

SAURAV KAMBIL

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Education

Carnegie Mellon University, Pittsburgh PA

Master of Science in Mechanical Engineering - Research

May 2024

GPA 4.0/4.0

Indian Institute of Technology, Indore, India

Bachelor of Technology in Mechanical Engineering

May 2022

GPA 3.7/4.0

Relevant Coursework

- Planning for Robotics
- Optimal Control and RL
- Modern Control Theory
- Deep Learning
- Computer Vision
- Manipulation Mechanics
- Machine Learning and AI
- Trustworthy AI

Experience

Carnegie Mellon University

Aug 2022 - Present

State Estimation of Cloth with Dr. Zachary Manchester

Pittsburgh, PA

- Pioneered the use of an unscented Kalman filter for cloth state estimation, a first in the field, employing April tag mesh markers for 3D position tracking via camera data, enabling unprecedented precision in gravity drop test analyses
- Advanced cloth particle simulation using Julia, C++, and Python across Dojo and Codimensional Incremental Potential Contact simulators; executed trajectory optimization via CMAES for cloth movement, referencing states in Blender sim
- Transitioning to EKF-based state estimation for in-air cloth manipulation with a robotic arm in real world study

Assistive Feeding Robot with Dr. Zackory Erickson

- Developed 'ToolflowNet', a learning-based control for robotic tool movement forecasting, trained on 50 demonstrations for efficient food scooping with a 6-DOF arm, incorporating RGBD camera feedback via ROS
- Applied Imitation Learning for the Ufactory X-Arm 6 to precisely scoop specified food quantities, achieving 92% accuracy in 50 trials; employed Keras to build a neural network predicting end-effector positions

Orbital Mekatronik Systems Pvt. Ltd.

May 2019 – Sept 2019

Smart Area Sensor for Automation Line

Mumbai, India

- Designed the 'Pick-to-Light' Sensor in Solidworks, generating annual revenue of USD 50,000+; Indian Patent: 498614

Academic Projects

Planning and Decision Making in Robotics | C++, ROS, Docker, Gazebo-Rviz, Stretch Robot

Aug 2023

- Designed a multi-goal RRT* path planner with legibility in C++, integrated with AnyGrasp AI and RealSense for grasp optimization in cluttered environments, tested in a ROS-enabled Gazebo-RViz Docker simulation on the Stretch robot
- Developed an efficient path planning algorithm using temporal backward Dijkstra and A* search in C++, enabling rapid, obstacle-navigating robot movement in grid-based 2D simulations, balancing speed & path cost for optimal performance
- Evaluated and optimized four sampling-based planners (RRT, RRT*, RRT Connect, PRM) for an N-DOF robotic arm, balancing speed, reliability, and path quality in 2D visualization setup

Deep Learning Innovations in Speech and Vision | Pytorch, CNN, RNN, LSTM, GRUs, CUDA, GCP

Jan 2023

- Enhanced Automatic Speech Recognition by generating synthetic speech with VITS synthesizer and developing a Listen-Attend-Spell-based ASR system, blending synthetic and real speech data for improved recognition accuracy
- Built deep learning models in NumPy, including MLPs, CNNs, RNNs with GRU and CTC decoding, and implemented sequence generation with Beam search in language models, demonstrating algorithmic and architectural proficiency
- Developed a 72M parameter CNN model for facial recognition and verification, inspired by ArcFace, achieving 92.3% accuracy in facial classification and 67% accuracy in verification trained on a large dataset of 140,000 images.
- Crafted an 18M parameter RNN with CNN, bi-LSTM layers for long-term contextual dependencies, and pBLSTM layers to effectively downsample input sequence time-resolution for accurate speech-to-phoneme transcription.

Autonomous Vehicle Control Analysis in Webots Simulator | EKF-SLAM, LQR, MPC, Webots

Nov 2022

- Engineered an advanced autonomous vehicle controller in Webots, featuring LQR, EKF SLAM with map feature analysis, and a detailed vehicle dynamics model, aimed at enhancing navigation and state estimation for optimal path tracking
- Conducted a comparative study of LQR and MPC strategies for precise autonomous control in Webots, optimizing control and dynamic response on a race track simulation to complete circuits in minimal time

Technical Skills

Languages and Packages: Python, C++, ROS, Docker, Gazebo-Rviz, Julia Pytorch, Tensorflow, OpenCV, CUDA

Tools and Framework: Linux, X-Arm Robot, SOLIDWORKS, Ansys, Simulink, MATLAB, GCP, AWS, Intel Realsense

Technical Skills: State Estimation, Imitation Learning, Path Planning, Robot Controls, Deep Learning, Physics Simulators