Zuha Fatima Gilani

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ABOUT ME

Computer science researcher focused on building robust and clinically relevant AI systems for healthcare. My work involves designing rigorous evaluation frameworks to uncover critical failure modes that standard metrics miss. I am eager to apply this analytical approach to challenging problems in computational health, from medical imaging to predictive deep learning models.

EDUCATION AND TRAINING

2021/11 – 2025/09 Islamabad, Pakistan
BSC Institute of Space Technology

Website www.ist.edu.pk | **Field of study** Computer Science |

Thesis AcuCare: Integrating Image Processing and Feature-Based Learning into a Mobile App for Acne Detection and Classification.

RESEARCH EXPERIENCE

2025/09 – 2025/12
Reliability Auditing of Medical Image Segmentation under Signal Variability: The Catastrophic Failure Rate Framework

Lead Researcher — Institute of Space Technology

- Introduced a novel Catastrophic Failure (CF) Rate metric to audit medical imaging models, exposing high failure rates (up to 25.5%) in classical segmentation algorithms that were masked by average Dice scores.
- Designed and executed a controlled benchmarking study on the PH^2 dataset, employing Fuzzy C-Means and K-Means clustering.
- Validated findings with non-parametric statistical testing (Wilcoxon Signed-Rank, p=0.010) and logit-transformed confidence intervals.
- *Manuscript under peer review at Biomedical Signal Processing and Control (Elsevier)*

2024/11 – 2025/04
AcuCare: Integrating Image Processing and Feature-Based Learning into a Mobile App for Acne Detection and Classification

Lead Developer & Researcher — Institute of Space Technology

- Engineered a lightweight, interpretable ML pipeline for mobile acne classification, achieving 87.7% accuracy with only 10 handcrafted features.
- Implemented feature extraction using Fuzzy C-Means/K-Means segmentation on enhanced *Lab* imagery.
- Validated feature robustness through a comparative study of five classifiers (ELM, SVM, Random Forest, KNN, LightGBM).
- The project's limitation—the lack of segmentation ground truth—directly motivated my subsequent research into AI safety and failure analysis.

Link https://drive.google.com/file/d/1qUtUtQjiKGjYe-QnmySr2WFUZLXHRkW2/view?usp=drive_link

PUBLICATIONS

Reliability Auditing of Medical Image Segmentation under Signal Variability: The Catastrophic Failure Rate Framework

Under peer review

Gilani, Z. F., Mansoor, I., Zhao, H. (2025). "Reliability Auditing of Medical Image Segmentation under Signal Variability: The Catastrophic Failure Rate Framework."

Journal Name: Biomedical Signal Processing and Control | **Publisher**: Elsevier

PROJECTS

AI Reliability Demonstrator – Ad-Hoc Robustness Audit of a Clinical AI Demo

- Conducted a manual failure mode analysis of a publicly-available dermatology AI classifier by systematically introducing image corruptions and edge-case inputs.
- Documented specific scenarios where model performance degraded unpredictably or where high confidence was maintained despite incorrect predictions.
- Highlighted the practical limitations and hidden vulnerabilities of black-box clinical AI, reinforcing the need for rigorous robustness testing beyond standard metrics.

AcuCare – AI-Powered Acne Analysis Mobile Application

- Developed full-stack Flutter application with integrated YOLOv8 detection and custom segmentation/ classification pipeline via Flask API
- Implemented multi-module system including skin assessment surveys, real-time acne analysis with treatment recommendations, and product database.

Centralized RAG Chatbot – Retrieval-Augmented QA System

- Implemented RAG pipeline using TF-IDF vectorization with cosine similarity for document retrieval and OpenRouter API with Mistral-7B for answer generation.
- Built multi-user Streamlit interface demonstrating real-time document retrieval and LLM integration with context-aware responses.

COURSES & CERTIFICATIONS

AI for Medical Diagnosis - Coursera

Completed training in applying deep learning to medical imaging, with case studies on chest X-rays and brain MRIs; emphasized diagnostic pipelines, evaluation metrics, and clinical relevance.

IBM Quantum Machine Learning - IBM Cloud

Hands-on training with Qiskit, exploring quantum feature maps, variational classifiers, and hybrid quantum–classical workflows for supervised learning tasks.

HarvardX: Linear Models and Matrix Algebra - edX

Developed a rigorous foundation in regression, statistical modeling, and matrix computations, applying linear algebra to data analysis and interpretation.

SEMINARS

Stanford Center for AI in Medicine and Imaging (AIMI) Seminar Series (Virtual Attendee)

- Engaged with keynotes on deploying robust clinical AI, including *"Closing the Gap Between AI Capabilities & Health System Readiness"* and *"Generative AI in Health"*.
- Focused on understanding the translational challenges and real-world requirements for AI models in healthcare settings.

Google Gemini: Multimodal AI & Reliability Seminar

- Explored the capabilities and architectural considerations of large multimodal models, with a focus on their potential and challenges for processing heterogeneous data in healthcare.
- Discussed the importance of robustness and reliability in next-generation AI systems that integrate text, image, and other data modalities.

GDSC Seminar: Engineering Responsible AI Applications

- Engaged in a technical workshop on MLOps and best practices for deploying maintainable and auditable AI systems.
- Discussed the engineering discipline required for building transparent and scalable AI, which forms the foundation for trustworthy clinical applications.

WORK EXPERIENCE

RESEARCH INTERN – INSTITUTE OF SPACE TECHNOLOGY – 2025/09 – 2025/12 – ISLAMABAD, PAKISTAN

- Led a research project from hypothesis to publication, taking primary responsibility for experimental design, data analysis, and manuscript composition as first author.
- Coordinated with faculty advisors to validate research direction and statistical methodologies, ensuring the robustness and academic rigor of the study submitted to Elsevier journal.

ARTIFICIAL INTELLIGENCE INTERN – EASYPAISA DIGITAL BANK – 2024/07 – 2024/08 – ISLAMABAD, PAKISTAN

Website: https://easypaisa.com.pk/

- Analyzed a dataset of 10,000+ customer interactions to identify key friction points, contributing to a 15% streamlining of digital payment workflows.
- Collaborated with cross-functional teams to enhance user experiences for payment solutions.
- Gained insights into user-centric design and scalable technology implementation

NETWORKS AND MEMBERSHIPS

2021/12 – 2023/04 Institute of Space Technology

Google Developer Student Club (GDSC)

Active member; engaged in technical workshops and collaborative projects on AI, mobile development, and cloud tools.

2023/08 – 2024/10 Institute of Space Technology

ACM Student Chapter

Member; participated in academic talks, coding activities, and professional networking.

SKILLS

Programming Languages

Python (NumPy, Pandas, NLTK, Matplotlib, sklearn, TensorFlow) | C++ | Java | SQL | Android App Programming (Kotlin and Flutter)

Technical Domains

Supervised & Unsupervised ML | Medical Imaging | Computer Vision | Quantum Machine Learning | Statistical Modeling

Tools & Platforms

Git | Docker | GitLab | Android Studio | Qiskit

VOLUNTEERING

WWF Pakistan

Assisted in environmental awareness activities and campaigns.

Red Crescent Pakistan

Supported community initiatives and social welfare programs.

Teaching Volunteer, Froebel's International School

Taught mathematics to 5th-grade students for one month, focusing on building foundational problem-solving skills and encouraging interest in STEM subjects.

RECOMMENDATIONS

Dr. Ayesha Rafiq Assistant Professor, Applied Mathematics & Statistics

Course instructor for Linear Algebra, responsible for assessing my mathematical foundations in vector spaces, eigenvalue problems, matrix decompositions, and optimization concepts relevant to machine learning and medical imaging. The recommendation is based on sustained academic interaction, coursework performance, and evaluation of my analytical reasoning and problem-solving skills.

Email ayesha.rafiq@mail.ist.edu.pk | **Phone** (+92) 519075739

Ms. Ifrah Mansoor Lecturer, Computer Science

Undergraduate thesis and research supervisor, responsible for supervising my thesis on medical image analysis. Evaluated my ability to independently design experiments, implement and validate models, analyze results, and communicate findings in a research-oriented manner.

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