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Dhruba Jyoti Paul

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Work Experience

Machine Learning Engineer **ALL3D** **Sept 2024 - Present**

- Boosted inference speed 3x via SVDQuant quantization, compilation, and GPU memory snapshotting for reduced cold starts
- Architected in-painting pipelines using ControlNet, IP-Adapters, and LoRAs for high-fidelity product insertion
- Optimized mesh alignment via Robust ICP variants to minimize Chamfer distance between synthetic and ground-truth meshes.
- Designed Fibonacci-Sphere-like geometries to enhance synthetic data generation for training stable video diffusion models
- Implemented differential rendering with HDR environment maps (DiffusionLight) to automate realistic scene relighting
- Applied differential diffusion and DFT frequency transfer to preserve fine image details during multiple neural edits
- Deployed prompt-based segmentation tools (Florence, SAM) and solved depth-of-field artifacts via Sobel edge expansion

NLU Research Assistant **University of Wisconsin-Madison** **Oct 2023 - Sept 2024**

- Utilized various NLP techniques to generalize a process to optimize prompts, improving results by 10% on synthetic datasets
- Extracted and conducted static analysis on about 60.7% of the open-source API-based LLM usage on GitHub
- Categorized clusters of developer prompts in PromptSet, generated through t-SNE and K-Means of the prompt embeddings
- Explored prompt detection strategies like testing heuristics with Tree-sitter and fine-tuning flair NLP framework for text classification
- Proposed static analysis methods to improve prompt quality and reliability within software development pipeline

Software Architect **4P Marketing Consultancy** **Jan 2024 - Apr 2024**

- Designed a data pipeline using geofencing and FaceNet facilitated facial detection with a Flask server and an Android app
- Enhanced data security via Fourier transformations for pixel pattern detection in digital data and AES encryption
- Automated data entry using Google Vision OCR and NER models, enhanced by Levenshtein distance-based heuristics

Software Engineer **MYLO** **Oct 2023 - Dec 2023**

- Developed mobile and web apps. Collaborated with designers to iterate on design and implementation
- Identified and resolved performance and scalability issues by architecting modular systems and abstractions
- Contributed to the company's overall success, including directly participating in the resolution of issues or concerns that arose in other departments, as necessary or prioritized by MYLO's management or executives.

Virtual Private Tutor **Self-Employed** **Oct 2020 - Dec 2021**

- Provided virtual tutoring for two high school students in Mathematics and Computer Science fundamentals
- Devised personalized study plans and assisted with homework during a year of COVID quarantine.
- Accelerated student progress by an entire grade level through active engagement on Khan Academy
- Developed a Python-based command-line app to scrape student work from IXL and generate progress reports

Teaching Assistant **American International School Dhaka** **Sept 2018 - Jun 2019**

- Graded Physics test papers and homework assignments, providing constructive feedback to students, and conducted additional tutoring sessions to explain difficult concepts to students outside the classroom
- Assisted the Lab Manager in maintaining and managing lab equipment
- Collaborated with the High School Physics Teacher in organizing lesson plans and educational material

Journalist Intern **Dhaka Tribune** **Jun 2018 - Jul 2018**

- Authored and revised news articles tailored towards teenagers, translated articles from Bangla to English
- Edited extensive video footage into concise news reports and documentaries, and received mentorship in photography

Education

Madison, WI **University of Wisconsin-Madison** **Sept 2020 - Aug 2023**

- **Bachelor of Science** in Computer Science and Data Science with a CGPA of 3.94/4.00 (Dean's List, Distinction in Major)
- Inducted into **PBK Honor Society**; invited by Dean of College of Letters and Science, recognizing top 0.4% of undergraduates.

Dhaka, Bangladesh **American International School Dhaka** **Sept 2016 - Jun 2020**

- Completed the **International Baccalaureate** (IB) Program, Graduated with Honors, Inducted into the National Honor Society
- **Vice President** of High School Executive Student Council, **Founder** of the AISD Robotics Club, Math Club Lead

Dhaka, Bangladesh **Chhayanaut** **Apr 2010 - Mar 2019**

- Studied and practiced **Bengali Folk**, **Classical**, and **Tagore** music. Participated in stage performances for cultural events.
- Bengali Musical Notation, Musical History, Musical Improvisation, and the **Esraj**

PUBLICATION

Rzig, D.E., **Paul, D.J.**, Pister, K., Henkel, J., Hassan, F. (2024). *Developer Prompts in Practice: An Empirical Study of Bias, Security, and Optimization.* ESEM '25
Pister, K., **Paul, D.J.**, Brophy, P., Joshi, I. (2024). *PromptSet: A Programmer's Prompting Dataset*. ICSE '24

VOLUNTEER EXPERIENCE

Project Organizer, Presenter **University of Wisconsin-Madison** **Sept 2024 - Dec 2025**

- Contributed as a volunteer for the Machine Learning Marathon (MLM) for two consecutive years (Fall 2024 & Fall 2025)
- Advised student teams through MLM sprints, providing strategic guidance and technical support to drive project completion. Assisted students with developing their RAG pipelines for the WattBot challenge (MLM 2025). Worked with different teams to explore ways to get competitive results on the ARC-AGI benchmark, fine-tune different variants of BERT for tweets classification, and leverage ML algorithms like XGBoost to highlight trends in housing datasets (MLM 2024).
- Built a RAG pipeline and validation scripts to test dataset integrity and assess the viability of the WattBot challenge
- Presented on advanced AI concepts, including Prompt Optimization, Caching, and RAG to guide student development

Co-Instructor **Microsoft TEALS** **Dec 2023 - May 2024**

- Supported an initiative to extend comprehensive educational support and actively foster student engagement outside the traditional classroom environment through the development of a RAG-based Discord bot hosted on GCP
- Developed and delivered engaging lectures to enhance student participation and learning outcomes
- Rapid Issue Resolution. Consistently addressed at least 96% of student problems within 6 hours, ensuring timely support.

Community Service Leader **JAAGO Foundation** **Sept 2016 - Jun 2020**

- Successfully spearheaded fundraising initiatives to facilitate the education of underprivileged children
- Organized and hosted a series of events for the poverty-stricken orphans affiliated with the JAAGO Foundation
- Conducted visits to local JAAGO campuses to lead educational seminars and coordinate extracurricular activities

PROJECTS

- **Tagore GPT** (2024). A simple language model based on the paper "Attention is All You Need" and OpenAI's GPT-2, trained on a custom dataset of literary pieces by Bengali poet and writer, Rabindranath Tagore. ***Python, PyTorch***
- **Face Emotion Classifier** (2023). Classifies faces by emotion with a 3-layer neural network. Trained using stochastic gradient descent. Accuracy estimated through 8-fold cross-validation. ***Python, Keras, Tensorflow***
- **Runscan** (2023). Recover image files from ext2 disk images by analyzing inodes and data blocks to identify file type and content by checking file signatures for known JPG header patterns. ***C, debugfs, mkfs***
- **The New York Times Wordle Solver** (2022). Solves The New York Times Wordle on any given day in approximately 3 guesses. Displays each step dynamically as it interacts with the website. Algorithm: Uses maximum letter frequency for each position of a word to assign scores to all possible words. ***Python, Numpy, Pandas, Selenium***
- **"Guess The Author" Mini Game** (2022): GUI application featuring interactive tree animations and audio effects to enhance user engagement. Given a quote, it challenges users to correctly guess the author of environmental literature, rewarding correct guesses with dynamic tree growth animations. ***Java, Processing Library***
- **Nuke Proliferation** (2017). Built and deployed a dynamic website from scratch to create awareness on Nuclear Proliferation. Website traffic data collected through Google Analytics. ***HTML, CSS, PHP, SQL***

TECHNICAL SKILLS AND FRAMEWORKS

- **Languages**: Python, R, Java, C/C++, HTML, CSS, JavaScript, SQL, x86 assembly, PHP
- **Frameworks and Tools:** Numpy, Pandas, Playwright, Flask, Git, MySQL, SQLite, Scikit-Learn, PyTorch, SciPy, Keras, LangChain
- **Generative AI & Computer Vision:** Diffusers (HuggingFace), ControlNet (PyraCanny), IP-Adapters, LoRA Training, Image Segmentation, Homography, Seam-Carving, Matting, Depth Estimation, Edge Detection, and Detail Transfer
- **3D & Geometry Processing:** Gaussian Splatting, NeRF, Photogrammetry, Mesh Optimization (ICP, Chamfer Distance)
- **Inference & MLOps**: SVDQuant, Model Pruning/Compilation, Docker, Kubernetes, GPU Memory Snapshotting, GPU Lambdas.
- **Methods & Concepts**: Latent Diffusion, In-painting/Out-painting, Differential Diffusion, Fourier Transform (DFT) for Detail Transfer, Prompt Engineering & Inversion

ADDITIONAL

1st Place, CheeseHacks Hackathon (2022). Built Facial Detection Attendance Tracker using cosine similarity (ResNet)
Florence Waste Pulver Scholarship (2022). Merit Scholarship awarded for academic excellence.
UW-Madison Undergraduate Scholarship for Summer Study (2022-2023). Merit Scholarship. Awarded 2 consecutive years.
Caribou Contest Winner at AISD (2018): Ranked 1st in the mathematics competition at AISD.