Calculus, Series & Sequences, *Teaching Assistant* — *Spring 2016 - Spring 2017*
- PHY 113: Mechanics, *Teaching Assistant* — *Fall 2017, Spring 2018*
- PHY 122: Electricity & Magnetism, *Lab Teaching Assistant* — *Fall 2016, Spring 2017*
- AST 105, AST 106: Introductory Astronomy, *Teaching Assistant* — *Fall 2014, Spring 2015*

Selected Publications

Vombatkere, Mousavi, Zannettou, Roesner, & Gummadi. (2024). **TikTok and the Art of Personalization: Investigating Exploration & Exploitation on Social Media Feeds**. The Web Conference 2024.

Vombatkere, Terzi, & Gionis. (2023). **Forming Coordinated Teams that Balance Task Coverage and Expert Workload**. Submitted: Springer Data Mining and Knowledge Discovery. *[preprint]*

Vombatkere, Terzi. (2023). **Balancing Task Coverage and Expert Workload in Team Formation**. SIAM International Conference on Data Mining 2023.

Kritharakis, Luo, Unnikrishnan, & Vombatkere. (2022). **Detecting Trading Trends in Streaming Financial Data using Apache Flink**. ACM International Conference on Distributed and Event-Based Systems 2022.

Vombatkere, Lyu, & Luo. (2021). **How Political is the Spread of COVID-19 in the United States?**. International Conference on Social Computing, Behavioral-Cultural Modeling and Prediction and Behavior Representation in Modeling and Simulation 2021. Springer, Cham.

Vombatkere, Li, & Duan. (2017) **Automatic Lyrics Display System for Live Music Performances**. IEEE Signal Processing Magazine 2017.

Technical Projects

Coresets for Clustering & Streaming *2021*
Python implementation of Coreset algorithms for clustering and streaming.

Settlers of Catan AI Framework *2020*
Catan boardgame built in Python with AI framework.

Ultimate TicTacToe AI *2018*
Ultimate Tic Tac Toe framework (nine 3x3 boards) built in Java implementing adversarial search using MiniMax with Alpha-Beta pruning. Developed a heuristic AI, which beat a control player in 99/100 games.

WWII Enigma Simulator *2017*
A complete implementation of the Enigma machine in Python. Object-oriented framework with full encryption and decryption functionality. Implemented known-plaintext attack methodology to crack the Enigma cipher.

Augmented Audio Reality Binaural Headphones *2017*
Designed and built binaural headphones with real-time recording and filtering capability and < 12 ms latency.

Non-linear Dynamics of Damped & Driven Pendulum *2016*
Researched the non-linear dynamics of the damped and driven pendulum. Developed a theoretical framework and computationally solved the problem using Mathematica to find regions of chaotic and non-chaotic motion.

Academic Honors and Awards

University of Rochester Merit Scholarships *[Genesee Scholarship, Dean's Scholarship]*
Awarded 100% scholarship for undergraduate tenure, and 75% scholarship for MS degree.

Tau Beta Pi Engineering Honor Society *[National Tau Beta Pi Scholarship]*
Awarded National Tau Beta Pi Scholarship for 2016-17 academic year.

Citation for Achievement in College Leadership
Awarded for demonstrating outstanding undergraduate teaching and research commitment.

Donald M. Barnard Engineering Prize
Awarded annually to one senior for high personal achievement in Electrical & Computer Engineering.

Phi Beta Kappa Honor Society

Technical Skills

Proficient: Python, SQL, Java, LaTeX, git
Familiar: Linux, MATLAB, C, TensorFlow

Extracurriculars [University of Rochester]

Club Tennis Team, *Competed at USTA TOC National Championships, Florida, 2018* — *2013 - 2018*
Men's Rowing Team, *Competed as a rower in coxed fours and eights* — *2014 - 2015*
Sigma Phi Epsilon Fraternity, *Housing Manager, 2016* — *2015 - 2017*