Sandeep Kumar Routray

MS in Machine Learning | Carnegie Mellon University

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Education

Carnegie Mellon University — *Pittsburgh, PA*

Master of Science, Machine Learning — *August 2024 - Present*

Indian Institute of Technology - Kanpur — *Kanpur, India*

Bachelor of Technology, Electrical Engineering — *July 2017 - May 2021*

- **GPA: 9.8/10**
- Awarded **Academic Excellence Award 2017-18, 2018-19, 2019-20** Equivalent to Dean's List
- Awarded **Prof. Samares Kar Memorial Gold Medal** for the best undergraduate project in Electrical Engineering
- **Key Courses:** Machine Learning, Probabilistic ML, NLP, Optimization Algorithms, Stochastic Geometry, Wireless Communications

Publications

Conference Proceedings

[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 (ICCL)*, Dec 2020. [Paper]

[2] N. V. Deshpande*, S. Routray* and A. K. Gupta, "Spectral Efficiency in Poisson Cluster Based HetNets with Users-Basestations Correlation", in *IEEE International Conference on Advanced Networks and Telecommunications Systems (ANTS)*, Dec 2020. [Paper], [Video]

* *indicates equal contribution*

Work Experience

Machine Learning Engineer [Press] — *Seoul, South Korea*

SmartThings Team, ***Samsung Electronics*** — *Sep 2021 - Jun 2024*

- Pioneered development of deep learning and vectorization stages of *Map View* engine to convert home layouts in wild (brochures, LiDAR, CAD, hand-drawn, etc.) to interactive 3D model. The engine was unveiled at CES 2024 and has been deployed across 400,000 homes globally.
- Designed a ConvNeXt based model and trained using focal loss to identify rooms, walls, doors and junctions in layouts. Performed integer quantization and deployed in Android and iOS devices using TF Lite C API achieving 4x reduction in size and 3x increase in inference speed.
- Worked on 3D reconstruction from single image by training a neural radiance field (NeRF) on multi-views generated from a diffusion model.

Research Fellow — *Toronto, Canada*

Prof. Sanja Fidler's Lab, ***Vector Institute for Artificial Intelligence*** — *Oct 2020 - July 2022*

- Researched ways to leverage inter-image relationships for object-centric self-supervised learning. Designed an image-context aware score function to mine positives/negatives from a queue of images for contrastive loss. Obtained 1 % mIoU improvements over existing benchmarks.
- Experimented ways to incorporate geometrical cues from 2D-mesh decomposition of image and perform hierarchical grouping to discover object-part relationships in a dense feature self-supervised feature learning framework.

Intern [Report] — *Seoul, South Korea*

6G Research Team, ***Samsung Research*** — *May 2020 - Jul 2020*

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

Research Experience

Minimax Optimization in Non-Euclidean Space Using Bregman Divergence [Slides] — *IIT Kanpur, India*

Undergraduate Project, ***Prof. Ketan Rajawat*** — *Aug 2020 - Dec 2020*

- Designed an $\mathcal{O}(1/k^4)$ algorithm for minimizing smooth and strongly convex functions in non-Euclidean norm space using Nesterov's Accelerated Gradient Descent Algorithm (AGD) and a novel restarting strategy.
- Designed an $\mathcal{O}(1/k^2)$ *conceptual* algorithm for smooth minimax optimization in non-Euclidean norm space using the above result.
- Proposed an *inexact* and *implementable* version of the above algorithm; but attempts at a proof of convergence was unsuccessful.

Common Sense Validation And Explanation [Paper] — *IIT Kanpur, India*

Undergraduate Project, ***Prof. Ashutosh Modi*** — *Jan 2020 - May 2020*

- Designed a Siamese architecture and incorporated various transformer-based text encoders like BERT, RoBERTa, ALBERT.
- Enabled efficient inter-relational information extraction among input sentences and eliminated logical fallacies in output.
- Achieved an accuracy of 94.8% for Validation task and 89% for Explanation task. Results published in SemEval-2020.

Throughput Analysis of HetNets Using Poisson Cluster Process [Slides] [Video] — *IIT Kanpur, India*

Undergraduate Project, ***Prof. Abhishek Gupta*** — *Mar 2020 - Dec 2020*

- Used Poisson Point Process (PPP) and Poisson Cluster Process (PCP) to model base stations and users correlation in a K-tier HetNet.
- Derived an expression for the Laplace Transform of the interference and used it to calculate the average throughput.
- Verified theoretical predictions using Monte Carlo simulations of throughput for special cases of Thomas and Matern Cluster Process.

Skills

Programming Languages Python, MATLAB, C, C++

Software/Tools CUDA, PyTorch, Keras, TensorFlow, OpenCV, NumPy, SQL