Vedant Sanjaykumar Raval

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Education

University of Southern California (USC), Los Angeles, USA — Aug 2023 - Present
M.S in Computer Science. Advisors: Prof. Daniel Seita, Prof. Yue Wang — *GPA: **4.00/4***

Indian Institute of Technology (IIT), Delhi, India — July 2017 - June 2021
B.Tech in Computer Science. Advisors: Prof. Parag Singla, Prof. Rahul Narain — *GPA: **9.05/10***

Publications and Patents

- **Vedant Raval***, Enyu Zhao*, Hejia Zhang, Stefanos Nikolaidis, and Daniel Seita. "GPT-Fabric: Smoothing and Folding Fabric by Leveraging Pre-Trained Foundation Models." In *ISRR'24*. (* equal contribution)
- Sumit Shekhar, **Vedant Raval**, Tripti Shukla, Simarpreet Singh Saluja, Paridhi Maheshwari, and Divyam Gupta. "Template-based redesign of a document based on document content." U.S patent 11,537,787, granted Dec 27, 2022.
- Arnab Bhattacharyya, Sutanu Gayen, Saravanan Kandasamy, **Vedant Raval**, and Vinodchandran N. Variyam. "Efficient interventional distribution learning in the PAC framework." In *AISTATS'22*.

Experience

University of Southern California, Los Angeles, USA — Oct 2023 - Present
Graduate Research Assistant. Advisor: Prof. Daniel Seita

- *HERO*: Designing a framework to evaluate generalist robot policies using real-world datasets like DROID, focusing on action-based metrics for low-level agent behavior understanding as opposed to conventional binary success rates.
- *ManipBench*: Curating an open-source benchmark to evaluate recent Vision-Language Models (VLMs) for low-level robot manipulation and designing experiments correlating its performance with robot action selection by VLMs.
- *GPT-Fabric*: Developed a novel method for deformable manipulation that leverages GPT for low-level decision-making, achieving state-of-the-art fabric smoothing results without needing a supervised training dataset. *Accepted at ISRR'24*. Expanding upon this by addressing limitations, incorporating bi-manual capabilities and exploring fine-tuning for VLMs.

Adobe Systems, Bengaluru, India — July 2021 - July 2023
Software Engineer. Team: Document and Interop services for Adobe Express

- *Automated Service Monitoring and Deployment Checks*: Designed a system to track client-side issues, highlight any upstream outages, and maintain JIRA using the obtained information, improving the team's productivity by 10%. Optimized the CircleCI E2E checks by writing a server that mocks the external APIs called by our services.
- *Enhanced Open and Create Document Workflow*: Incorporated performance optimizations like designing bulk APIs to parallelize resource downloads, and devising a lazy document creation workflow to improve user experience.
- *Improved Save Document Workflow*: Achieved 75% memory reduction by streaming the cloud resource transfer.

Indian Institute of Technology, Delhi, India — Sept 2020 - June 2021
Undergraduate Research Assistant. Advisor: Prof. Parag Singla

- Formulated a method to transfer semantic embeddings using IndoWordNet along with incorporating Stanza parse tokens for better dependency information, achieving up to 10% improvement in BLEU score for Transformer-based NMT.

Adobe Research, Bengaluru, India — April 2020 - July 2020
Undergraduate Research Intern, Advisor: Dr. Sumit Shekhar

- Designed a system to re-style documents based on templates recommended from layouts generated via Latent Space Interpolations and GANs and devised a graph-matching approach for transferring content. *Published U.S Patent.*

National University of Singapore, Queenstown, Singapore — Dec 2019 - Jan 2020
Visiting Research Intern, Advisor: Prof. Arnab Bhattacharyya — (remote contributor later)

- Contributed to developing a polynomial-time algorithm for learning interventional distributions in causal Bayesian networks from a finite number of observations within the PAC framework. *Accepted at AISTATS'22.*
- Investigated and evaluated state-of-the-art streaming algorithms on network flow and movie recommendation datasets.

Independent Research and Coursework Projects

DexCT: Dexterous Manipulation for Catching and Throwing Sept 2024 - Present
Research project taken as a part of the course Robotic Perception at USC

- Designed an RL framework for dynamic manipulation tasks, using Soft Actor-Critic (SAC) to train robotic hands for catching and throwing objects. Developed custom reward functions and simulation mini-benchmarks on MuJoCo.

Planning in Task-Space Regions (TSR) Mar 2024 - May 2024
Lab project taken as a part of the course Introduction to Robotics at USC

- Developed a grasping and motion planning pipeline for a 6-DOF manipulator using AIKIDO, ROS-Noetic, RRT, and Jacobian control. Applied TSR constraints for efficient grasping and utilized RViz for visualizing trajectories.

Source Language Expert Driven Low-Resource NMT Sept 2023 - Jan 2024
Research project taken as a part of the course Machine Learning at USC

- Integrated BERT-based source experts with mBART for low-resource NMT through embedding fusion and fine-tuning strategies. Conducted thorough analysis revealing limited BLEU score improvements, highlighting impact of noisy data.

Fast and Robust Simulation of Deformable Objects June 2019 - June 2020
Research project under Prof. Rahul Narain at IIT Delhi

- Evaluated Position-Based Dynamics (PBD) methods for real-time hair simulation, proving convergence to accurate solutions, and explored integrating higher-order methods with IISPH to enhance incompressible fluid simulation.

Processing Form Information from Images August 2019 - Sept 2019
Lab Project taken as a part of the course Digital Image Analysis at IIT Delhi

- Implemented a system that preprocesses the given form image to fix issues of alignment and illumination, scans for the fields via morphological operations, and detects and returns the data present via Keypoint detection.

Awards and Achievements

- **OpenAI Researcher Access Program Grant**: Awarded $5000 for my research on Foundation Models for Robotics.
- **IITD Dean's Merit Award**: Awarded twice during my undergrad for being among the top 5 academic performers.
- **iGEM 2018 Bronze Medal**: Awarded for developing recombinase-based incoherent feed-forward loop constructs.
- **All India Rank 4** in Joint Entrance Examination (JEE) Main 2017 among 1.2 million students, scoring 345/360.
- **KVPY Fellowship**: Awarded by the Indian Institute of Science (IISc) in 2017 for securing a Top 300 national rank.

Service

- **Mentoring** Gayathri Rajesh (B.Tech student at NIT Trichy) for her work on VLMs for Robotics since Summer 2024.
- **Grading Assistant** for Deep Learning course at USC in Fall 2024, grading exams for over 300 graduate students.
- **Reviewer** for IEEE ICRA 2024 Workshop on 3D Visual Representations for Robot Manipulation.
- **Teaching Assistant** for Data Structures course at IIT Delhi in Fall 2020, directly managing 350^+ UG students. Responsible for designing programming assignments, grading exams, and conducting discussion sessions.
- **Subject Guide** for Quantum Mechanics course at IIT Delhi in Fall 2018; held doubt sessions for 40^+ UG freshers.

Relevant Coursework and Technical skills

- **Graduate Courses** - Deep Learning for Robotic Manipulation*, Robotic Perception*, Artificial Intelligence, Machine Learning, Robotics, Analysis of Algorithms, Digital Image Analysis (* currently enrolled)
- **Programming Languages** - Python, C++, MATLAB, Typescript, Ocaml, Java, PostgreSQL, NodeJS, VHDL
- **AI** - NLP (Large Language Models, Machine Translation, Feature Engineering, etc), Vision (Segmentation, Feature Detection, etc), Deep Learning (Transformer, RNN, CNN, etc), Machine Learning (Regression, EM, Optimization, etc)
- **Robotics** - ROS, Robot Calibration, RL (SAC, PPO, etc), Planning (A*, RRT*, etc), Simulation (Softgym, MuJoCo)
- **Technologies** - PyTorch, Tensorflow, Docker, Sklearn, OpenCV, React Native, Splunk, Kubernetes, Linux, AutoCAD