Sri Mihir Devapi **Ungarala**

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Education

May 2023 **Aug 2019** | **Birla Institute of Technology and Science (BITS) Pilani** — **Hyderabad, India**
B.E. Electronics and Communications Engineering (ECE) - *CGPA: 8.2/10*

Research Experience

Mar 2025 **Oct 2024** | **Independent Researcher**
Collaborators: PhD students from University of Manchester and Stanford University
Worked on disentangled representation learning for improved generalization in reinforcement learning environments with domain shift and visual complexity variations.

Aug 2024 **June 2023** | **IIIT Hyderabad | Robotics Research Center[]** — **Hyderabad, India**
Research Assistant
Worked on representation learning projects with applications in computer vision and robotics, including Perception in Adverse weather, Generative Modeling, semantic analysis of foundation model embeddings, etc

Jan 2023 | *Research Intern (Bachelor Thesis) | Advisors: Dr. K Madhava Krishna, Dr. Joyjit Mukherjee*
Developed and deployed a multi-agent SLAM framework with robust inter-robot loop closure detection on real hardware systems.

Sept 2022 **Mar 2022** | **BITS Hyderabad** — **Hyderabad, India**
Student Researcher | Advisors: Dr. Rajesh Kumar Tripathy
Developed retinal OCT image classification system using Empirical Wavelet Transform preprocessing for deployment on resource-constrained edge devices.

Publications

S=In Submission, C=Conference, W=Workshop, P=Poster/Demo, J=Journal

[C.1] **DiffPrompter: Differentiable Implicit Visual Prompts for Semantic-Segmentation in Adverse Condition[]**
Sanket Kalwar*, Mihir Ungarala*, Shruti Jain*, Aaron Monis, Krishna Reddy Konda, Sourav Garg, K Madhava Krishna
IEEE/RSJ International Conference on Intelligent Robots and Systems [**IROS 2024 (Oral Pitch)**]

Selected Research Projects

Differentiable Implicit Visual Prompts for Semantic Segmentation in Adverse Condition[] — Aug'23 - Sept'23
Advisors: Dr K. Madhava Krishna, Dr Sourav Garg

- Developed differentiable visual prompts for semantic segmentation in adverse weather conditions, outperforming state-of-the-art methods EVP and SAM-Adapter on Dark Zurich, ACDC, and Wild Dash datasets with superior qualitative and quantitative performance.
- Created parallel (PDA) and serial (SDA) differentiable adapters with ∇HFC processing blocks that automatically learn weather-specific image processing operations without manual parameter tuning across different weather conditions.

My Contributions: Introduced auxiliary ViT model for rapid prototyping, reducing experiment time from 3 days to 30 minutes per iteration, enabling faster research cycles. Trained different variations on the model on adverse weather datasets along with ablations. Also contributed to writing and refining the final manuscript.

DepthDiff: Agnostic Noise Removal in Depth Images Using Diffusion[] — Mar'24 - Aug'24
Advisors: Dr K. Madhava Krishna

- Formulated depth denoising as a diffusion process using custom "Alpha Scheduler" inspired by alpha-blending, enabling noise removal without prior knowledge of noise characteristics from depth sensors like RealSense D434.
- Used structural embeddings from monocular depth estimation models as conditioning signals for diffusion, creating a noise-agnostic denoising framework that handles multiple noise types simultaneously.
- Trained on 8 diverse noise models (linear, quadratic, cubic, constant) to ensure the model acts as a general optimizer rather than learning specific noise patterns, demonstrating robustness to out-of-distribution noise.

My Contributions: Led the project from conceptualization to implementation, designed the Alpha Scheduler methodology, and developed the complete denoising pipeline.

Distributed/Multi-Agent SLAM[] Jan'23 - June'23

Advisor: Dr K. Madhava Krishna, Dr Joyjit Mukherjee

- Enhanced VINS-Mono with GTSAM backend and integrated NetVLAD for robust visual place recognition, enabling effective inter-robot loop closure detection under varying illumination conditions in large-scale environments.
- Implemented two complementary inter-robot loop closure algorithms optimized for computational efficiency (time) and memory efficiency (space), with Graduated Non-Convexity (GNC) optimizer for robust outlier rejection.
- Successfully deployed and tested the complete multi-agent SLAM pipeline on physical robot hardware, demonstrating practical applicability beyond simulation for collaborative mapping tasks.

My Contributions: Implemented both loop closure algorithms, integrated NetVLAD and helped in integrating GTSAM, and contributed to the comprehensive literature study and system design.

Semantic Segmentation using Segment Anything Model(SAM)[] June'23 - Aug'23

Advisors: Dr K. Madhava Krishna, Dr Sourav Garg

- Discovered and exploited semantic properties in SAM's mask embeddings through systematic latent space analysis, revealing that semantically similar objects have higher cosine similarity in embedding space.
- Developed training-free memory bank approach using K-means clustering on SAM embeddings from detection datasets, enabling zero-shot semantic classification without additional training on BDD100k dataset.
- Created MLP-based transformation learning to amplify semantic signals in SAM's feature space, improving classification accuracy while avoiding fine-tuning the foundation model.

My Contributions: Worked independently on most of the project, conducted latent space analysis, implemented both training-free and supervised classification pipelines, and identified key limitations for future improvements.

Koopman Theory in Deep Learning for Linearizing Drone Dynamics[] Sept'23 - Jan'24

Advisors: Dr K. Madhava Krishna, Dr Arun Kumar Singh

- Investigated applying Koopman operator theory to learn neural network transformations that embed nonlinear drone state space into higher-dimensional linear space for simplified trajectory tracking and path planning.
- Designed encoder-decoder architecture with trainable transformation matrices and generated comprehensive training datasets using Flightmare simulator and ACADO toolkit for discrete-time dynamics.
- Gained valuable insights into the challenges of applying Koopman theory to complex dynamical systems and limitations of neural network-based state space transformations, despite unsuccessful linearization results.

My Contributions: Implemented the complete neural architecture, conducted extensive experiments, and found that, by koopman theory, drone state system is unbounded – meaning the linear model that we get is always an approximation.

Relevant Courses and certificates

- **BITS F312: Neural Networks and Fuzzy Logic**: Grade(Letter grade/10 scale): A-/9
- **BITS F464: Machine Learning**: Grade(Letter grade/10 scale): A-/9
- **BITS F441: Sel Topics from CS - Computer Vision**: Grade(Letter grade/10 scale): B/8
- **Deep Learning Specialization in Coursera by Andrew Ng**: Certificate Link
- **Reinforcement Learning**: RL by David Silver (MOOC)

Technical Skills

Languages	Python, C++, C, MATLAB
Frameworks	Pytorch, Tensorflow, ROS
Tools	Git, Github
Hardware	Arduino, RaspberryPi