

# DEEPTI HEGDE

## 3D Computer Vision, Deep Learning

<https://deeptibhegde.github.io>

### ABOUT ME

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I am a fourth year PhD student advised by Vishal M Patel at the Vision and Image Understanding Lab in the Department of Electrical and Computer Engineering, Johns Hopkins University. I am interested in learning in label and data scarce scenarios as well as vision-language models for 3D scene understanding. I have previously worked on pointcloud refinement, image enhancement, and embedded intelligence.

### EDUCATION

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#### Johns Hopkins University

PhD, Department of Electrical and Computer Engineering

*August 2020 - Present*

#### KLE Technological University

Bachelor of Engineering, School of Electronics and Communication

*August 2016 - June 2020*

### EXPERIENCE

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#### Mitsubishi Electric Research Labs (MERL)

*Research Intern*

June 2023- September 2023

Summer research internship working self supervised representation learning on LiDAR point clouds..

#### Mitsubishi Electric Research Labs (MERL)

*Research Intern*

June 2022- August 2022

Summer research internship working on multi-modal domain generalization for 3D object detection using lidar and image data to address cross-dataset distribution shift in autonomous driving scenarios. Work submitted to a major computer vision conference.

#### Vision and Image Understanding Lab, Johns Hopkins University

*Graduate Research Assistant*

August 2020 - Present

Research in the department of Electrical and Computer Engineering advised by Vishal M. Patel working on domain adaptation, domain generalization, and self-supervised learnign for 3D scene and shape understanding.

#### Samsung Research Institute, Bangalore

*PRISM Program*

November 2018- May 2019

One year project collaboration with SRI, Bangalore on embedded computing intelligence and efficient implementation of the convolution operation for the ARM Compute Library

#### IIT, Guwahati

*Research Intern*

June-July 2019

Summer internship working with Prabin K Bora in the Image Processing and Computer Vision Lab, IITG on the enhancement of images captured underwater towards improved structure-from-motion reconstruction of submerged heritage sites.

#### IIT, Delhi

*Summer Intern*

June-July 2018

Summer internship working with Prem Kalra to demonstrate real-time relocalization of an agent by estimation of pose and trajectory of a camera at any given mapped location with a memory efficient relocalization algorithm capable of being run on 2GB RAM ARM Cortex A53 processor.

## PROJECTS

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- Equivariant Spatio-Temporal Self-Supervision for LiDAR Object Detection, *Deepti Hegde, Suhas Lohit, Kuan-Chuan Peng, Michael Jones, Vishal Patel*

We propose a spatio-temporal equivariant learning framework by considering both spatial and temporal augmentations jointly. Our experiments show that the best performance arises with a pre-training approach that encourages equivariance to translation, scaling, and flip, rotation and scene flow. For spatial augmentations, we find that depending on the transformation, either a contrastive objective or an equivariance-by-classification objective yields best results. To leverage real-world object deformations and motion, we consider sequential LiDAR scene pairs and develop a novel 3D scene flow-based equivariance objective that leads to improved performance overall.

- Multimodal 3D Object Detection on Unseen Domains, *Deepti Hegde, Suhas Lohit, Kuan-Chuan Peng, Michael Jones, Vishal Patel*

We leverage paired LiDAR-image data present in most autonomous driving datasets to perform multimodal object detection. We suggest that working with multimodal features by leveraging both images and LiDAR point clouds for scene understanding tasks results in object detectors more robust to unseen domain shifts. Second, we train a 3D object detector to learn multimodal object features across different distributions and promote feature invariance across these source domains to improve generalizability to unseen target domains. To this end, we propose , a multimodal fusion and supervised contrastive learning framework for 3D object detection that performs alignment of object features from same-class samples of different domains while pushing the features from different classes apart.

## PUBLICATIONS

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- CLIP goes 3D: Leveraging Prompt Tuning for Language-Grounded 3D Recognition, *Deepti Hegde, Jeya Maria Jose Valanarasu, Vishal Patel, ICCVW 2023*
- Attentive Prototypes for Source-free Unsupervised Domain Adaptive 3D Object Detection, *Deepti Hegde, Vishal Patel, WACV 2024*
- Uncertainty-aware Mean Teacher for Source-free Unsupervised Domain Adaptive 3D Object Detection, *Deepti Hegde, Vishwanath Sindagi, Velat Kilic, A. Brinton Cooper, Mark Foster, Vishal Patel, ICRA 2023*
- Lidar Light Scattering Augmentation (LISA): Physics-based Simulation of Adverse Weather Conditions for 3D Object Detection, *Velat Kilic, Deepti Hegde, Vishwanath Sindagi, A. Brinton Cooper, Mark Foster, Vishal Patel*
- Refining SfM Reconstructed Models of Indian Heritage Sites, *T Santosh Kumar, Deepti Hegde, Ramesh Tabib, Uma Mudenagudi, - SIGGRAPH Asia 2020.*
- *Deepti Hegde, Chaitra Desai, Ramesh Tabib, Uma Mudenagudi* Single Underwater Image Restoration, Oral Presentation - WiCV, ECCV 2020.
- *Deepti Hegde, Chaitra Desai, Ramesh Tabib, Ujwala Patil, Uma Mudenagudi, Prabin K Bora,* Adaptive Cubic Spline Interpolation in CIELAB Color Space for Underwater Image Enhancement, Oral Presentation - Best Paper Session, CoCoNet 2019

- *Deepti Hegde, Chaitra Desai, Ramesh Tabib, Ujwala Patil, Uma Mudenagudi, Prabin K Bora,* Adaptive Color Correction for Underwater Image Enhancement, International Conference on Computer Vision Workshops (ICCV 2019).

## ACADEMIC ACHIEVEMENTS

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First place, Smart India Hackathon, Software Edition, for the project “Real-Time Multiple Person Recognition and Tracking for CCTV Camera” (Team Leader)

Certificate of Excellence, Samsung PRISM Program for contribution to the worklet ”Offline Graph Generation Study for Deep Neural Networks”