Manas Madine

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Education

University of Massachusetts-Amherst **Aug. 2023 – present**

Masters in Computer Science, 4.0/4.0 *Amherst, MA*

Indian Institute of Technology-Kharagpur **Aug. 2017 – Aug, 2021**

Bachelors of Technology in Computer Science and Engineering 7.98/10.0 *Kharagpur, WB*

Relevant Coursework

- Adv NLP
- Advances in OS design
- Database Management
- Distributed Systems
- Advanced ML
- Deep Learning
- Reinforcement Learning
- Responsible AI

Experience

AMD **May 2024 – Dec 2024**

Applied Scientist Fall CO-OP

- Built a debug triage tool, which helps in causal root cause analysis, and binning bugs.
- Created a parser to clean and convert the raw simulation/emulation logs of X86 processor to higher level abstraction
- Introduced a novel **hierarchal attention mechanism** to solve the **tokenization problem** and to increase the context length.
- Curated the objective function to pre-train,fine-tune various decoder architectures including deepseek, mixtral.
- Refined the tool by incorporating debug engineers' human feedback, employing Reinforcement Learning from Human Feedback (**RLHF**) with the Proximal Policy Optimization (**PPO**) algorithm for model refinement.
- Used various Optimized on **Rocm**, for training **Deepspeed**, **Flashattention** and Inference **VLLM**,**SGLang**, **KV cache offloading** for large token generation.
- Leveraged the attention scores to **causally infer** the most influential data-path for the failure

AMD **May 2024 – Aug 2024**

Applied Scientist Intern

- Chat-Bot on MongoDB : Developed a scalable natural language query and Analytics system on MongoDB Data using Azure Open-AI Gateway. The Chat-Bot can process complex queries on large datasets, ensuring low latency and accurate results, Leveraged the system to generate visualizations and perform complex analytics on the retrieved data.
- For scaling-up to multiple large collections used vector databases to store database schemas as vector embedding for efficient management and retrieval, ensuring scalability and performance.
- Using GPT4o generated a dataset of NLQ and py code and finetuned Llama3-7B using **LoRA** and **QLoRA** and performed knowledge Distilation.
- Using Human preference data curated from teammates, performed **RLHF** and **DPO** to align the model to abstain from irrelevant questions.
- **Pre-Trained** Llama3-7B using next word prediction objective on all available documents to compare the performance to traditional RAG

PayPal **Aug 2021 – July 2023**

Software Engineer

- Led Key Projects and Compliance Implementations: Implemented bankruptcy scrubbing and developed a system for Right To Cure Letters for the Global Pay Later Product, ensuring legal compliance and collaborating with cross-functional teams to design efficient solutions.
- System Enhancements and Legacy Migration: Successfully migrated legacy C++ APIs to a RESTful framework using NLP techniques, and enhanced the email recon mechanism with **Kafka** for efficient communication and status tracking.

Bidgely Technologies **May 2020 – Aug 2020**

Cloud Software Developer Intern

- Developed Bidgely Data Lake Catalogue: Created a cloud-agnostic solution by implementing a crawler layer to fetch and store external schemas in AWS S3, and designed an API layer for schema extraction. Developed and hosted the frontend using HTML, CSS, JS, and AJAX on AWS S3.
- Optimized Algorithms and Achieved Recognition: Designed efficient algorithms to reduce complexity to linear, and received a Pre Placement Offer based on the recommendation of the Senior Vice President.

Patents

IOT WITH AI-BASED RAILWAY CROSSING TRAFFIC MONITORING USING DEEP LEARNING

- To design an intelligent transport system which makes Railway crossing more safe and secure.
- Taking the sensor data such as LIDAR, depth sensor, Infrared camera from the Railway crossing as input, which gets processed in GPU, using modified YOLO algorithm to detect event with a recall rate of 89%.
- When dangerous situations are detected, the system sends a signal to the authorities, the systems architecture also ensures the security of all the sensitive data.
- Patent got published in Intellectual Property India.

Research Papers/ Projects

Towards Robust LLMs for Out-of-Distribution Sentiment Analysis |

- Conducted an in-depth investigation into the robustness of large language models (LLMs) for out-of-distribution (OOD) sentiment analysis, focusing on the generalization challenges faced by fine-tuned models.
- Explored and evaluated multiple strategies to enhance OOD robustness, including prompting strategies, zero-shot learning, few-shot learning, chain-of-thought prompting, and explanation-based generalization.
- Utilized various fine-tuned encoder models (e.g., BERT, **RoBERTa**, DeBERTa) and pre-trained LLMs (Llama-2, **Llama-3 70B**) finetuned with **LoRA** and **QLoRA**, demonstrating that simple prompting techniques can outperform traditional fine-tuning methods on OOD datasets.
- Assessed the impact of **4-bit,16-Bit quantization** on model performance, highlighting the trade-offs between memory and power usage and robustness, with significant findings on the effectiveness of explanation-based prompts for OOD generalization.

Bridging Distribution Gap via Semantic Rewriting with LLMs | ***ACL-SRW'24***

- **Introduced Semantic Rewriting:** Developed a **novel technique** that leverages the flexibility of Large Language Models (LLMs) to perform semantic rewriting, aligning both in-distribution (ID) and out-of-distribution (OOD) data with the LLMs' internal distributions to standardize linguistic properties and minimize distributional discrepancies.
- Conducted experiments on benchmark datasets (Amazon Reviews, SST-5, SemEval, DynaSent) with LLMs (LLaMA-2, LLaMA-3), demonstrating significant improvements in OOD robustness and performance.
- Theoretical and Empirical Analysis: Utilized **Gaussian Mixture Models (GMM)** and **UMAP** to show that semantic rewriting reduces centroid distances and simplifies clustering, enhancing OOD robustness.
- Comparative Evaluation: Evaluated traditional fine-tuning, zero-shot learning, in-context rewriting, and semantic rewriting on RoBERTa and LLaMA models, demonstrating that **semantic rewriting bridges distribution gaps** and outperforms other methods in accuracy and generalization.

AutoCareers: multi AI agent system for Optimized job search

- Developed a multi agent system to refine resume parsing and ATS scoring, using the **ATS** score as the reward model to iteratively improve candidate-job matching.
- Implemented reinforcement learning training with custom reward functions using the **PPO** variant algorithm, optimizing the system's recommendations and ensuring resumes align with job requirements.
- Leveraged RL techniques to automate and enhance cover letter generation and resume optimization, significantly streamlining the job application process.

Predicting and Enhancing the Fluctuations of Cryptocurrency Using Algorithms | ***IJARESM*** **October 2022**

- This paper we engineered a sophisticated Recurrent Neural Network (RNN) model leveraging Long Short-Term Memory (LSTM) architecture for accurate Bitcoin price prediction, effectively analyzing historical data and minimizing overfitting through advanced optimization techniques.
- Utilizing the Keras framework to handle extensive cryptocurrency datasets, achieving precise daily price fluctuation predictions and significantly enhancing neural network processing efficiency.

SKILLS AND EXPERTISE

Languages: C, C++, Java, Python, SQL, HTML, JavaScript, CSS, Verilog, MIPS, Bash.
Developer Tools: Git, Anaconda, Linux, Latex, Windows, MS Office.
Technologies/Frameworks: Spring,Spring-Boot,Kafka,C++ STL, OpenCV, Keras, TensorFlow,Pytorch

Awards and Achievements

- Won the Popular Vote as part of the Generative AI Hackathon at PayPal and therefore received a sport award.
- Received an appreciation letter from the Senior Vice President of Bidgely for my work.
- Recipient of the prestigious Kishore Vaigyanik Protsahan Yojana(KVPY) scholarship by IISC.