

# Karan Owalekar

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## EXPERIENCE

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### Graduate Research Assistant

Dec. 2023 – Present

*University of Southern California, SLURM lab*

*Los Angeles, CA*

- Designed IMPACT, a safety-driven motion planner integrating vision-language models to infer object semantics (e.g., fragility, material) and optimize contact-aware paths, achieving 84% task success in cluttered real-world environments.
- Enabled robots to interpret scene context for safety-critical decisions (e.g., avoiding glass vs. brushing pillows), outperforming collision-free baselines by 15% in safety metrics across 3,600+ trials.

### Researcher

Sep. 2021 – July 2023

*Tata Consultancy Services*

*Mumbai, India*

- Innovated a novel deep learning architecture to optimize spectral response functions for hyperspectral imaging, inspired by biological vision systems, improving material classification accuracy.
- Deployed one-shot learning for methane leaks detection, accelerating environmental monitoring workflows.

## PROJECTS

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### IMPACT – Intelligent Motion Planning with Acceptable Contact Trajectories | *PyBullet simulation*

- Collaborated on a cutting-edge motion planning system leveraging voxel-based path optimization, successfully improving robotic manipulation efficiency in complex environments

### Privacy-Preserving LLM Sanitization Pipeline | *NLP, Data Masking, Privacy Compliance*

- Developed a framework that masks sensitive data before LLM processing and reintegrates original data post-processing, ensuring privacy and regulatory compliance

### Artificial Vision for Material Classification | *Deep Learning, Spectral Analysis, Computer Vision*

- Designed a deep learning system using generative modelling to optimize spectral response functions, challenging standard three-channel vision and leading to a patent-pending innovation

### MethaneSig – One-Shot Learning for Methane Leak Detection | *Hyperspectral Imaging, Anomaly Detection*

- Engineered a one-shot learning framework (triplet loss) to detect methane leaks in hyperspectral satellite data, reducing false positives by 25% and accelerating deployment in real-time monitoring systems.

## TECHNICAL SKILLS

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**Programming & Framework:** Python, TensorFlow, PyTorch, Scikit-Learn, OpenCV, PyBullet, Docker, Git

**ML Techniques:** Multimodal Learning, Transformer Architectures, Generative Modeling (Diffusion Models, GANs), Reinforcement Learning, One-Shot Learning, Distillation, Transfer Learning

**Tools & Data:** Statistical Analysis, Model Optimization (Quantization, Pruning), Data Visualization, Hyperspectral Imaging, Multimodal Data Integration

## EDUCATION

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### University of Southern California

Los Angeles, CA

*Master of Science in Computer Science (Artificial Intelligence)*

*Aug. 2023 – May 2025*

Courses: Analysis of Algorithms, Web Technologies, Foundations of Artificial Intelligence, Machine Learning, Large-Scale Optimization and Machine Learning, Deep Learning, Advanced Computer Vision, Applied Natural Language Processing

### University of Mumbai

Mumbai, India

*Bachelor of Engineering in Computer Engineering*

*June 2017 – June 2021*

Relevant Coursework: Data Structures, Analysis of Algorithms, Artificial Intelligence & Soft Computing, Machine Learning, Digital Signal and Image Processing, Big Data Analysis, Operation Research

## PUBLICATIONS

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### IMPACT: Intelligent Motion Planning with Acceptable Contact Trajectories via VLM's

*International Conference on Intelligent Robots and Systems (IROS) [Under Review]*

*2025*

### One-Shot Learning for Methane Leak Detection in Remote Areas using Hyperspectral Data

*The International Geoscience and Remote Sensing Symposium (IGARSS)*

*2023*