

VAIBHAV KUMAR

Research Assistant, IITM \diamond Associate Data Scientist, UnitedHealth Group

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EDUCATION

Master of Science in Computer Science

2021 - 2023

University of California, Los Angeles

Bachelor of Technology in Computer Science

2016 - 2020

Delhi Technological University, Delhi, GPA: 8.25/10

RESEARCH EXPERIENCE

Research Assistant – Gender Bias Benchmark Tests

August'20 - January'21

Indian Institute of Technology, Madras, Guide: Dr. Mitesh and Dr. Pratyush

Madras, India (WFH ¹)

- Exploring the interpretability and gender-based reasoning ability of language models like BERT.
- Utilizing socially and psychologically grounded templates to expose gender bias in fine tuned models.
- Employing ideas from the latest developments in the intersecting fields of NLP and software engineering to create checklist based test cases to summarize stereotypes.

Summer School – Eastern European Machine Learning (EEML)

1 July'20 - 9 July'20

EEML (Virtual)

Krakow, Poland

- Accepted for the **EEML** summer school after getting shortlisted for the poster presentation of a short paper.
- Poster presentation on **Gender Bias in Hyperbolic Word Embeddings** which extends our earlier work of bias in Euclidean vector space to the hyperbolic space.
- Proposed and presented the idea of black box optimization using Bayesian Deep Reinforcement Learning with an international team of seven students for the EEML unconference session.

Research Assistant – Hyperbolic Word Embedding Specialization

Jun'20 - August'20

LCS2 Lab, IIITD, Guide: Dr. Tanmoy Chakraborty

IIITD, Delhi

- Studied the Gyrovector Space as a Hyperbolic analogue to the Euclidean vector space.
- Proposed a new generalized metric and debiasing objective for bias in Poincaré-GloVe.
- Submitted a related paper to the NAACL 2021 conference.

Research Assistant – Mitigating gender bias in Word Embeddings

Sep'19 - Jun'20

LCS2 Lab, IIITD, Guide: Dr. Tanmoy Chakraborty

IIITD, Delhi

- Created a Gender Based Illicit Proximity Estimate (GIPE) to quantify gender proximity-based bias in word embeddings and a multi-objective function to mitigate it.
- Achieved state-of-the-art results in minimizing gender bias while introducing minimal semantic offset.
- Contributed as the first author of a full paper accepted at the prestigious **TACL journal** and open-sourced all the related code ² and data with reproducibility guidelines on GitHub.

Research Intern – Predictably Securing Network Systems Through Sequence Modelling and Reinforcement Learning

Jun'19 - Nov'19

Guide: Dr. Arun Balaji Buduru

IIITD, Delhi

- Developed a novel attention based network called “AnomalyNet” to predict DDoS attacks in network systems.
- Trained the network over a class-imbalanced data using an Imbalanced classification Markov decision process (ICMDP) based approach and attained competitive results over the CTU-13 dataset.

¹Work From Home

²<https://github.com/TimeTraveller-San/RAN-Debias/>

WORK EXPERIENCE

Associate Data Scientist

Optum (UnitedHealthGroup)

August'20 - July'21

Bangalore, India (WFH)

- Working with the natural language processing team for intent mining and test-case generation.
- Utilized graph-based natural language processing techniques to generate new test cases for software testing.
- Creating interpretable NLP based models and techniques for real-time intent classification and prediction over the UnitedHealthcare customer care chat.

PUBLICATIONS

[Nurse is Closer to Woman than Surgeon? Mitigating Gender-Biased Proximities in Word Embeddings](#)

Vaibhav Kumar, Tenzin Singhay Bhotia, Vaibhav Kumar, Tanmoy Chakraborty - Published in the Transactions of the Association for Computational Linguistics (**TACL**), Volume 8, 2020 p.486-503.

[Fair Embedding Engine: A Library for Analyzing and Mitigating Gender Bias in Word Embeddings](#)

Vaibhav Kumar, Tenzin Singhay Bhotia, Vaibhav Kumar - Accepted at the 2nd Workshop for Natural Language Processing Open Source Software at Empirical Methods in Natural Language Processing (**NLP-OSS, EMNLP**), 2020.

[Multiple Resource Management and Burst Time Prediction using Deep Reinforcement Learning](#)

Vaibhav Kumar, Siddhant Bhambri, Prashant Giridhar Shambhakar - Published in the International Journal of Advanced Computer Science and Applications (**IJACSA**), January, 2019.

ACHIEVEMENTS

Generative Dog Images

Silver Medal

Aug'19

Kaggle

- Won a second silver medal and became a kaggle competitions expert by implementing C-GAN architecture with the Wasserstein GAN loss function for dog image generation.
- Achieved a public MiFID score of 47.02.

Santander Customer Transaction Prediction

Silver Medal

Apr'19

Kaggle

- Won my first silver medal on Kaggle by doing a predictive analysis of transactions by the Santander customers.
- Achieved a public AUC-ROC score of 0.91

PROJECTS AND OPEN SOURCE CODE

[Fair Embedding Engine](#)

- Fair Embedding Engine: A Library for Analyzing and Mitigating Gender Bias in Word Embeddings.
- FEE will facilitate the development and testing of debiasing methods for word embeddings models and also make it easier visualize the bias present in word vectors, demonstrating their possible impact.

[Food Waste Prevention](#)

- Multi-Agent RL for dynamic pricing of food to save wastage while maximizing profit.
- Carefully crafted an OpenAI gym compatible environment for food waste prevention by considering various economic theories and implications.

[Fair-GAN](#)

- A generative adversarial network based approach to mitigate gender bias in word embeddings.
- The generator generates 300 dimensional word embeddings using the existing ones and learns through the discriminator that identifies the gender of the corresponding word correctly.

- Fair-GAN was able to drastically reduce the direct bias in the GloVe 300D embedding while introducing minimal semantic offset.

Epidemic Spread Mapper

- A real-time epidemic mapping system which can work on the basis of trustworthy crowdsourced data.
- Created tree-based and neural network models for utilizing the past temporal and spatial data to predict future epidemic spreads.

yTermPlayer

- A minimal, terminal based YouTube playlist streaming program written in python.
- Published on PyPI with more than 13,000 total downloads (pip install ytermplayer).

Turing Machine Simulator

- Implemented a Turing machine simulator in the Python programming language.
- Used Matplotlib's pyplot to create real-time animation for the running tape of the Deterministic Turing Machine.

TECHNICAL SKILLS

Programming Languages: Fluent in Python, C++, Solidity; Familiar with JavaScript, Java, Bash and Prolog.

Libraries: pyTorch, Jax, Haiku, Fastai, OpenAI Gym, Pandas, Scikit-Learn, Numpy.

Software Skills: Git, \LaTeX .

Development: Docker, Kubernetes, Flask, SQLite, jQuery, HTML, CSS.

POSITIONS OF RESPONSIBILITY

Graphic Designer

Coding Blocks

Sept'18 - Feb'19

Delhi

- Edited more than 200 online lectures for Coding Blocks India in Adobe After Effects and Premiere Pro.
- Created graphics for the Coding Blocks YouTube channel and managed their online video lecture portal.

Graphic Designing Head

Team Engifest

Sept'16 - Sep'18

DTU, Delhi

- Managed the online presence of the biggest fest in north India – Engifest, Delhi Technological University (DTU).
- Created various advertisements, sponsor posters and promotional videos for the fest.

EXTRACURRICULARS

Technical Blogging

- [Mathematical Analysis of Reinforcement Learning — Bellman Optimality Equation](#)
- [PyTorch 1.3 — What's new?](#)
- [Reinforcement learning: Temporal-Difference, SARSA, Q-Learning](#) [Expected SARSA in python](#)
- [PyTorch Autograd](#)
- [Random forests and decision trees from scratch in python](#)
- [Deploy Machine Learning Models for Free](#)