Omey M. Manyar

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Research Interests

Robotic Manipulation; Perception; Imitation Learning; Physics-Informed Learning; Motion Planning; Reinforcement Learning; Physics-based Simulation

Education

University of Southern California May 2021 – May 2025 (Expected)
Ph.D. in Mechanical Engineering (Robotics) *Los Angeles, CA*

University of Southern California Aug. 2019 – May 2021
Master of Science in Mechanical Engineering *Los Angeles, CA*

National Institute of Technology Karnataka Jul. 2012 – May 2016
Bachelor of Technology in Mechanical Engineering *Surathkal, India*

Experience

Robotics Research Intern May 2024 – Aug. 2024
Toyota Research Institute *Los Altos, CA*
- Worked on Visual Place Recognition task with RGB-D images for an indoor grocery picking robot
- Trained a multi-task model that fuses RGB and Depth images to predict goal pose for a given query RGB-D image

Applied Science Intern May 2023 – Aug. 2023
Amazon Robotics *Seattle, WA*
- Implemented a 3D pose estimation feature of heterogeneous objects placed in cluttered bins as a part of stow manipulation team (Link)
- Trained a Vision Transformer-based model for effective feature matching and subsequently employing the Perspective-n-Point with RANSAC algorithm for accurate pose estimation

Graduate Research Fellow May 2021 – Present
Advisor: Dr. S. K. Gupta. Realization of Robotics Systems Lab, USC *Los Angeles, CA*
- Developed a self-supervised physics-informed learning methodology for Bi-manual bin-packing of deformable packages. The model was trained in Mujoco and deployed in the real-world for efficient packing
- Devised an inverse reinforcement learning-based methodology to model expert behavior from sparse demonstrations for sequential planning problems for an autonomous agent
- Developed a LSTM (GRU)-based multi-modal model that fused vision and wrench data for object state estimation for anomaly detection. Validated the framework on a real-world screwdriving task
- Designed a framework to generate physics-informed synthetic images for training a ResNet-50-based segmentation model in Pytorch to detect wrinkles and folds in sheets with a test mAP of 0.98. Link: code and dataset

Robotics Technologist Jan. 2018 – Jul. 2019
Rolls-Royce Plc. *Singapore*
- Spearheaded the deployment of an AI-based smart predictive tool for robotic surface finishing processes
- Developed a collaborative robotic solution that improved Cpk value of filleting operations to 1.98

Graduate Engineer Aug. 2016 – Jul. 2017
General Motors India Pvt. Ltd. *Bengaluru, India*
- Streamlined robotic welding process in the body shop unit of the manufacturing facility of GM India
- Created an investment forecasting tool with savings of 25% for Global Vehicle Development Program at Level 0
- Formulated a dealership improvement strategy, focusing towards customer satisfaction in the west zone of GM India

Honors and Awards

- Runner up at the AeroDef Student Research Poster Challenge. *Secured 2nd place for presenting a poster on Physics-Informed AI for Multi-Robot Cells*

- Best Conference Paper Award. *Won the conference wide best paper award at the 42nd ASME's IDETC-CIE Conference 2022*

- Viterbi Graduate School Fellowship. *Receipient of the Viterbi Graduate School Fellowship awarded to selected Ph.D. students by the Viterbi School of Engineering, USC*

- Academic Excellence Award. *Given to the best outgoing Master of Science student by the Aerospace and Mechanical Engineering Department at the Viterbi School of Engineering, USC*

List of Selected Publications

- **Omey M. Manyar**, Hantao Ye, Meghana Sagare, Siddharth Mayya, Fan Wang and S. K. Gupta. Simulation-Assisted Learning for Efficient Bin-Packing of Deformable Packages in a Bimanual Robotic Cell. *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), Abu Dhabi, UAE, Oct 2024.*

- **Omey M. Manyar**, Santosh V. Narayan, Rohin Lengade, and S. K. Gupta. Physics-Informed Learning to Enable Robotic Screw-Driving Under Hole Pose Uncertainties. *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), Detroit, MI, USA, Oct 2023.*

- **Omey M. Manyar**, Zachary McNulty, Stefanos Nikolaidis, and S. K. Gupta. Inverse Reinforcement Learning Framework for Transferring Task Sequencing Policies from Humans to Robots in Manufacturing Applications. *IEEE's International Conference on Robotics and Automation, London, UK, May 2023.*

- **Omey M. Manyar**, Junyan Cheng, Reuben Levine, Vihan Krishnan, Jernej Barbic and Satyandra K. Gupta. (November 22, 2022). Physics Informed Synthetic Image Generation for Deep Learning based Detection of Wrinkles and Folds. ASME. Journal of Computing and Information Sciences and Engineering. doi: https://doi.org/10.1115/1.4056295

- **Omey M. Manyar**, Junyan Cheng, Reuben Levine, Vihan Krishnan, Jernej Barbic and Satyandra K. Gupta. Synthetic Image Assisted Deep Learning Framework for Detecting Defects During Composite Sheet Layup. *ASME IDETC-CIE Conference, St. Louis, MO, USA, August 2022.* **Best Paper Award**

- **Omey M. Manyar**, Alec Kanyuck, Bharat Deshkulkarni and Satyandra K. Gupta. Visual Servo-Based Trajectory Planning for Fast and Accurate Sheet Pick and Place Operations. *ASME MSEC, Purdue University, IN, USA, June 2022*

- Yi-Wei Chen, Rex Jomy Joseph, Alec Kanyuck, Shahwaz Khan, Rishi Malhan, **Omey M. Manyar**, Zachary McNulty, Bohan Wang, Jernej Barbic, and S. K. Gupta. A Digital Twin for Automated Layup of Prepreg Composite Sheets. *ASME Journal of Manufacturing Science and Engineering, September 2021.* *https://doi.org/10.1115/1.4052132*

- **Omey M. Manyar**, Jaineel Desai, Nimish Deogaonkar, Rex Jomy Joesph, Rishi Malhan, Zachary McNulty, Bohan Wang, Jernej Barbic, and S. K. Gupta. A Simulation-Based Grasp Planner for Enabling Robotic Grasping during Composite Sheet Layup. *IEEE's International Conference on Robotics and Automation, Xi'an, China, May 2021.* *https://doi.org/10.1109/ICRA48506.2021.9560939*

Projects

Suction-based Manipulation of Deformable Packages| Video Link   Aug. 2023 – Present
- Built a system with a minimalist suction-based gripper for handling of complaint packages
- Trained a GNN-based physics-informed model to learn package dynamics to identify failure modes in manipulation by observing packages under motion capture system

Mobile Manipulation-based System for Fastening | Video Link   Jan. 2023 – May. 2023
- Extended a mobile manipulator platform to perform insertion and screw-driving operations under high perception uncertainties

Human-Robot Teaming for Sheet Manipulation Task | Video Link   Jan. 2020 – Sep. 2021
- Developed a hybrid cell demonstrating the use of robots as assistants in sheet manipulation tasks on an industrial application
- Integrated multiple software modules developed in C++, Java and Python with ROS to accomplish a system that reduced cycle time by 30%

Technical Skills

Programming: Python, C/C++, Java, MATLAB
Libraries and Frameworks: ROS, ROS2, PyTorch, Tensorflow, OpenAI Gym, MoveIt, OpenCV, Open3D
Simulators: MuJoCo, Nvidia Issac Sim, WeBots, Gazebo, Unity
Robots: KUKA LBR iiwa, ABB, UR5, Yaskawa
Developer Tools: Git, Docker, CUDA

Leadership and Involvement

Viterbi CURVE Fellowship Mentor: Mentored Undergraduate CURVE Fellowship Recipients
Reviewer and Session Chair: CoRL (2024), RAL (2022-2024), ICRA (2021-2024), IDETC-CIE (2022)