Divyanshu Singh

Curriculum Vitae

Education

2022 – 2026 **B.E. Computer Science**, *Birla Institute of Technology and Science, Pilani*, Goa, India

Publications

[IEEE Xplore] **The Last Mile: A Novel, HotSpot-Based Distributed Path-Sharing Network for Food Deliveries**, *IEEE Transactions on Intelligent Transportation Systems*

- **Authors:** Ashman Mehra, **Divyanshu Singh**, Vaskar Raychoudhury, Archana Mathur, Snehanshu Saha

Experience

March 2025 – Present **CLAN Labs, Purdue University**, *West Lafayette, IN*, Research Intern

Supervisor: Dr. Vaneet Aggarwal

- Currently developing dynamic obstacle avoidance techniques using uncertainty-based adaptive planning with diffusion models.
- Exploring multimodal applications of diffusion models in medical domains.

December 2023 – Present **APP Center for AI Research (APPCAIR)**, *Goa, India*, Undergraduate Researcher

Supervisors: Dr. Snehanshu Saha, Dr. Santonu Sarkar

- Developed DeliverAI, a reinforcement learning-based model for optimizing food delivery routes.
- Investigating a novel dynamic ride-sharing system using a multi-agent actor-critic approach with enhancements to minimize detours and optimize rider pickups.
- Formulating a driver behavior modeling framework to quantify unruliness in traffic scenarios, with plans to adapt it for complex traffic conditions in India.

May 2024 – July 2024 **Digital India Bhashini Division**, *India*, Research Intern

Contributed to the National Language Mission to advance language technologies for Indian languages

- Collaborated with the post-processing team, focusing on Inverse Text Normalization (ITN).
- Designed a WFST-based model for ITN across diverse Indic languages, [Git].
- Implemented a T5-based model to enhance ITN by introducing punctuation handling.

Ongoing Projects

December 2024 – Present **Driver Behaviour Modeling**, *BITS Pilani, Goa*

Generative AI, Computer Vision

- Developing a transformer-based encoder-decoder model integrating kinematic data, vectorized maps, and vision-language outputs for real-time anomaly detection in traffic behavior.
- Designing a driver unruliness quantification framework, capturing risky maneuvers, violations, and aggressive driving patterns.

August 2024 – Present **Altruistic Ride Sharing**, *BITS Pilani, Goa*

Deep Reinforcement Learning, Optimization

- Developed an altruistic ride-sharing framework where drivers can pick up and drop off riders along their route while minimizing detours.
- Utilizing an Attention-based Multi-Agent Actor-Critic model with novel policy modifications to enhance cooperative decision-making, optimizing ride allocation while balancing altruism and efficiency in ride-sharing

March 2025 – Present **Graph Diffusion for RNA 3D Folding**, *BITS Pilani, Goa*

Graph Neural Networks, Diffusion Models, Computational Biology

- Developing a graph diffusion model to predict 3D structures of RNA molecules by leveraging graph neural networks and probabilistic sampling techniques.
- Exploring the integration of structural constraints and energy-based priors to enhance the accuracy of RNA folding predictions.
- Evaluating the model's performance on benchmark datasets, focusing on metrics like RMSD and structural fidelity to native conformations.

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Completed Projects

December 2023 – June 2024 **DeliverAI**, *BITS Pilani, Goa*
Reinforcement Learning, Optimization
- Proposed DeliverAI, a reinforcement learning-based path-sharing algorithm to optimize food delivery routes by reducing costs and improving efficiency.
- Modeled the problem as a multi-objective optimization balancing consumer satisfaction and delivery costs.
- Simulated DeliverAI on real-world Chicago delivery data, demonstrating a 15% reduction in fleet size, 16% reduction in distance traveled, and 50% increase in fleet utilization compared to traditional point-to-point delivery methods.
- Published in *IEEE Transactions on Intelligent Transportation Systems*: [IEEE Xplore]

January 2025 **LLMExam: AI-Driven Question Paper Generation**, *BITS Pilani, Goa*
NLP, Retrieval-Augmented Generation, Generative AI, Multimodal AI, Reinforcement Learning
- Built a multimodal pipeline using a local LLM (Qwen 2.5) for automated retrieval of textual questions, diagrams, and graphs from PDFs, leveraging vector search for topic-based extraction.
- Implemented LLM-driven topic tagging with dynamic matching against a vector database for accurate question categorization.
- Generated curated question papers in Markdown format based on user-defined topics and constraints, preserving textual and visual content.
- Developing a Reinforcement Learning with Human Feedback (RLHF) framework to evaluate and improve topic tagging accuracy, difficulty assignment, and overall pipeline stability.

November 2024 **Zero-Shot Classification with RoBERTa**, *BITS Pilani, Goa*, [Git]
NLP, Deep Learning, Generative AI
- Utilized a pre-trained RoBERTa model for zero-shot classification on the AG News dataset using Hugging Face transformers.
- Optimized label prompts iteratively with generative LLMs (Gemma2-9B, Qwen2.5-32B, Nemotron-70B), boosting accuracy from 48.5% to 82.13% (achieved by Nemotron-70B).
- Assessed performance using precision, recall, F1-score, and confusion matrices, analyzing common error patterns and label effectiveness.

Relevant Coursework

CS Reinforcement Learning, Generative AI [Git], Natural Language Processing, Foundations of Data Science, Object-Oriented Programming, Data Structures and Algorithms, Database Systems, Design and Analysis of Algorithms, Discrete Structures in Computer Science, Logic in Computer Science, Theory of Computation

Online DeepMind x UCL: Deep Learning Lectures, DeepMind x UCL: Reinforcement Learning Lectures, CS229 Stanford ML, CS50's Introduction to AI with Python [Certificate]

Technical Proficiency

Languages Python, C++, C, Java, SQL, LaTeX

Tools PyTorch, TensorFlow, JAX, Hugging Face, Gymnasium, PettingZoo, Anaconda, GitHub, Docker

Interests Reinforcement Learning, Generative AI, Deep Learning, Natural Language Processing, Optimization

Volunteer Experience

January 2024 – Present **Teaching Assistant, CS-F425 Deep Learning**, *BITS Pilani*, Goa, India
- Designed and conducted tutorials on deep learning concepts for undergraduate students.

December 2024 **Undergraduate Volunteer, IndoML 2024**, *Goa, India*
- Represented APPCAIR as one of the few undergraduate volunteers, showcased research at the sponsor stall, and facilitated Q&A sessions during the conference.

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