Bhuvanesh Murali

Education

University of Virginia **Aug. 2016 - May. 2019**
Bachelor of Science in Computer Science & Bachelor of Arts in Mathematics, 3.98 GPA (out of 4) *Charlottesville, VA*

- **Awards:** Rodman Scholar, Dean's List, Raven Society Finalist, Graduated Summa Cum Laude, Intermediate Honors
- **Minor(s):** Business, Physics[1], Economics[1]

Thomas Jefferson High School for Science and Technology **Aug. 2012 - Jun. 2016**
Advanced Studies Jefferson Diploma, 4.52 GPA (out of 4) *Alexandria, VA*

Work Experience

Amazon.com **New York, NY and Seattle, WA**
Machine Learning Research Engineer II, Research and Development - Generative AI *Apr. 2021 - Present*

- Led by Dr. Larry Davis (– Dec. 2022) and advised by Dr. Michael Black (– Dec. 2021)
- *Research and development team applying deep learning techniques to generate imagery.*
- Architected and implemented an automation service to expedite training data processing, eliminating costly manual intervention steps. Systems have successfully processed 300+ MM images into training data buckets for generative models.
- Developed heuristic-based filters and classifiers to label data using traditional computer vision techniques. Optimized process in partnership with research scientists by training a series of Resnet-based ML classifiers which showcased higher precision/recall (+10%) than the heuristic-based algorithms.
- Collaborated w/ scientists to implement a U-Net model to smooth image boundaries by removing aliasing artifacts from an image. Processed over 2+ MM images since deployment.
- Supported general development of generative adversarial networks (GANs), latent diffusion models (LDMs), stable diffusion models (SD), semantic segmentation models (e.g., Grapy, ISNet), alignment models, pose estimation (e.g., MMPOSE, DensePose, MMCV), etc. used to support generative imagery and videos. Utilized PyTorch, Horovod, and MLFlow to create model training framework.
- Developed a batch processing system capable of scaling ad infinitum to process data. This tool is used for curating training data, exploring capabilities of newly trained models, running production engineering workflows, etc.

Software Development Engineer I & II, Amazon Currency Converter & Consumer Payments *Aug. 2019 - Apr. 2021*

- *First-party foreign-exchange (FX) platform handling cross-currency transactions for both buyers and sellers, processing* $100B$ *dollars in revenue annually.*
- Migrated the central foreign-exchange rates accounting from monolithic, on-premise service to cloud-hosted (AWS), serverless architecture.
- Supported re-architecture of the core FX rate-pulling service maintaining support for 100+ TPS.
- Led and implemented a reusable solution for collecting and reporting VAT taxes for FX disbursements to specific locales (e.g., KSA, Turkey, Sweden, Poland). Supported over 1,000 merchants and $30 MM in revenue within a few weeks of launch.
- Architected support for faster seller disbursements and multi-account disbursements with banking partners for Seller Wallet.
- Collaborated on a machine-learning-backed advertisement optimization engine with $10,000$+ TPS contributing to nearly a billion dollars of annual value.

Amazon.com **Seattle, WA**
Software Development Intern, Amazon Currency Converter *May 2018 - Aug. 2018*

- Designed and developed a full-stack internal tool to support FX-rate configuration changes and monitoring for use by the product and engineering

MITRE - National Cybersecurity Center of Excellence **Rockville, MD and McLean, VA**
Applied Cybersecurity Intern *May 2017 - Aug. 2017*

- Developed an e-commerce website to support multi-factor authentication (i.e., FIDO U2F tokens) to define NIST SP1800-17

Ntrepid Corporation **Herndon, VA**
Passages Product Development Intern *Jun. 2015 - Aug. 2015 & Jun. 2016 - Aug. 2016*

- Improved virus detection accuracy using probabilistic and machine learning analytic models.

Research Experience

Amazon.com, Research & Development - Generative AI **Apr. 2021 - Present**

- Advised by Dr. Larry Davis (– Dec. 2022) and Dr. Michael Black (– Dec. 2021)
- **Stable Diffusion:** Collaborated with Dr. Ali Jahanian and Dr. Betty Mohler-Tesch to fine-tune SD 2.1 enabling users to describe "contextualized" backgrounds complimenting foreground image.
- **Latent Diffusion:** Collaborated w/ scientists to identify opportunities where LDMs outperform GANs (see below).
- **Generative Adversarial Networks** Added conditional inputs and local discriminators to StyleGAN2 architecture to convert pixels into digital people as part of the primary charter for the team (see above).
- See Work Experience for additional details.

Law + CS: Legally Compliant Fairness Algorithms **Dec. 2020 - (Paused)**

- Advised by Dr. David Evans and guided by Thomas Nachbar, J.D. for a self-study project.

[1] Completed, not awarded

- Explored treating fairness in artificial intelligence algorithms as an invariant in order to better understand how to handle bias in deep learning models.
- Short-term goal included publishing a Systemization of Knowledge (SoK) paper and propose an evaluation matrix for algorithmic bias. Long-term goal is to define an algorithm/training paradigm that does not violate Constitutional law and treats "fairness" as an invariant rather than an optimizable parameter.

Robustness of the Perceptron Algorithm to Adversarial Perturbations **Aug. 2018 - May 2019**

- Advised by Dr. Mohammad Mahmoody at the University of Virginia in Charlottesville, VA
- Approached adversarial machine learning from fundamental principles in a theoretical and empirical study of linear separators in higher dimensions.
- Compared theoretical bounds to empirical results. Experiment used a Gaussian Multinomial Distribution with $\sigma = 1, \mu = 0$ in 100-dimensional space. Empirical results matched the theoretical upper bound of 0.8 for the magnitude of the perturbation.

Exploration of Retraining for Action Recognition Tasks **Jan. 2019 - May 2019**

- Advised by Dr. Vicente-Ordonez Roman at the University of Virginia in Charlottesville, VA
- Goal of project was to automatically recognize the action in a video and generate a description of what is occurring in the video.
- Adopted a pre-trained Resnet-18 and modifies the final fully-connected layer to match the expected number of categories. Re-trained the model using the data from the UCF101 dataset and achieved accuracies of 92.11%, 82.34%, and 79.31% for 10, 25, and 50 categories of UCF101, respectively.

Security Research Group at University of Virginia **Dec. 2016 - May 2019**

- Led by Dr. David Evans at the University of Virginia in Charlottesville, VA
- Worked on `minimalTLS`: a minimal implementation of TLS 1.3 in Rust. Implementation supported the least possible set of server features and cipher suites meeting a goal of supporting 95% of browser clients. Objective was to minimize security vulnerabilities and attacks by decreasing quantity of potentially exploitable code.

Image Classification: Using Convolutional Neural Networks to Identify Images **Aug. 2015 - Jun. 2016**

- Advised by Dr. Shane Torbert and Dr. Csaba Peter Gabor at the Thomas Jefferson High School for Science and Technology in Alexandria, VA
- Project focused on taking the learnings from the success of the MNIST digit recognition tasks and applying those techniques to a more nuanced image recognition task.
- Presented results at the tjSTAR symposium.

Projects

Publication of *The Woman Seeker* **October 2023**

- Worked with Chinmaya Mission International on the publication of *The Woman Seeker* book.

Machine Learning Self-Study **2021 - Present**

- Self-exploration of literature and books including: *Introduction to Statistical Learning*, *Elements of Statistical Learning*, *Deep Learning*, and *Understanding Machine Learning: From Theory to Algorithms*

Activities & Service

Chinmaya Mission New York
Chinmaya Yuva Kendra Lead; Marketing & Outreach Coordinator *2022 - Present*

Teaching Assistant at University of Virginia
Department of Computer Science *2017 - 2019*

Learning Pathways Project
Program Officer *2014 - 2018*

Codeducate
Director *2014 - 2016*

Technical Skills

Languages: Java, Python, C/C++, JS/TS
Technologies/Frameworks: React.js, PyTorch
Foreign Languages: English (Fluent), Tamil (Fluent), Latin (Proficient), Hindi (Elementary), Spanish (Elementary)