Ardalan Aryashad

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Education

University of Southern California, PhD in Mechanical Engineering, GPA: 3.88/4.0 — Aug 2023 – present

University of Southern California, M.Sc in Computer Science, GPA: 3.88/4.0 — Jan 2026 – present

Sharif University of Technology, B.Sc in Mechanical Engineering, GPA: 18.18/20.0 — Sept 2018 – Aug 2023

Publications

VLAG: Graph-Based Planning for Vision-Language-Action Models in Long Horizon Manipulation Tasks

Ardalan Aryashad, Y. Jin, *Proceedings of ASME 2025 International Design Engineering Technical Conferences & Computers and Information in Engineering Conference, IDETC2025*, PDF

From Filters to VLMs: Benchmarking Defogging Methods through Object Detection and Segmentation Performance

Ardalan Aryashad, P. Razmara, A. Mahjoub, S. Azizi, M. Salmani, A. Firouzkouhi, Accepted to Workshop on Image/Video/Audio Quality Assessment in WACV 2026, PDF, Website

Research Experience

Research Assistant, Impact Laboratory - USC — Aug 2023 – present

- Developed a graph-based planning framework for **vision-language-action** models in long horizon manipulation tasks.
- Trained a high accuracy **vision model** using CLIP features, achieving **95% accuracy** of environmental key states prediction.
- **Fine-tuned a sentence transformer model** to reach **98% instruction-to-task matching accuracy** for reliable task selection.
- Trained an **Transformer based action model** to operate from vision and language inputs, and validated on CALVIN dataset.
- Designed a **single and multi agent** assistant workflows for mechanical systems engineering and design tasks.
- Created a Visual Paradigm **plugin that auto generates SysML diagrams** for mechanical systems using a **custom LLM agent**.
- Initiated to **build a benchmark dataset** to evaluate different LLMs on SysML diagram design tasks.
- Implemented **text extraction pipeline** and integrated the outputs into a **RAG system** for the agent.

Research Assistant, Micro-Nano Systems Lab - SUT — Aug 2022 – June 2023

- Conducted **system identification experiments** on a PCR microsystem prior to designing a controller.
- Designed a two-degree-of-freedom **PID controller** to reduce settling time by **17%** and eliminate overshoot.
- Trained a neural network predictive model on experimental data and implemented it in a **Model Predictive Control (MPC)**.
- Used the Matlab/Simulink to design and simulate the MPC on the identified system model and executed it on a Raspberry Pi.

Research Assistant, Experimental Solid Mechanics and Manufacturing Lab (ESMML) - SUT — Sept 2021 – June 2022

- Reviewed literature to develop a list of essential parameters for choosing pipe material in water networks.
- Conducted surveys and interviews with design engineers to rank the importance of parameters during design process.
- Researched, modeled, and simulated **surge pressure phenomena** using **finite element method** in Iranian PE pipes.

Skills

Software: Matlab, Simulink, Simscape, SolidWorks, Abaqus, NX, Ansys, Proteus, Cursor

Programming Languages and Tools: Python (Pytorch, Mujoco, Pybullet, lerobot), C/C++, Linux, Git, AWS, Slurm

Prototyping: Arduino, Raspberry Pi, 3D Print, Lathe, Soldering, Serial Communication, Servo/Stepper Motor Control

Professional Experience

Industrial Saipa Heavy Dies Manufacturing, Student Intern — June 2020 – Aug 2020

- Supported maintenance department operations by assisting with equipment maintenance tasks.
- Automatinc the preventive maintenance tasks by developing an excel based maintenance schedule.
- Improved the maintenance department workflow by developing a web based maintenance request system.

Automotive Industries Research & Innovation Center of SAIPA (AIRIC), Student Intern — June 2021 – Aug 2021

- Researched and simulated regenerative braking performance for Saipa Shahin on a standardized test track.
- Developed a script to convert Google Maps data into road profile data formats compatible with simulation environments.
- Simulated regenerative braking across multiple real-world routes and analyzed performance against standardized track.

Volunteer Experience

Peer Reviewer,

- IDETC-CIE, WACV, and the International Journal of Computer Integrated Manufacturing.

Teaching Assistant, Mechanical Engineering Department

- Applied Finite Element, Control Design, Mechanical Design, Embedded Systems, Dynamic, and Static courses.

Mentor, Impact Laboratory - USC

- Mentored students on implementing a Retrieval-Augmented Generation (RAG) module for an AI Agent assistant.
- Guided students in conducting hyperparameter optimization studies, improving robotic manipulation policy performance.
- Led a team of students to collect a dataset of diagrams and UML code representing mechanical engineering concepts.

Projects

USC Formula Student Racing - Suspension and DAQ Member

- **Design Finals (Top 10)** at FSAE Michigan 2024, presenting suspension design and answering technical judge questions.
- **Developed a quarter-car suspension model** in MATLAB and conducted an optimization study to maximize the grip force.
- **Built a Raspberry Pi NAS** for sharing the MoTeC ECU log files between different subteams during test and competition day.
- **Developed a local web server** to gather the setup sheet data from the subteams and injects the values into the log files.

Steering LLM via Sparse Autoencoder Features

- Constructed **flow graphs** using feature co-activation and developed the **CircuitSteer** to steer multi-layer circuits.
- **Benchmarked generation quality** on steered Gemma-2-2B and Llama-3-8B using the RealToxicityPrompts dataset.
- **Reduced toxicity** by up to **4x** as measured by automated toxicity scores and LLM-as-a-judge evaluations.
- **Increased fluency** by **1.88x** and minimized perplexity degradation compared to baseline (CAA) method.

Benchmarking Fog removal methods link

- Designed a **benchmark pipeline** to measure the fog-removal methods performance on object detection and segmentation.
- Studied the performance of the pipelines on synthetic and real-world fog datasets and compared the results.
- **Automated the evaluation of 54 pipelines** using YOLO, Mask2Former, and FiftyOne within a single CI run.
- Demonstrated low generalizablity of trained models on synthetic fog when testes on real-worl cases

Simulation and Control of Biped Robot link

- Developed a **2D biped robot model** in MATLAB Simscape, modeling physical constraints and contact for simulation.
- Implemented Model Predictive Control (MPC) and **gait scheduling** for forward and backward walking tasks.

Automotive Predictive Maintenance Application link

- Preprocessed an automotive maintenance dataset by cleaning and normalizing for training and evaluation.
- Trained and tested **multiple classification algorithms and models** on the automotive maintenance dataset.
- **Developed an application** for PC and mobile devices allowing users to receive predictions using the trained models.

Optimal Control of Semi-Active Suspension System

- Developed an **active suspension model** in Simulink for a quarter-car model to analyze the ride dynamics.
- Tested different controller methods for damper coeffecient to maximize the ride comfort during different road conditions.
- Optimized a PID controller parameters using **Genetic Algorithm (GA)** to minimize body displacement response to bumps.

Inwardly Folding Umbrella Design

- Identified design improvements for water management and ergonomics through user interaction studies.
- Designed an inwardly folding mechanism to enhance convenience and created detailed CAD model using **SolidWorks**.
- Validated mechanical motion by constructing 2 types of prototypes via current design of umbrella parts and **3D printing**.

Honors and Awards

- Andrew and Erna Viterbi Graduate Student Fellowship, Department of Aerospace & Mechanical Engineering, USC, 2023.
- Best Teaching Assistant in Mechanical Engineering Department, voted by students, Sharif University of Technology, 2022.
- Ranked 146th out of 144,000 students in the National University Entrance Exam, Mathematics branch, Iran, 2019.

References

- Relevant references, recommendations, and certificates of qualification will be made available at request.