Adi Banerjee

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Education

University of Arizona *2019-2023*
Bachelor of Science, Computer Science | Minor: Data Science and Statistics GPA: 4.0

- Upper Divison Coursework: Algorithms, Databases, Automata, Compilers, Linear Models, Machine Learning, Computer Vision
- Academic Awards: Summa Cum Laude, 4x Highest Academic Distinction, $120000 Merit Scholarship
- Research Awards: Excellence In Undergrad Research, 2x Galileo Circle Scholar

Publications

Published, University of Arizona

- Pyarelal, A., **Banerjee, A.**, Barnard, K. (2022). Modular Procedural Generation for Voxel Maps. In: Gurney, N., Sukthankar, G. (eds) Computational Theory of Mind for Human Machine Teams. AAAIFSS 2021. Lecture Notes in Computer Science, vol 13775. https://doi.org/10.1007/978-3-031-21671-8_6.

Ongoing Research, University of Arizona

- Developing a transformer-based OCR model to read mathematical expressions from images and convert them into grammatically correct LaTeX. The model is trained using a hybrid two-stage learning approach: transfer learning followed by reinforcement learning. A key challenge in building this model is ensuring grammatically correct LaTeX output using an ad-hoc abstract syntax tree to represent loss for a context-sensitive, Turing-complete language like LaTeX, which lacks a standard Backus-Naur Form (BNF).

Presentations

Galileo Circle Awards, University of Arizona *2021*

- Presented a procedural generator I designed and implemented for the ToMCAT (Theory of Mind-based Cognitive Architecture for Teams) highlighting the reasons for using a flexible axis-aligned bounding box approach to modularization, which allows for more intuitive customizations during map generation.

Experience

Amazon, Software Development Engineer *January 2024 - Present*

- Delivered 4 minor and 2 major projects over 5 months leading to SDE-2 promotion recommendation 5 months after start.
- Presented transport network optimization analysis and designed workflow affecting 230MM+ configs as tech lead across 3 teams.
- Designed email service in AWS and Spring driving 1000 emails/min from 5+ teams to global vendors and other partner teams.

University of Arizona, Research Engineer *July 2023 - January 2024*

- Designed deep RL transformer math OCR models, achieving a 6% increase over SOTA using PyTorch, and Stable Baseline.
- Overhauled MathML parser with Nom in Rust improving traceability for 30% of tag syntax errors during AST generation.

University of Arizona, Undergraduate Research Assistant *September 2019 - May 2023*

- Designed modular procedural generation framework in C++ for emulating RL environments, and 2nd authored AAAI paper.
- Sole recipient of the Research Excellence Award for Computer Science and 1 of 4 recipients of the Galileo Circle Award, twice.

Amazon, Software Development Engineer Intern *May 2022 - August 2022*

- Designed a React in TypeScript full-stack internal tool and deployed to CloudFront with proxy-based authentication for securely monitoring millions of purchase orders globally, enhancing operational transparency across 2 Amazon orgs.
- Automated non-relational to relational data transformation pipeline with AWS CDK, DynamoDB, Kinesis Datastream, Kinesis Firehose, Lambda, S3, Glue, Athena, and IAM, achieving a 98% improvement in data availability.

Tech Core, Lead Software Developer *February 2021 - May 2022*

- Led web and AR/VR projects using NodeJS and .NET for 10+ clients across 6+ university departments and startups.
- Optimized SQL queries and JS through code profiling, improving web app load times by 80.51% across 3 services.

Awards

Galileo Circle | *2021-2023*

- $1000 scholarships awarded to undergraduate and graduate students who demonstrate exceptional potential in the physical, mathematical, environmental, cognitive, or life sciences.

Academic Merit Scholarship | *2019-2023*

- A competitive undergraduate tuition scholarship offered annually to a select number of international students attending Arizona. $120,000 received in tuition scholarship.

Summa Cum Laude | *2023*

- Awarded to students graduating with a GPA of 4.0 over 4 years.

Highest Academic Distinction | *2019-2023*

- 4-time recipient from 2019-2023. Awarded to students maintaining a 4.0 GPA for an academic year.

Excellence in Undergraduate Research | *2023*

- Awarded to one student in a department for significant contribution, originality, creativity, and independence in research.

Dean's List With Distinction | *2019-2023*

- 8-time recipient from 2019-2023. Awarded to students maintaining a 4.0 GPA for an academic year.

Projects

Host Management System | *Python, Apache, AWS Boto*

* Architected an EC2 host management system leveraging cryptographic techniques for secure user authentication and session management. Implemented features encompassing host monitoring, dynamic fleet scaling, and controlled termination, employing encryption protocols to safeguard against potential man-in-the-middle attacks.

TaylorGPT | *PyTorch, Lightning, Numpy*

* Designed a 1.4 million parameter character-level transformer decoder model to Taylor Swift lyrics from scratch using PyTorch including custom implementations for masking, multi-head attention, and transformer blocks along with model profiling, logging, and multi-GPU training.

Tau Compiler | *Python, PyTest*

* Developed an LL1 Recursive Descent compiler for Tau, comprising of a lexer, parser, decorator, and generator including syntax analysis, scoping, type checking, optimization, and memory management.

Cat(G)AN | *Python, TensorFlow, Keras, Matplotlib*

* Implemented a Generative Adversarial Network (GAN) with 3.5 million parameters from scratch in NumPy, TensorFlow, and Keras to generate cat images.

Start Journey | *Python, PyTorch, HuggingFace, CUDA*

* Designed a full-stack stable diffusion-based image generator with PyTorch, CUDA, HuggingFace, and FastAPI for the backend and React in TypeScript for the front end.

ResumeGPT | *Python, PyTorch, Streamlit, ChromaDB*

* Designed and deployed a Streamlit application with LangChain, ChatOpenAI, and ChromaDB that uses LLMs to answer questions about me including customized underlying vector DB logic.

Signature | *Python, OpenCV, Pillow, Matplotlib*

* Designed a multi-platform desktop application that lets you create an e-signature from a photograph with custom implementations for image recognition logic that combined normalization and thresholding approaches to extract signatures.

AI-PlaysSnake | *Python, NEAT, PyGame*

* Implemented the game Snake and a genetic neuro-evolving reinforcement learning model to beat it including implementations for the underlying physics engine and graphics for the game.

Outreach and Extracurriculars

Google Developers Student Club, Chapter Founder and President *2020-2021*

* Led a team of 6 to organize 30+ workshops in Web Dev, Machine Learning, and Career Building for 180+ members.
* Partnered with 50+ GDSC chapters worldwide fostering innovation and increasing overall CS club engagement by 132%.

MLH: Hack Georgia Tech, Mentor *2020*

* Invited to mentor hacker teams at Hack Georgia Tech Hackathon with 2500+ attendees.

MLH: Hack Arizona, Winner *2020*

* Received Amazon's Most Impactful Use of Data-Driven Technology at Hack Arizona among 200+ contestants and 50+ teams for developing a machine learning model for detecting distracted drivers with AWS Sagemaker.

MLH: To the Moon and Hack, Winner *2020*

* Received In-Flight Anomaly prize among 330+ contestants for Project Space Station: a spin-off Space Invaders, and an AI trained via neuroevolving genetic reinforcement learning methods to beat it.

University of Arizona Residence Hall Association, Council Member *2019-2020*

* Promoted sustainability practices and awareness across dorms and campus related to various social, environmental, and medical issues for which I received two RHA Person of the Week nominations.
* Organized and voted on various dorm and RHA programs, events, budgets, and issues.

Blue Chip Leadership, Volunteer *2019-2020*

* Participated in community service projects with local AIDS organizations like SAAF (Southern Arizona Aids Foundation) and sustainability organizations like Tucson Trees Please.

Google Developer Challenge, Winner *2019*

* Received 2nd place award for solving algorithm problems at Google Tech Challenge among 50+ contestants.