Karan Vombatkere

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Education

Boston University *Aug 2021 - present*
Ph.D. Computer Science

University of Rochester *Aug 2013 - May 2018*
M.S. Data Science *May 2018*
- GPA: 3.83/4.00, *Focus in Computational & Statistical Methods*

B.S. Electrical & Computer Engineering *May 2017*
B.A. Physics *May 2017*
- GPA: 3.92/4.00, *Highest Distinction, Magna Cum Laude*

Research and Work Experience

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

Machine Learning for Optimal Bid Pricing
- As the primary code owner, developed a novel method for bid price optimization using logistic model trees in Python for a business-to-business competitive pricing setting. The method uses a hierarchical decision-tree model to segment customers based on historical non-pricing data, and then models segment-specific price sensitivities using a logistic regression framework to predict optimal line-item pricing.
- Developed a gradient ascent algorithm to solve the constrained revenue maximization problem, and integrated automated 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 to integrate with IBM Watson Annotator for Clinical Data.
- Wrote code to extract natural language concepts and contextual language features from patient clinical data for bariatric and laminectomy procedures.
- Tested and deployed NLP model framework on Amazon Web Services for *CVS Health*.

Data Pipeline Engineering for Dashboards
- Wrote SparkSQL code to perform ETL on streaming and large static datasets to support dashboards capabilities for *Apple Media Products*.
- Managed dataset metadata and created enhancements for dashboard data visualizations.

Brand Networks, Rochester, NY *Jan 2018 - May 2018*
Master's Capstone Practicum Supervisor: Dr. Ajay Anand
- Worked with 2017 Facebook ad-campaign data to help research drivers of campaign success and identify optimal ad-campaign configurations, using SQL scripts to generate campaign performance distributions.
- 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 2016 - Aug 2016*
Research Fellow (Sponsored by Xerox) Supervisor: Prof. Zhiyao Duan
- Developed an automatic lyric display system for live music performances in Java, using a real-time implementation of the dynamic time warping algorithm to align annotated and live temporal sequences, based on their harmonic similarity.
- Designed a GUI to display lyrics in real time, and successfully tested the system on several soundtracks using a multi-threaded framework for live audio recording and processing.

Tata Institute of Fundamental Research, Mumbai *Jul 2014 - Aug 2014*
Research Intern Supervisor: Dr. Ravi Venkatramani
- Investigated conformation changes and molecular dynamics in the photoisomerization cycle of Bacteriorhodopsin using NAMD simulation software, and presented findings to research group.

Teaching Experience

University of Rochester Department of Electrical & Computer Engineering

- ECE 231: Applied Electromagnetism, *Head 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*

University of Rochester Department of Mathematics

- MTH 161: Differential Calculus, *Teaching Assistant* — *Fall 2014 - Fall 2015*
- MTH 162: Integral Calculus, Series & Sequences, *Teaching Assistant* — *Spring 2016 - Spring 2017*

University of Rochester Department of Physics & Astronomy

- PHY 113: Mechanics, *Teaching Assistant* — *Fall 2017, Spring 2018*
- PHY 122: Electricity & Magnetism, *Lab Teaching Assistant* — *Fall 2016, Spring 2017*
- AST 105 - 106: Introductory Astronomy, *Head Teaching Assistant* — *Fall 2014, Spring 2015*

Technical Projects

Settlers of Catan AI Framework *2020*
Catan boardgame built in Python. AI framework built using reinforcement learning with Tensorflow.

Ultimate TicTacToe AI *2018*
Ultimate Tic Tac Toe framework (9 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.

Tennis Player Performance Prediction *2017*
Predicted professional tennis player performance with 80% accuracy using aggregated statistical features from historical match data, and neural network and logistic regression models in Python.

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.

Brownian Motion Stock Price Evolution *2016*
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.

Papers

Karan Vombatkere, Hanjia Lyu, Jiebo Luo. **How Political is the Spread of COVID-19 in the United States? An Analysis using Transportation and Weather Data**. *Submitted to AAAI 2021.*

Karan Vombatkere, Bochen Li, Zhiyao Duan. **Automatic Lyrics Display System for Live Music Performances**. *IEEE Signal Processing Magazine, January 2017.*

Academic Honors and Awards

University of Rochester Merit Scholarships *[Dean's Scholarship, Genesee Scholarship]*
Awarded 100% ($220,000) scholarship for undergraduate tenure, and 75% ($42,000) scholarship for MS degree.

Tau Beta Pi Engineering Honor Society *[National Tau Beta Pi Scholarship]*
Awarded $2,000 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

Programming Languages: Python, Java, C/C++, SQL, MATLAB
Tools: NumPy, Pandas, Scikit-learn, TensorFlow, PyTorch, LaTeX, git

Extracurriculars [University of Rochester]

Club Tennis Team, *Competed at USTA TOC National Championship, 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*

Relevant Coursework

Artificial Intelligence (graduate level)
Data Mining (graduate level)
Data Science II: Complexity & Network Theory (graduate level)
Statistical Learning (graduate level)
Database Systems (graduate level)
Cryptography (graduate level)
Game Theory
Computational Physics
Statistical Mechanics
Classical Mechanics
Robot Control
Data Structures & Algorithms
Signals & Systems
Linear Algebra & Differential Equations
Multivariate Calculus