Prakhar Dixit

Graduate Research Assistant

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SUMMARY

PhD student in Computer Science at UMBC specializing in **Machine Learning**, **Reinforcement Learning**, and **Mathematical Reasoning in LLMs**. Research focuses on enhancing reasoning in LLMs, improving RL sample efficiency, and developing **Sim2Real frameworks**, with contributions in **graph attention mechanisms**, **human feedback integration**, and **YOLO-based Sim2Real techniques**, achieving significant improvements in efficiency and decision quality.

EXPERIENCE

Graduate Research Assistant Jan '22 — Present
University of Maryland Baltimore County Baltimore, United States

- - Currently working on enhancing mathematical reasoning capabilities in large language models through human-driven learning techniques.
  - Designed a Sim2Real framework, training RL algorithms with YOLO object detectors in simulation, achieving an 85% transfer success to real-world robots.
  - Enhanced navigation efficiency of low-powered nano drones by 30% using Hierarchical Reinforcement Learning.
  - Worked on Reinforcement Learning using Human Feedback(RLHF) technique TAMER (Scalar binary feedback) and showcased how can agents harness the information contained in human-generated signals of reward to learn sequential decision-making tasks.
  - Integrated graph attention networks within an R-GCN framework to enhance model-free RL algorithms. Achieved a 20% improvement in sample efficiency on Boxworld and Minigrid LavaGap environments, leading to faster learning and better decision quality.

Graduate Assistant Aug '21 — Dec '21
University of Maryland Baltimore County Baltimore, United States

- Assisted in teaching CMSC 691.4 (Introduction to Data Science), contributing to the education of over 50 students by grading assignments and providing feedback, ensuring a 95% assignment completion rate. Collaborated with a professor to implement student projects, increasing student engagement and project completion rates by 20%.

Software Engineer Jul '19 — Apr '21
Titan Company Limited Bengaluru, India

- Developed a web application using Spring Boot and REST APIs, enabling over 8,000 employees to efficiently visualize and manage their asset data stored in Oracle DB, resulting in a 40% reduction in data retrieval time. Implemented a comprehensive Python dashboard to analyze daily login data, enabling the derivation of actionable insights and significantly improving the accuracy of user engagement tracking by 25%.

Software Engineer Intern Mar '19 — Jun '19
Titan Company Limited Bengaluru, India

- Participated in testing and improving various applications within the software development cycle, enhancing software reliability by 30% and reducing bug occurrences by 20%. Tested and managed BPM-related applications, increasing process efficiency by 25% and ensuring seamless workflow integration.

Research Intern Jun '18 — Jul '18
National University of Singapore Singapore, Singapore

- Examined a credit card fraud detection dataset and attained a 90.5% success rate with logistic regression, exceeding the performance of other models like decision tree and SVM by 5-10%. Generated advanced data preprocessing, reducing data redundancy by 25% and model training time by 30%, boosting efficiency.

EDUCATION

PhD in Computer Science, University Of Maryland Baltimore County (GPA: 3.589) Aug '23 — Present
Baltimore, United States

- Working to find out how the math reasoning is so poor in LLMs

MS in Computer Science, University Of Maryland Baltimore County (GPA: 3.5) Aug '21 — May '23
Baltimore, United States

- Thesis - Dynamic Edge Weighting in Relational Graph Convolutional Networks: Enhancing Sample Efficiency via Graph Attention in Reinforcement Learning

B.Tech in Computer Science Engineering, SRM Institute of Science and Technology (GPA: 3.7) Aug '15 — May '19
Chennai, India

- Final Research Project - NEURAL SKETCHING
  International Journal of Scientific & Engineering Research(IJSER)

PROJECTS

LLM Detect AI Text Link
- Created a machine learning model to detect if an essay was written by a student or an LLM, finishing in the top 25% of leaderboard.

Explorer Link
- Innovated an Android application that helps visually impaired users locate and identify objects within a picture frame.

Deep Learning Steering Model Link
- Built a self-driving prototype using Convolutional Neural Networks and OpenCV. The system used images and steering angles as labels to determine the correct steering angle for the vehicle.

SKILLS

Programming Languages Python, Java, SQL, JavaScript
Machine Learning Deep Reinforcement Learning(DRL), Logistic Regression, Neural Networks (ANN, CNN), YOLO Object Detection, Sim2Real, Large Language Models(LLMs), Retrieval Augmented Generation(RAG)
Database Management MySQL, Oracle DB, CRUD operations
Software Development Spring Boot, REST APIs, Android Studio, Gradle, MERN stack (MongoDB, Express.js, React, Node.js)
Research Methodologies Mathematical reasoning in LLMs, Sample efficiency in RL, big data research, deep learning advancements

PUBLICATIONS

SBI-RAG: Enhancing Math Word Problem Solving for Students through Schema-Based Instruction and Retrieval-Augmented Generation
NeurIPS 2024
Paper Link

ReProHRL: Towards Multi-Goal Navigation in the Real World using Hierarchical Agents
AAAI 2023
Paper Link

Toward Real-World Implementation of Deep Reinforcement Learning for Vision-Based Autonomous Drone Navigation with Mission
RSS 2022
Paper Link