Shikhar Jaiswal

Research Fellow, Algorithms Group
Microsoft Research India (Jun '20 - Present)
Mentors: Dr. Harsha Simhadri & Dr. Ravishankar Krishnaswamy

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Education

Indian Institute of Technology Patna — *India*
Bachelor of Technology, Computer Science and Engineering — *July '16 - May '20*
GPA: 8.66/10 (Overall) **9.07/10** (CS)

Research Interests

Primary: Machine Learning for Systems and Systems for Machine Learning
Others: Information Retrieval, Algorithms and Applied Mathematics

Publications

OOD-DiskANN: Efficient and Scalable Graph ANNS for Out-of-Distribution Queries
Shikhar Jaiswal, Ravishankar Krishnaswamy, Ankit Garg, Harsha Simhadri & Sheshansh Agrawal
Under Review at *The ACM Web Conference (**WWW**), 2023.* [🔗]

MinUn: Accurate ML Inference on Microcontrollers
Shikhar Jaiswal*, Rahul Kranti Kiran Goli*, Aayan Kumar, Vivek Seshadri & Rahul Sharma
Under Review at *Sixth Conference on Machine Learning and Systems (**MLSys**), 2023.* [🔗]

Acting Engaged: Leveraging Play Persona Archetypes for Semi-Supervised Classification of Engagement
Benjamin D. Nye*, Mark G. Core*, **Shikhar Jaiswal***, Aviroop Ghosal & Daniel Auerbach
In *Proceedings of the 14th International Conference on Educational Data Mining (**EDM**), 2021.* [🔗]
(*) Denotes equal contribution.

Workshop / Symposium Presentations

Integrating an Engagement Classification Pipeline into a GIFT Cybersecurity Module
Benjamin D. Nye, Mark G. Core, Daniel Auerbach, Aviroop Ghosal, **Shikhar Jaiswal** & Milton Rosenberg
In *Proceedings of the Eighth Annual GIFT Users Symposium (**GIFTSym8**), 2020, (pages 49-57)* [🔗]

Research Experience

Billion-Scale Graph ANNS for Out-of-Distribution Queries [</>]
Advisors: Dr. Ravishankar Krishnaswamy & Dr. Harsha Simhadri — *Jan '21 - October '22,* ***Microsoft Research***

Developed RobustVamana, a graph-based Approximate Nearest Neighbor Search (ANNS) algorithm suitable for billion-scale text-to-image embedding retrieval, and Accurate PQ (APQ), a novel product quantization algorithm for fast and accurate distance computations. The resulting system, OOD-DiskANN, offers upto 40% latency improvement over the previous state-of-the-art at billion-scale. Parts of this work are deployed across various Microsoft Bing verticals.

► **In submission to WWW '23**

Accurate ML Inference on Resource-Constrained Devices [M] [📄] [</>]
Advisors: Dr. Prateek Jain, Dr. Harsha Simhadri & Dr. Rahul Sharma — *June '20 - Nov '21,* ***Microsoft Research***

Developed an efficient bit-width demotion heuristic named Haunter, and co-designed the MinUn compiler around it. MinUn generates accurate ML models under a strict RAM budget, while being agnostic of the number representation (fixed-point/floating-point/posit). When used with posits, MinUn generates TinyML models with upto 5.1× lower RAM consumption and negligible loss in accuracy/mAP scores, compared to 32-bit floating point models.

► **In submission to MLSys '23**

SMART-E: Service for Measurement and Adaptation to Real-Time Engagement [P] [🎥]
Advisor: Dr. Benjamin D. Nye — *Summer '19,* ***USC - Institute for Creative Technologies***

Built an active-learning based algorithmic pipeline for detecting user engagement with interactive tutoring systems. Applied feature engineering to develop a set of generalizable engagement metrics, tackling cold start and automated annotation problems using easy-to-obtain play-persona data. Analysis demonstrates the utility of play-persona data gathered during professional or quality assurance testing for training useful data mining algorithms.

► **Published as a full paper at EDM '21**

Thesis

Passenger Demand Prediction using Graph Convolutional Networks [📄]

Advisor: Dr. Joydeep Chandra — *Thesis Project,* ***IIT Patna***

Worked on improving the empirical performance of an the existing Grid-Embedding-based passenger demand prediction model by introducing architectural changes and spectral filtering techniques. Improved model showed marked decrease in RMSE scores on the New York GreenTaxi Trip dataset for 2014.

Software

DiskANN: Fast Accurate Billion-point Nearest Neighbor Search [GitHub]

Devvrit, Philip Adams, Andrija Antonijevic, Deng Cai, Ningyuan Chen, Magdalen Dobson, Jerry Gao, **Shikhar Jaiswal**, Rohan Kadekodi, Ravishankar Krishnaswamy, Huisheng Liu, Jigao Luo, Dax Pryce, Harsha V. Simhadri and Suhas J. Subramanya ★ >250 ⑂ >80

EdgeML: Machine Learning for Resource-Constrained Edge Devices [GitHub]

Don K. Dennis, Yash Gaurkar, Sridhar Gopinath, Sachin Goyal, Chirag Gupta, Moksh Jain, **Shikhar Jaiswal**, Ashish Kumar, Aditya Kusupati, Chris Lovett, Shishir G. Patil, Oindrila Saha and Harsha V. Simhadri
★ >1,400 ⑂ >350

Open Source Contributions

Implementing Essential Deep Learning Modules [GitHub]

Mentor: Marcus Edel — ***Google Summer of Code 2018***

Deployed implementations of Generative Adversarial Networks (GAN, Deep Convolutional GAN, Wasserstein GAN and Cycle GAN) and Restricted Boltzmann Machines (RBM and Spike and Slab RBM), achieving ~1.57x single core aggregate speeds over *Sklearn*'s and *Tensorflow*'s implementations. ★ >4,100 ⑂ >1,400

Improving SymEngine's Python Wrappers and SymPy-SymEngine Integration [GitHub]

Mentors: Isuru Fernando & Sumith Kulal — ***Google Summer of Code 2017***

Improved the overall infrastructure of *SymEngine*, an efficient, standalone C++ Computer Algebra System (CAS), and refactored its Python wrapper *SymEngine.py*. Further introduced SymEngine as an optional core for *SymPy*, and *PyDy*, a multi-body dynamics tool-kit for speeding up their backend computations by the order of ~70x. ★ >900 ⑂ >250

Industrial Experience

Software Development Intern - HackerRank [🌐]

Manager: Harishankaran Karunanidhi, Co-Founder and CTO — *Summer '18,* ***Bangalore***

Open Mainframe Project Intern - The Linux Foundation [🌐]

Mentor: Wolfgang Engel, SUSE Linux GmbH — *Summer '18,* ***Remote***

Honours & Achievements

- Achieved *98.71%* percentile in JEE Advanced (previously IIT-JEE) 2016 among 200,000 candidates
- Achieved *99.54%* percentile in JEE Main (previously AIEEE) 2016 among 1,200,000 candidates
- Achieved *99.13%* percentile in National Entrance Screening Test (NEST) 2016 among 40,000 candidates
- Recipient of the Kishore Vaigyanik Protsahan Yojana Scholarship in 2016 (*top 1400* students out of 100,000)
- Recipient of CBSE Award for Community Service - Human Rights and Social Equality 2013

References (available on request)

Dr. Harsha Simhadri
Principal Researcher
Microsoft Research India

Prof. Ravishankar Krishnaswamy
Principal Researcher
Microsoft Research India

Dr. Rahul Sharma
Principal Researcher
Microsoft Research India

Dr. Prateek Jain
Senior Staff Research Scientist
Google Research India

Dr. Ankit Garg
Senior Researcher
Microsoft Research India