MUKUNDAN CHARIAR

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EDUCATION

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

SKILLS

<u>Programming Languages:</u> Python, C++, C, Julia, Embedded C, Assembly, SQL, Java, MATLAB.
<u>Libraries:</u> PyTorch, NumPy, MuJoCo, OpenCV, Open3D, SMPL/SMPL-X, JAX, Pandas.
<u>Tools:</u> Git, Weights & Biases, MuJoCo MPC, COLMAP.

PROJECTS

<u>CppMjStep: Efficient Differentiable Simulation with MuJoCo and PyTorch</u>   *May 2025 - July 2025*
Independent: Open-Source Package   *Pittsburgh, PA*
 • Engineered a C++ PyTorch autograd op for MuJoCo with batched, multi-step rollouts and sensor passthrough;
 leveraged MuJoCo's derivative routines and optional multithreading in forward/backward to deliver >2× faster
 differentiable rollouts on large models and batches.
 • Open-sourced a pip-installable library with benchmarks and examples enabling scalable RL/control training.

<u>Learning Human Locomotion Reward Functions using Inverse Reinforcement Learning</u>   *January 2025 - May 2025*
Carnegie Mellon University: Course Project   *Pittsburgh, PA*
 • Developed an inverse RL pipeline using BiGAN and VAE-GAN on PPO trajectories with a GAIL trajectory discriminator,
 stabilizing training and improving episode length and reward quality in humanoid running.

<u>Robust Bipedal Locomotion on Uneven Terrain</u>   *January 2025 - May 2025*
Carnegie Mellon University: Course Project   *Pittsburgh, PA*
 • Learned PPO locomotion for a 12-DOF biped in MuJoCo; designed clock-based rewards and sensor features, and
 evaluated against receding-horizon iLQR on custom uneven and staircase terrains to assess robustness.

<u>Physical-Therapy Assessment with Uncalibrated Cameras and Inertial Sensors</u>   *August 2023 - December 2024*
Carnegie Mellon University: Research Project   *Pittsburgh, PA*
 • Built an auto-calibration pipeline fusing uncalibrated multi-view video and IMU for markerless 3D pose via SMPL;
 engineered joint-kinematics features from noisy signals.
 • Trained ML and heuristic classifiers for movement error detection, achieving 60.0% F1 and 93.2% recall with 38
 subjects and Leave-P-Subjects-Out, P=8.

<u>Neural-Symbolic Visual Question Answering with Transformer Models</u>   *January 2024 - May 2024*
Carnegie Mellon University: Course Project   *Pittsburgh, PA*
 • Adapted MDETR for CLEVR VQA to 70.5% test accuracy, conducted attention-head ablations and replaced RoBERTa
 with ALBERT to study multimodal alignment, and migrated NS-VQA/Mask R-CNN pipelines to modern PyTorch.

<u>Machine Learning for Squat Analysis and Correction</u>   *January 2023 - June 2023*
Manipal Institute of Technology: Research Project   *Manipal, India*
 • Curated an end-to-end squat pipeline: collected a volunteer dataset, extracted 2D keypoints with MediaPipe,
 reconstructed 3D joints via photogrammetry, and augmented with interpolated motions.
 • Trained a neural network to classify squat form, achieving 94.0% accuracy.
 • Published: Chariar, M. *et al.* "AI Trainer: Autoencoder-Based Approach for Squat Analysis and Correction." *IEEE
 Access*, 2023. DOI**:** 10.1109/ACCESS.2023.3316009.

EXPERIENCE

<u>24-703 Numerical Methods in Engineering</u>   *Carnegie Mellon University, Pittsburgh, PA*
Course Assistant   *January 2025 - May 2025*
 • Facilitated office hours/recitations; proctored and graded assignments; provided feedback to 30 students.

<u>24-678 Special Topics: Computer Vision for Engineers</u>   *Carnegie Mellon University, Pittsburgh, PA*
Course Assistant   *August 2024 - December 2024*
 • Coordinated office hours, proctored and graded assessments, and delivered detailed feedback to 60 students as part of
 the course assistant team.

LEADERSHIP

<u>Vice President</u>   *June 2021 - September 2022*
Institution of Engineers, Mechatronics Students' Chapter, Manipal   *Manipal, India*
 • Directed 120+ member chapter with an 8-person board, planned and budgeted chapter events; coordinated funding.