MARGI PANDYA

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Research Interests

My research lies at the intersection of multimodal learning, computer vision, and generative AI, with a focus on:

- **Generative AI** approaches including diffusion models and large language models for image generation and understanding.
- Development of **vision-language models** (VLMs) for robust multimodal learning, especially under limited data regimes.
- Weakly supervised and low-data learning techniques for **scene understanding** through semantic segmentation and object detection.

Experience

Mar 2025
Nov 2024

Graduate Researcher   **San Diego, CA, USA**
Statistical Visual Computing Lab, UCSD

- Spearheaded research in amodal segmentation and completion models for intelligent image editing, enabling visual reasoning via natural language prompts to reconstruct occluded objects.
- Evaluated 4+ vision-language models (VLMs) for multimodal inference, identifying limitations in occlusion handling through visual/language prompt analysis.
- **Technologies:** Multimodal Learning, Diffusion Models, Large Language Models, Kubernetes

June 2024
Jan 2024

Research Assistant – Thesis   **Tamil Nadu, India**
National Institute of Technology, Tiruchirappalli

- Engineered a CNN and Attention-based model for weakly supervised multi-object foreground segmentation, surpassing existing methods in performance.
- Curated a multi-class object detection dataset by modifying Cityscapes, overcoming COCO's single-class restriction through label reassignment (**10+ categories**).
- Automated image preprocessing pipelines with PyTorch and OpenCV, decreasing model training time by 30% and overall development time by **15%**.

June 2024
May 2023

Computer Vision Researcher– ContraFusionNet   **Uttar Pradesh, India**
Indian Institute of Technology, Kanpur

- Developed a student-teacher framework leveraging **knowledge distillation and contrastive loss** for semantic segmentation, achieving high performance with only **5,000 training images** by integrating **CNNs** (fine-grained feature extraction) and **Transformers** (global context).
- Improved segmentation mIoU by **26%**, surpassing state-of-the-art models in low-data regimes (ContraFusionNet).

Education

Current **Sept 2024**	**University of California, San Diego** MS, Electrical and Computer Engineering | **GPA: 3.75/4**	**California, USA**
May 2024 **Sept 2020**	**National Institute of Technology, Tiruchirappalli** B.Tech, Electrical and Electronics Engineering | **CGPA: 3.96/4**	**Tamil Nadu, India**

Relevant Coursework

CSE 252D: Advanced Computer Vision, ECE 285: Deep Generative Models, ECE 269: Linear Algebra, ECE 225: Probability, ECE 271A: Statistical Learning

Technical Skills

Languages & Platform	Python, MATLAB, GiT, VS Code, Windows, Linux Ubuntu, LaTeX, Microsoft
Frameworks & Libraries	PyTorch, Tensorflow, Keras, JAX, TFLite, OpenCV, HuggingFace, Transformers, Scikit-Learn, LangChain
Cloud CI/CD	Nautilus, AWS, Google Cloud, GitHub Actions, TensorRT

Publications (* denotes equal contribution)

1. **Energy Management in DC Microgrid Using Machine Learning** ⬀
   M. Pandya, A. S. Rana, A. Farhan M A (* = Equal Contribution)
   *2023 International Conference on Recent Advances in Electrical, Electronics Digital Healthcare Technologies (**REEDCON**), New Delhi, India, 2023*

2. **Image Edge Detection Using Fuzzy Logic Controller** ⬀
   A. K. Pandey*, H. R. S. S. N. Chatla*, **M. Pandya***, A. Farhan M A, A. S. Rana (* = Equal Contribution)
   *2023 International Conference on Recent Advances in Electrical, Electronics Digital Healthcare Technologies (**REEDCON**), New Delhi, India, 2023*

Projects

RAG for Research Papers | *GitHub*   Apr 2025 – May 2025

Skills: LangChain, LangGraph, RAG, Python, PyTorch.
Developed a **Retrieval-Augmented Generation (RAG)** system leveraging SciBERT embeddings and FAISS-HNSW similarity search to semantically retrieve, summarize, and extract insights from academic papers, supporting both corpus-based and user-uploaded PDF inputs.

AI-Powered Social Media Ad Campaign Creator | GitHub   Apr 2025 – May 2025
Skills: Python, LLM, Flask.

- Built a modular **minimum viable product (MVP)** to automate ad campaign creation using Google Gemini LLM. Included prompt engineering, CLI support, structured brief handling, and Zapier integration for simulated LinkedIn deployment.

Building a Large Language Model from Scratch   Jan 2025
Skills: LLM, Attention, PyTorch

- Implemented a GPT-style Transformer in PyTorch including tokenizer, attention, and positional encoding. Fine-tuned for text classification using LoRA and hyperparameter optimization.

Building Long Exposure in Post-Processing   Oct 2024 – Dec 2024
Skills: Python, OpenCV, Optical Flow Algorithms

- Applied motion blur to regions of interest (ROIs) using optical flow and frame interpolation. Designed a novel **re-arrangement block** for handling motion blur transitions between frames.
- Benchmarked results against neural network-based methods and analyzed limitations of traditional and deep-learning techniques.

Image Edge Detection using Fuzzy Inference | GitHub   Oct 2022 – Dec 2022
Skills: Edge Detection, OpenCV

- Implemented fuzzy inference-based edge detection in Python and evaluated against conventional filter methods.
- Integrated an open-loop fuzzy logic controller to improve edge detection in medical images, successfully identifying abnormalities in MRI scans.

Pest Detection System | GitHub   Feb 2023 – Apr 2023
Skills: Object Detection, Raspberry Pi, TensorFlow Lite

- Captured crop images using a Raspberry Pi camera and deployed object detection via TensorFlow Lite on-device.
- Improved crop monitoring and early pest detection, contributing to food security and agricultural sustainability.

Positions of Responsibility

Head of Machine Learning, DataByte   May 2023–May 2024

- Led a computer vision team and supervised two projects: an animal detection initiative aimed at reducing hazards caused by snakebites, and an AI-based yoga instructor named YogaPal.
- Secured a $100 investment from Bharat Petroleum Corporation Limited (BPCL) and garnered interest from various startups and companies to hire and collaborate with DataByte.
- Conducted workshops for 130+ aspiring students during Vortex 2023 and spearheaded the monthly article series AI Odyssey on Medium.

Deputy Manager for Workshop Team, Electrical and Electronics Association   May 2022–May 2024

- Hosted an outreach workshop in the CURRENTS 2023, EEE department symposium, providing insights about Image Classification using PyTorch.
- Guided eager learners through the intricacies of Deep Learning.

Extracurricular

- Participated in Marathon conducted by NITT Sportsfest, 2022, 2023.
- Participated in 400 meters running at NITT Sportsfest and qualified for finals out of 30 students, March 2022