Omar Garib

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Research Interests

Intelligent systems for safety-critical autonomy; multimodal perception & interaction (speech/vision/3D spatial reasoning); human-in-the-loop decision support; robotics & human–robot teaming.

Education

Georgia Institute of Technology — Atlanta, GA

M.S. in Computational Science & Engineering | GPA: 4.0 **Aug. 2024–Current**

- Aerospace Systems Design Lab (ASDL), Digital Engineering Division.
- **Focus:** intelligent-AI systems; automatic speech recognition (ASR); multimodal perception; LLM-based automated document extraction.

B.S. in Aerospace Engineering **Aug. 2020–May 2024**

Research Experience

Aerospace Systems Design Lab (ASDL) — Atlanta, GA **Aug. 2024–Current**

Graduate Research Assistant (Advisors: O. J. Pinon Fischer, D. N. Mavris)

Human-in-the-Loop Multimodal Simulation Environment for Aviation Conflict Detection:

- Built a modular simulation testbed (Godot + FastAPI) with REST/JSON interfaces to easily swap models across ASR (automatic speech recognition), vision, decision, and TTS (text-to-speech); supports pilot/ATC-in-the-loop studies.
- Released a scripted scenario suite (terminal and en route conflicts) and a reference end-to-end pipeline; enables rapid comparison and iteration of intelligent-system architectures across hundreds of reproducible runs.

GAN-Based Radio-Noise Augmentation and Fine-Tuned ASR for Air Traffic Control:

- Trained a generative adversarial network (GAN) radio-noise augmenter on air traffic control (ATC) corpora and fine-tuned Whisper; achieved 3.58% word-error-rate (WER) on real ATC (vs. 14.66% baseline; a 75.6% relative reduction).

Multimodal Document Extraction for Simulation Repositories:

- Automated document/figure extraction and tagging via optical character recognition (OCR) + vision-language model (VLM) embeddings, and retrieval-augmented generation (RAG) with a large language model (LLM); improved discoverability of engineering artifacts.

NASA Langley Research Center (LaRC) — Hampton, VA (remote) **May 2025–Current**

Research Collaborator (Digital Transformation Initiative)

- Implemented ML pipelines and interactive visual analytics to accelerate engineering decision-making.
- Built an automated document-extraction pipeline for engineering PDFs to facilitate integration into pre-existing NASA systems/models.

Industry Experience

Tesla — Palo Alto, CA **Aug. 2023–Dec. 2023**

Mechanical Design Engineer Intern — Battery Structures

- Owned the design of 15+ battery-pack structural components; applied CAD & GD&T toward NHTSA collision-safety goals.
- Conducted 20+ FEA studies (Ansys/SimSolid); delivered a lifting system that improved test/manufacturing maneuverability and cut cost by ∼35%.

Research Publications & Submissions

- **O. Garib**, J. D. Kambhampaty, O. J. Pinon Fischer, D. N. Mavris. "AIRHILT: A Human-in-the-Loop Testbed for Multimodal Conflict Detection in Aviation." *IEEE Int. Conf. on Robotics and Automation (ICRA). in submission* link.
- **O. Garib**, M. Ghanem, O. J. Pinon Fischer, D. N. Mavris. "SimuGAN-Whisper-ATC: Generative Noise Injection for Improved Automatic Speech Recognition in Air Traffic Control." *AIAA SciTech.* accepted abstract.
- **O. Garib***, M. M. Davis*, A. J. Kennedy, J. D. Kambhampaty, O. J. Pinon Fischer, D. N. Mavris. "Accelerating Knowledge Discovery in Engineering Simulation Repositories through Multimodal, LLM-Driven Metadata Tagging." *AIAA SciTech.* accepted abstract.

Coursework Projects

Dynamic Rollout in Model-Based Policy Optimization (MBPO) — *Deep Reinforcement Learning*

- Designed adaptive rollout schedulers (uncertainty-aware truncation, error/stability gating, gradient-based horizons) achieving ∼25% higher return vs. fixed schedules on Hopper-v5 while avoiding long-horizon collapse.

Semantic Segmentation with PSPNet and Transfer — *Computer Vision*

- Developed & trained a Pyramid Scene Parsing Network (PSPNet) for CamVid and adapted it to KITTI road segmentation, achieving ∼0.86 mIoU.

Visual Geometry & Panorama Stitching (from scratch) — *Computer Vision*

- Estimated projection and fundamental matrices; implemented Random Sample Consensus (RANSAC); built custom Direct Linear Transform (DLT)/singular value decomposition (SVD) homography estimation with manual warping/blending.

LoRA-Fine-Tuned LLM for Dialog — *Natural Language Processing*

- Fine-tuned 4-bit OPT-1.3B with parameter-efficient fine-tuning/Low-Rank Adaptation (PEFT/LoRA); implemented top-p and beam search.

Technical Skills

ML/AI: Python, PyTorch, TensorFlow, MATLAB, Whisper (ASR), YOLO, OpenCV, FastAPI, REST/JSON, LLM/RAG, Vector DBs.