

# SRECHARAN SELVAM

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## Education

### Carnegie Mellon University

*Master of Science, Research: Machine Learning*

Relevant Coursework: Machine Learning, Deep Learning, Advanced Computer Vision, Visual Recognition

May 2025

Pittsburgh, PA

GPA - 4/4

## Research Experience

### Kantor Lab, Carnegie Mellon University [[GitHub](#) ↗ ]

Aug 2023 – Present

*Graduate Research Assistant*

Pittsburgh, PA

- Engineered real-time vision system for autonomous leaf grasping integrating YOLOv8 segmentation, RAFT-Stereo depth estimation & custom CNN (GraspPointCNN), featuring self-supervised data generation and weighted decision framework.
- Built self-supervised data generation pipeline using geometric features (SDF, gradients), eliminating manual annotation.
- Finetuned YOLOv8 on custom dataset of **900+** plant images, achieving **68% mAP@[0.5:0.95]** for leaf mask generation.
- Optimized RAFT-Stereo pipeline for precise grasping, attaining sub-pixel accuracy (**<0.5px**) on 1080p stereo pairs.
- Trained GraspPointCNN with spatial attention for grasp point selection, reaching **97.09%** recall and **92.59%** precision.
- Developed a confidence-weighted decision system merging geometric scoring algorithms (70-90%) and CNN predictions (10-30%), improving leaf grasping success rate by **4.66%** over scoring-only baseline across **150** test cases.

## Professional Experience

### Hanon Systems [[GitHub](#) ↗ ]

Jan 2023 – June 2023

*Machine Learning Engineer Intern*

Chennai, India

- Architected a real-time 3D hand tracking and gesture recognition system in Unity AR, enabling over **50** automotive technicians to practice precise component placement and assembly procedures for virtual HVAC systems.
- Implemented Extended Kalman Filter for robust 3D hand tracking, with **< 7.5mm** ground truth tracking accuracy.
- Designed geometric analysis pipeline for static hand gesture recognition (grab, pinch, point, open palm) with **97% acc.**
- Trained custom GRU neural network to recognize dynamic hand motions (swipe, circle, wave) attaining **< 30ms** latency.
- Optimized hand tracking using ONNX, delivering **33%** faster inference with **50%** smaller model size than MediaPipe.
- Integrated WebSockets between Python backend and Unity frontend, driving **30Hz** data streaming with **<1KB** packets.

### Vee Ess Engineering [[GitHub](#) ↗ ]

Jul 2022 – Dec 2022

*Computer Vision Engineer Intern*

Chennai, India

- Developed a multi-camera vision system using YOLOv5 to enhance high-value material recovery amidst low-value debris through material sorting and conveyor speed modulation, demonstrating **96.8% mAP@[0.5:0.95]** detection accuracy.
- Accelerated dataset creation using fine-tuned Mask R-CNN for auto mask generation, creating **43k+** segmented images.
- Boosted detection robustness through custom data augmentation pipeline, incorporating synthetic object compositing.
- Minimized false positives in material counting through worker-interaction filtering, combining ROI-based MOG2 (Mixture of Gaussian) background subtraction with YOLOv5 person tracking and worker-induced occlusion handling.
- Achieved **<15ms** inference latency with **74.5% mAP@[0.5:0.95]** worker detection precision for safety monitoring.

## Projects

### Multi-Model Stock Prediction with NLP & Automated Trading [[GitHub](#) ↗ ]

Oct 2024 – Feb 2025

- Built end-to-end automated trading system combining stock prediction (bidirectional LSTM + XGBoost) with real-time FinBERT market sentiment analysis (news/Reddit/SEC), yielding **55-65%** directional accuracy for multiple timeframes.
- Created a dynamically-weighted ensemble model using LSTM (attention-based time-series) and XGBoost (**35+** market features) with adaptive learning rate, attaining MAE of **0.27-0.44%** across intraday timeframes (5m, 15m, 30m, 1h).
- Leveraged FinBERT to process **360+** financial texts, boosting **~5%** prediction accuracy using 12 temporal features.
- Simulated trading via Tradier API with risk management, showing **58.5%** win rate and **+0.32%** net return.

### Deep Image Synthesis with GANs, VAEs, and Diffusion Models [[GitHub](#) ↗ ]

Apr 2024 – Jul 2024

- Benchmarked generative model architectures (GANs, VAEs, Diffusion Models) by developing custom loss functions and training pipelines on the CUB-200-2011 dataset, optimizing performance for image quality and model stability.
- Designed two GAN variants (LSGAN, WGAN-GP) implementing custom ResBlocks, with gradient penalty optimization.
- Applied  $\beta$  annealing to improve VAE reconstruction fidelity while balancing sample diversity, and accelerated diffusion via DDIM sampling with **10 $\times$**  fewer steps (100 vs 1000), maintaining comparable quality (**FID: 38.32 vs DDPM 34.73**).
- Delivered best image quality with WGAN-GP (**33.07 FID**), outperforming diffusion models by **4.7%**.

## Skills

**Frameworks:** PyTorch, TensorFlow, OpenCV, scikit-learn, pandas, ROS2, ONNX, MLflow, Weights & Biases, Seaborn

**Languages:** Python, C++, JavaScript, SQL      **Deployment:** AWS (SageMaker, EC2), GCP(Vertex AI), Azure, Docker

## Publications

Lakshminarayanan A K, Vishwa S, Srecharan Selvam et al. "Role of oscillation frequency and amplitude on the microstructure & properties of linear friction welded Ni. Al. CuSn. joints" Physica Scripta, Vol. 99, No. 6