Mosam Dabhi

PH.D. STUDENT

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Research Interests

Machine Learning Self-supervised & Few-shot learning, Multimodal time-series modeling, Vector Quantization, Information Theory

Computer vision 3D Reconstruction, Auto-labeling, Multi-view geometry

Robotics Multimodal sensory integration, Autonomous navigation and mapping, 3D object interaction

Education

Carnegie Mellon University — *Pittsburgh, PA, USA*

PH.D. IN ROBOTICS — *Aug. 2021 - Present*

- **Advisor**: Simon Lucey and Laszlo Attila Jeni

Carnegie Mellon University — *Pittsburgh, PA, USA*

M.S. IN ROBOTICS — *Aug. 2019 - May 2021*

- **Advisor**: Simon Lucey
- Thesis: Multi-view NRSfM: Affordable Setup for High-Fidelity 3D Reconstruction

National Institute of Technology — *Surat, Gujarat, India*

B.TECH. IN ELECTRONICS AND COMMUNICATION ENGINEERING — *Aug. 2013 - May 2017*

Research Experiences

Carnegie Mellon University — *Pittsburgh, PA, USA*

GRADUATE RESEARCH ASSISTANT — *Aug. 2019 - Present*

- **Advisor**: Simon Lucey, Laszlo Attila Jeni
- Self-supervised learning for democratizable 3D shape reconstruction neural priors, leading to multi-view NRSfM. [1, 2]
- Few-shot approach for 2D/3D labeling in-the-wild, resulting in a MBW. [3]
- Research on affordable foundation models for 3D vision by utilizing geometry and permutation equivariance. [4]

Apple AI Research — *Cupertino, CA, USA*

RESEARCH SCIENTIST INTERN — *June 2023 - Present*

- Multimodal time-series modeling, shaping the foundation for lightweight AI foundation models.

Apple, Inc. — *Sunnyvale, CA, USA*

RESEARCH SCIENTIST INTERN — *May 2022 - Aug. 2022*

- Delivered the “MBW” (NeurIPS 2022 paper [3]) in production, driving substantial financial savings by auto-generating 3D labels for hands and eyes.
- Developed few-shot learning techniques and Out-Of-Distribution detection algorithms, required for the success of “MBW” in production.

Apple, Inc. — *Sunnyvale, CA, USA*

RESEARCH INTERN — *May 2021 - Aug. 2021*

- Active learning and self-supervised learning strategies.

Apple, Inc. — *Sunnyvale, CA, USA*

RESEARCH INTERN — *May 2020 - Aug. 2020*

- Foundational work on multi-view 3D neural priors, paving the way for affordable setups to generate 3D groundtruth for computer vision applications [1]

Carnegie Mellon University *Pittsburgh, PA, USA*

Research Assistant *May 2017 - May. 2019*

- **Advisor**: Nathan Michael
- Robotic exploration and mapping in real-time for search and rescue operations, enabling superior robot-to-robot communication on extra-terrestrial and sub-terrestrial surfaces [5].
- Achieved flights in challenging, GPS-denied terrains, hitting accelerations over 12 m/s^2 [6]
- Experience-driven Model Predictive Control (EPC) tailored for platforms with computational constraints [7, 8].
- Motion and path planning in cluttered environments through mixed-integer programming [9].

Indian Institute of Science *Bangalore, India*

Research Intern *May 2015 - Jul. 2015*

- **Advisor**: Prasanta Kumar Ghosh
- Home automation through an HMM model harnessing MFCC features and speaking rate analysis.
- Speech recognition with a focus on digit identification utilizing the aforementioned model.

Publications

[1] **Mosam Dabhi**, Chaoyang Wang, Kunal Saluja, Laszlo Jeni, Ian Fasel, and Simon Lucey. High Fidelity 3D Reconstructions with Limited Physical Views. In *2021 International Conference on 3D Vision (3DV)*. IEEE, 2021.

[2] **Mosam Dabhi**. Multi-view NRSfM: Affordable Setup for High-Fidelity 3D Reconstruction. Master's thesis, Carnegie Mellon University, Pittsburgh, PA, May 2021.

[3] **Mosam Dabhi**, Chaoyang Wang, Tim Clifford, Laszlo Jeni, Ian Fasel, and Simon Lucey. Multi-view Bootstrapping in the Wild. In *Thirty-sixth Conference on Neural Information Processing Systems Datasets and Benchmarks Track*. NeurIPS, 2022.

[4] **Mosam Dabhi**, Laszlo A Jeni, and Simon Lucey. 3d-lfm: Lifting foundation model. *In submission*, 2023.

[5] Wennie Tabib, Kshitij Goel, John Yao, **Mosam Dabhi**, Curtis Boirum, and Nathan Michael. Real-Time Information-Theoretic Exploration with Gaussian Mixture Model Maps. In *Robotics: Science and Systems*, 2019.

[6] Alex Spitzer, Xuning Yang, John Yao, Aditya Dhawale, Kshitij Goel, **Mosam Dabhi**, Matt Collins, Curtis Boirum, and Nathan Michael. Fast and agile vision-based flight with teleoperation and collision avoidance on a multirotor. In *International Symposium on Experimental Robotics*, pages 524–535. Springer, 2018.

[7] **Mosam Dabhi**, Alexander Spitzer, and Nathan Michael. Aggressive Flight Performance using Robust Experience-driven Predictive Control Strategies: Experimentation and Analysis. Technical Report CMU-RI-TR-19-08, Carnegie Mellon University, Pittsburgh, PA, June 2019.

[8] **Mosam Dabhi**, Vishnu R Desaraju, and Nathan Michael. Evaluation of Explicit Experience-driven Predictive Control on a Computationally Constrained Platform. Technical report, Carnegie Mellon University, Pittsburgh, PA, June 2017.

[9] **Mosam Dabhi**, Vishnu Desaraju, and Nathan Michael. Planning Aggressive, Dynamically Feasible and Optimal Trajectories for Autonomous Vehicles in Cluttered Environments using Mixed Integer Programming. Technical report, Carnegie Mellon University, Pittsburgh, PA, 2016.

Honors & Awards

2019 - Now	**Apple Research Grant**, Apple Inc.	*Sunnyvale, CA, USA*
2017	**Research Scholarship**, Federation of Indian Chambers of Commerce & Industry	*Pittsburgh, PA, USA*
2016 - 17	**Summer Scholar**, Robotics Institute Summer Scholar	*Pittsburgh, PA, USA*
2016	**Undergraduate thesis funding**, TEQIP Award, MHRD, Government of India	*Surat, India*

Academic Services

2023 - 2024	**Conference Paper Reviewer**, NeurIPS; CVPR; ICCV; WACV	
2022 - 2024	**Conference Paper Reviewer**, NeurIPS; CVPR	
2021	**Conference Paper Reviewer**, IROS	
2020	**Conference Paper Reviewer**, International Conference on Humanoid Robots	
2021 - 2024	**Admissions Committee**, Master of Science, Robotics, CMU (MSR)	*Pittsburgh, PA, USA*
2024	**Admissions Committee**, Master of Science, Computer Vision, CMU (MSCV)	*Pittsburgh, PA, USA*
2023	**M.S. in Robotics Thesis Committee** , Examinee: Heng Yu, Aarush Gupta	*Pittsburgh, PA, USA*
2017 - 2019	**Admissions & Admin. Committee**, Robotics Institute Summer Scholars, CMU (RISS)	*Pittsburgh, PA, USA*

Teaching Experiences

Carnegie Mellon University *Pittsburgh, PA, USA*

Teaching Assistant

- **Spring 2022** : Robot Localization and Mapping with Prof. Michael Kaess
- **Fall 2022** : Geometry-Based Methods in Vision with Prof. Shubham Tulsiani

Selected coursework

Carnegie Mellon University *Pittsburgh, PA, USA*

Learning for 3D Vision (**A+**), Computer Vision (**A**), Advanced Machine Learning (**A**), Convex Optimization (**A**), Robot Localization and Mapping (**A+**), Mathematics Fundamentals for Robotics (**A**), Kinematics, Dynamics, and Controls (**A+**), Ethics in Robotics (**A**) *Aug. 2019 - Present*

Proficient Skills

Programming languages

Primary: Python, C/C++, LaTeX, MATLAB

Secondary: CUDA, Lua, HTML, Javascript

Software libraries

Primary: PyTorch, TensorFlow, Blender, COLMAP

Secondary: OpenAIGym, Torch, Caffe, OpenCV, VLFeat, Pthread