Sandeep Kumar Routray

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EDUCATION

Carnegie Mellon University **Dec. 2025**
Master of Science in Machine Learning *GPA: 4.00 / 4*
Relevant Coursework: Deep Reinforcement Learning, Probabilistic Graphical Models, Multimodal Learning

Indian Institute of Technology Kanpur **May 2021**
Bachelor of Technology in Electrical Engineering | Department Rank: 2 *GPA: 4.00 / 4*
Relevant Coursework: Data Structures, Algorithms, NLP, Digital Signal Processing, Optimization Algorithms
Honors: Dean's List (all semesters), Summa Cum Laude, Gold Medal for Undergrad Project

PUBLICATIONS

[1] S. R. Dash*, S. Routray*, P. Varshney* and A. Modi, "**CS-NET at SemEval-2020 Task 4: Siamese BERT for ComVE**", in Proceedings of the Fourteenth Workshop on Semantic Evaluation, International Committee for Computational Linguistics (COLING), Dec 2020

EXPERIENCE

Carnegie Mellon University **Oct. 2024 - Present**
Graduate Research Assistant, Prof. Deepak Pathak's Lab *Pittsburgh, PA*

- Research on adapting **multimodal LLMs** and **video diffusion models** to predict actions from internet-scale human and robot video datasets enabling few-shot task, environment and embodiment generalization

Samsung Research **Sep. 2021 - June 2024**
Machine Learning Engineer, SmartThings Team *Seoul, South Korea*

- Spearheaded a project to convert home layouts to 3D models. Showcased at **CES 2024** and deployed across **1 million homes** globally
- Trained a **ConvNext** model with **focal loss** to identify rooms, walls, doors and junctions and designed a custom raster to vector pipeline
- Performed integer quantization for mobile deployment with TF Lite C API obtaining **4x** reduction in size and **3x** increase in inference speed
- Achieved 3D reconstruction from single image by training **neural radiance field (NeRF)** on multi-views generated from a diffusion model

Vector Institute for Artificial Intelligence **Oct. 2020 - July 2022**
Research Fellow, Prof. Sanja Fidler's Lab *Toronto, Canada*

- Leveraged inter-image relationships in a **Slot Attention** framework to learn object-centric features with self-supervised learning (SSL)
- Created an image context aware score function to mine positives and negative slots for **contrastive loss** to improve feature consistency
- Ablated **vision transformers** training with SSL losses on multi-GPU clusters, obtained **2 % mIoU** improvements over existing baselines

Samsung Research **May 2020 - July 2020**
Software Engineer Intern, 6G Research Team *Seoul, South Korea*

- Implemented a reinforcement learning based scheduler for LTE system with **Deep Deterministic Policy Gradient (DDPG)** algorithm
- Devised two reward mechanisms to maximize throughput while maintaining QoS requirements of delay and fair allocation among users
- Obtained **80% lower delay** and better **user scalability** than prevalent Proportional Fair scheduler without compromising data rates

PROJECTS

Simulator-based Scaling of Inference Time Compute for Robotics **Jan. 2024 - Present**

- Scaling inference-time compute for robotics by combining **Chain-of-Thought** reasoning with diffusion transformer **world model** rollouts
- Attained **30%** improvement with **model-based RL** and **reward modeling** to optimize trajectory search and policy performance at test time

Common Sense Validation And Explanation **June 2020 - Dec. 2020**

- Proposed a **Siamese architecture** and **Mixture-of-Experts** with encoder based **LLMs** for efficient inter-relational information extraction
- Coupled with cross attention, achieved **94.8%** accuracy for Validation task and **89%** for Explanation task. Results published in **COLING '20**

Minimax Optimization in Non-Euclidean Space Using Bregman Divergences **May 2020 - Nov. 2020**

- Designed a novel restarting algorithm to minimize smooth, strongly convex functions in non-Euclidean space based on Nesterov's AGD
- Proposed a new algorithm for smooth minimax optimization using above result. Improved convergence rate by **order of 2** in both cases

SKILLS

Languages: C, **C++, Python**, MATLAB, SQL
Technologies: Docker, Git, **PyTorch**, **JAX**, **CUDA**, ONNX, TF Lite, NetworkX, OpenCV, Fast APIs