MUKUNDAN CHARIAR

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EDUCATION

Carnegie Mellon University   *Pittsburgh, PA*
Master of Science in Mechanical Engineering   *May 2025*
 • Selected Courses: Introduction to Deep Learning, ST - Computer Vision for Engineers.
Manipal Institute of Technology   *Manipal, India*
Bachelor of Technology in Mechatronics   *June 2023*
 • Selected Courses: Machine Vision and Image Processing, Machine Learning.

SKILLS

Programming Languages: Python, Java, C, C++, Embedded C, Assembly, SQL, Matlab, Julia.
Libraries: PyTorch, NumPy, Pandas, OpenCV, Jax, MuJoCo.
Application Software: Fusion 360, MakerBot Print, Matlab Simulink.

PROJECTS

Learning Human Locomotion Reward Functions using Inverse Reinforcement Learning   *January 2025 - May 2025*
Carnegie Mellon University: Course Project   *Pittsburgh, PA*
 • Developed a Bidirectional GAN framework to infer reward functions for human locomotion trajectories.
 • Integrated a VAE-GAN architecture to stabilize discriminator training and extract state-based reward signals for reinforcement learning agents.

Robust Bipedal Locomotion on Uneven Terrain   *January 2025 - May 2025*
Carnegie Mellon University: Course Project   *Pittsburgh, PA*
 • Trained a 12-DOF bipedal robot in MuJoCo using Proximal Policy Optimization to walk on rough terrain without explicit trajectory planning.
 • Benchmarked learned policies against iLQR with trajectory tracking, revealing robustness gaps in model-based control.

Physical-Therapy Assessment with Uncalibrated Cameras and Inertial Sensors   *August 2023 - December 2024*
Carnegie Mellon University: Research Project   *Pittsburgh, PA*
 • Designed an auto-calibration pipeline to fuse uncalibrated multi-view video and IMU data, enabling markerless 3D pose estimation using a multi-stage SMPL mesh fitting framework.
 • Trained machine learning and heuristic-based classifiers for detecting physical therapy movement errors, achieving up to 60.0% F1 score - comparable to inter-clinician agreement - and 93.2% recall using joint angle statistics in data-limited settings.

Machine Learning for Squat Analysis and Correction   *January 2023 - June 2023*
Manipal Institute of Technology: Research Project   *Manipal, India*
 • Collected a custom dataset of squat exercises from volunteers and applied photogrammetry techniques to reconstruct 3D joint positions from MediaPipe-extracted 2D body keypoints.
 • Designed and trained a neural network to classify squat form correctness, achieving 94.0% classification accuracy.
 • Published paper: 'AI Trainer: Autoencoder Based Approach for Squat Analysis and Correction'. DOI: 10.1109/ACCESS.2023.33160090.

Bio Inspired Designs   *May 2022 - December 2022*
Manipal Institute of Technology: Research Project   *Manipal, India*
 • Engineered six unique bio-inspired internal structures (e.g., rhombic dodecahedron, hexagram) using Fusion 360, based on natural load-bearing systems like honeycombs and bird bone analogs.
 • Reduced material consumption by up to 65% while retaining 70–90% of solid block load-bearing capacity, enabling lightweight, cost-efficient designs for structural and impact-resistant applications.

EXPERIENCE

Rex Engineering and Metal Works   *Thane, India*
Floor Intern   *June 2022 - July 2022*
 • Studied operations on CNC machines, helped inspect completed jobs, created models, generated g-codes for jobs using Fusion 360, AutoCAD and MasterCam Mill 9.
 • Fabricated a CNC milled tray under supervision of senior engineers.

LEADERSHIP

Vice President   *June 2021 - September 2022*
Institution of Engineers, Mechatronics Students' Chapter, Manipal   *Manipal, India*
 • Organized multiple events, coordinated over projects and mini projects, volunteered for collaboration with other student clubs, organized and budgeted funds for the club and projects under the club, held recruitment sessions, etc.
 • Managed a board of 8 members and ran weekly meetings to oversee progress in essential parts of the chapter.
 • Led chapter of 120+ members to work towards goals that promote community service, academics, and unity.