Karan Vombatkere

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Education

Boston University — Boston, MA
Ph.D. Computer Science — *Aug 2021 - present*
- *Interests: Algorithmic Data Mining, Social Computing, Machine Learning* [GPA: 3.87]

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 — *Aug 2021 - present*
Ph.D. Researcher — Advisor: Dr. Evimaria Terzi

Approximation algorithms for team formation
- Design approximation algorithms for NP-hard team formation problems maximizing coverage minus cost.
- Use graph neural networks to solve combinatorial optimization problems.

Max Planck Institute-SWS, Saarbrücken, Germany — *May - Aug 2022*
Research Intern — Advisor: Dr. Krishna Gummadi

Content personalization in social media feeds
- Design framework to audit user personalization on TikTok's video content recommendations.

IBM, Cambridge, MA — *Sep 2018 - Jun 2021*
Data Scientist — Supervisor: Dr. Mark Freeman

Machine learning for bid price optimization
- Designed hierarchical decision-tree and logistic regression methods for bid price optimization in Python for a B2B competitive pricing setting.
- 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*.

Natural language processing for surgical pre-authorization
- Developed an NLP 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*
Data Science Practicum — Mentor: Dr. Ajay Anand
- Identified optimal Facebook ad-campaign configurations using SQL scripts. Developed classification models in Python to predict KPIs and presented a metric-driven campaign configuration process.

Audio Information Research Lab, University of Rochester — *May - Aug 2016*
Xerox Research Fellow — Mentor: Dr. Zhiyao Duan
- Developed an automated lyric display system for live music performances in Java. Used a real-time implementation of the dynamic time warping algorithm to align annotated and live temporal sequences.

Selected Publications

Vombatkere, Lappas, & Terzi. **A QUBO Framework for Team Formation**. European Conference on Machine Learning and Principles of Knowledge Discovery in Databases 2025.

Vombatkere, Gionis, & Terzi. **Forming Coordinated Teams that Balance Task Coverage and Expert Workload**. Springer Data Mining and Knowledge Discovery 2025.

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

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

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

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

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

Teaching Experience

Boston University - *Teaching Fellow* *2022 - 2025*

- CS 132: Linear Algebra - Geometric Algorithms
- CS 131: Combinatoric Structures
- CS 565: Algorithmic Data Mining
- BU Summer Challenge Computer Science *(Instructor)*

University of Rochester - *Teaching Assistant* *2014 - 2018*

- ECE 231: Applied Electromagnetism
- ECE 111, ECE 112: Analysis of Electrical Circuits and Logic Circuit Design
- MTH 161, MTH 162: Differential and Integral Calculus
- PHY 113, PHY 122: Mechanics and Electricity & Magnetism
- AST 105, AST 106: Introductory Astronomy

Honors and Awards

Boston University Teaching Excellence Award
Awarded in 2025 by CS department for excellence and leadership as a teaching fellow.
University of Rochester Merit Scholarships *[Genesee Scholarship, Dean's Scholarship]*
Awarded full scholarship for undergraduate tenure.
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.
Tau Beta Pi Engineering Honor Society *[National Tau Beta Pi Scholarship]*
Phi Beta Kappa Honor Society

Selected Projects

Coresets for Clustering & Streaming
Python implementation of Coreset algorithms for clustering and streaming.
Settlers of Catan Framework
Full implementation of Catan boardgame with AI agents.
Ultimate TicTacToe AI
Developed a heuristic AI with adversarial search using Minimax, that beat a control player in 99% games.
Enigma Simulator
Object-oriented implementation of the WWII Enigma machine.
Augmented Audio Reality Binaural Headphones
Designed and built binaural headphones with real-time recording and filtering capability and < 12 ms latency.
Non-linear Dynamics of Damped & Driven Pendulum
Developed a theoretical framework and computationally found regions of chaotic and non-chaotic motion.
Brownian Motion Stock Price Evolution
Statistical framework in Python to predict stock price evolution using geometric Brownian motion. Tested the model to have under 5% error using Monte Carlo simulations on 2 years of historical Nike stock prices.

Technical Skills

Proficient: Python (PyTorch, NumPy, Sklearn, Pandas, Networkx), SQL, Java, LaTeX, git
Familiar: Linux, C, Matlab, AWS, TensorFlow

Extracurriculars

Boston University Club Tennis Team *2023 - Present*
Rochester Club Tennis Team, *Competed at USTA National Championships 2018* *2013 - 2018*
Rochester Men's Rowing Team, *Competed as a rower in coxed fours and eights* *2014 - 2015*
Sigma Phi Epsilon Fraternity, *Housing Manager 2016* *2015 - 2017*