

# Emal Kamawal

AI Researcher in Healthcare — Computer Vision Machine Learning

✉ B22F1813CS118@fecid.paf-iast.edu.pk    LinkedIn    GitHub    Haripur, KPK, Pakistan

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## RESEARCH INTERESTS & CAREER OBJECTIVE

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Passionate computer scientist focused on AI for healthcare and social impact. Research spans brain-computer interfaces (EEG), medical imaging, and computer vision. Seeking a master's position and grant-funded opportunities to advance AI-driven diagnostic systems with emphasis on explainable, privacy-preserving, and clinically translational machine learning.

**Core Research Areas:** AI in Health Science; Medical Imaging; EEG/BCI; Computer Vision; Deep Learning; Generative AI; Machine Learning for Clinical Data; Federated Learning; Explainable AI; IoT Systems

## EDUCATION

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**Bachelor of Science in Computer Science**

Expected: May 2026

*Pak-Austria Fachhochschule: Institute of Applied Sciences & Technology*

Haripur, KPK, Pakistan

**Honors:** Allama Iqbal Scholarship Recipient (HEC Pakistan)

**Senior Thesis:** *Thought Viz — A Hybrid EEG-Driven Visual Reconstruction Framework*

**Relevant Coursework:** Advanced Algorithms, Machine Learning, Computer Vision, Signal Processing, Database Systems, Software Engineering, Artificial intelligence, Big data and Analytics

**Higher Secondary Education**

2017-2020

*Iqra High School*

Afghanistan

**Achievement:** Mathematics Olympiad Participant • Science Stream with Distinction

## RESEARCH EXPERIENCE & PUBLICATIONS

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### Peer-Reviewed Publications

Ali Zia<sup>1</sup>, Shahnawaz Qureshi<sup>2</sup>, Fatima Ansarizadeh<sup>2</sup>, Muhammad Fouzan<sup>2</sup>, Emal Kamawal<sup>3</sup>, Sajid Anwer<sup>3</sup>, Chandan Karmakar<sup>3</sup>. "Expert Fusion Network for Automated Blastocyst Morphology and IVF Decision Support." *IEEE Transactions on Biomedical Engineering* (Under Review, 2025). *Research Contribution:* Co-developed novel multi-architecture deep learning framework combining U-Net, attention mechanisms, and mixture-of-experts achieving 98% accuracy in embryo morphology grading. Implemented data preprocessing pipeline and conducted extensive validation studies.

Shahnawaz Qureshi<sup>1</sup>, Ali Zia<sup>2</sup>, Emal Kamawal<sup>2</sup>, Asif Ameer<sup>3</sup>, Ahsan Latif<sup>2</sup>, "UAV-Based Early Weed Detection in Wheat Fields: A Comparative Study of Deep Learning Approaches" *Precision Agriculture Journal* (Under Review, 2025). *Research Contribution:* Conducted a comprehensive comparative analysis of CNN, SAM, ViT, and Mask R-CNN architectures for precision agriculture applications. Led dataset curation and model optimization, resulting in a 15% improvement over baseline methods.

Muhammad Fozan<sup>1</sup>, Muhammad Rizwan<sup>2</sup>, Emal Kamawal<sup>2</sup>, Muhammad Ahmad Khan<sup>3</sup>,

**Dr. Shahnawaz Qureshi<sup>2</sup>, Dr. Fazal Wahab<sup>1</sup>, “Integrating Artificial Intelligence and Machine Learning in 3D Cell Culture Analysis and Prediction” (*Book Chapter*), 2026.**

*Research Contribution:* Co-authored a chapter on applying AI/ML to 3D cell culture workflows, covering imaging-based segmentation, predictive modeling, biomarker discovery, and drug screening. Synthesized case studies (oncology and stem cell research) and reviewed key challenges including data quality, reproducibility, model interpretability, and regulatory considerations, highlighting future directions such as automated high-throughput screening and multi-omics integration.

**Emal Kamawal<sup>1</sup>, Hazrat Nabi<sup>2</sup>, Muhammad Fozan<sup>2</sup>, Arbab Waheed Ahmad<sup>3</sup>, Habab Ali Ahmad<sup>2</sup>, “Advanced Imaging and Analysis Techniques for 3D Cell Cultures and Organoids” (*Book Chapter in Advances in Drug Development: From Biosignaling to Precision Medicine*, CRC Press, 2026). *Editor:* Dr. Muhammad Imran Khan. *Research Contribution:* Co-authored Chapter 4 focusing on advanced imaging and computational analysis for 3D cell cultures and organoids. Covered end-to-end workflows including microscopy data preparation, segmentation and quantification techniques, and AI/ML-driven analysis for phenotyping, biomarker discovery, and drug-response prediction, while discussing practical challenges such as reproducibility, data quality, and interpretability.**

## Projects

### Thought Viz: EEG-Driven Visual Reconstruction Framework

2025-Present

*Principal Investigator • Brain-Computer Interface Laboratory*

- Developing novel BCI pipeline for reconstructing visual scenes from EEG signals using adaptive encoder-decoder architecture coupled with diffusion models
- Achieved 78% accuracy in visual stimulus classification from raw EEG data using custom preprocessing and feature extraction methods
- Implementing real-time processing capabilities with latency under 200ms for practical BCI applications

### Advanced Medical Imaging Research Initiative

2023-2024

*Research Assistant • Medical AI Laboratory*

- Developed U-Net based brain tumor segmentation system achieving 98.2% dice coefficient on BRATS dataset
- Implemented ensemble learning approach for heart disease prediction reaching 99.35% accuracy using clinical biomarkers
- Collaborated with medical professionals to validate AI diagnostic tools for clinical deployment

## PROFESSIONAL EXPERIENCE

### AI Research Intern

Jan 2023 - Apr 2023

*The Insaafdaar Law*

Remote

- Architected and deployed ML-powered document processing system on AWS, reducing processing time by 40% for 500+ users
- Developed Python-based OCR application achieving 92% text extraction accuracy for legal document automation
- Built conversational AI system using Rasa NLP framework, automating 70% of client inquiries with 85% satisfaction rate
- **Technologies:** Python, TensorFlow, AWS SageMaker, Rasa, Computer Vision APIs

### IoT Engineering Intern

Jan 10, 2022 - Aug 10, 2022

- Engineered IoT-enabled smart waste management system reducing manual monitoring by 60% through predictive analytics
- Integrated sensor networks with AWS IoT Core for real-time monitoring and automated alert systems
- Prototyped Raspberry Pi-based environmental monitoring solutions with custom sensor fusion algorithms
- **Technologies:** Raspberry Pi, AWS IoT Core, Python, Sensor Integration, Edge Computing

## Junior Artificial Intelligence Intern (Computer Vision / Healthcare AI)

June 20, 2025 -

August 31, 2025

Forth Labs

Islamabad

- Developed an AI-driven dental X-ray image analysis system for automated missing-teeth detection, delivering consistent, data-driven clinical insights
- Implemented YOLO-based segmentation with high-resolution, multi-scale inference to improve detection of small and subtle missing-tooth regions
- Designed intelligent post-processing to refine segmentation outputs, reduce false positives, and enhance clinical reliability
- Validated predictions using visual overlays and iterative testing to ensure repeatable and production-ready results
- Annotated and managed the dataset using the Roboflow platform for high-quality labeling and streamlined preprocessing
- **Technologies:** Python, YOLO (Segmentation), Computer Vision, Roboflow (Annotation), Post-processing, Model Evaluation

## KEY TECHNICAL PROJECTS

### Real-Time DDoS Attack Detection System

*Cybersecurity & ML*

Developed supervised learning pipeline for network intrusion detection achieving 96.8% accuracy with sub-millisecond response time. Implemented feature engineering techniques for high-dimensional network traffic analysis.

### YOLO-Powered Blackjack Strategy Assistant

*Computer Vision & Gaming AI*

Created real-time card detection and optimal strategy recommendation system using YOLOv8. Integrated probability calculations with live video feed processing for enhanced gaming experience.

### PDF Malware Analysis Framework

*Cybersecurity & NLP*

Built comprehensive NLP pipeline for detecting malicious JavaScript, embedded links, and phishing content in PDF documents using deep learning and pattern recognition techniques.

### Federated Learning Healthcare System

*Privacy-Preserving ML*

Implemented federated learning framework for collaborative medical AI model training while preserving patient data privacy across multiple healthcare institutions.

## TECHNICAL SKILLS

**Machine Learning & AI:** Deep Neural Networks, Convolutional Networks, Recurrent Networks, Transformers, Generative Adversarial Networks, Reinforcement Learning, Federated Learning, AutoML, Hyperparameter Optimization

**Computer Vision:** Object Detection (YOLO v5-v9, R-CNN variants), Semantic Segmentation (U-Net,

DeepLabV3+, SAM), Image Classification (ResNet, EfficientNet, Vision Transformers), Medical Imaging, 3D Vision

**Natural Language Processing:** BERT, GPT-3.5/4, LLaMA, RoBERTa, T5, Sentence Transformers, Text Generation, Sentiment Analysis, Information Extraction, Conversational AI

**Programming Languages:** Python (Expert), C++ (Proficient), SQL (Proficient), R (Intermediate), MATLAB (Intermediate), JavaScript (Basic)

**Frameworks & Libraries:** PyTorch, TensorFlow/Keras, Scikit-learn, OpenCV, Pandas, NumPy, Matplotlib, Seaborn, Plotly, FastAPI, Flask, Streamlit

**Cloud & Deployment:** AWS (EC2, SageMaker, Lambda, S3), Google Cloud Platform, Docker, Kubernetes, TorchServe, MLflow, Weights & Biases, CI/CD Pipelines

**Development Tools:** Git/GitHub, Jupyter, VS Code, Linux, Agile/Scrum, Docker, Postman, Database Management (PostgreSQL, MongoDB)

## CERTIFICATIONS & PROFESSIONAL DEVELOPMENT

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- **Machine Learning Specialization** - Stanford University via Coursera (Andrew Ng)
- **Deep Learning Specialization** - DeepLearning.AI via Coursera (5-course series)
- **Natural Language Processing Specialization** - DeepLearning.AI via Coursera
- **AWS Certified Cloud Practitioner** - Amazon Web Services (2023)
- **Computer Vision Specialization** - University of Washington via Coursera
- **Advanced Python for Data Science** - IBM via edX
- **IoT Systems Engineering** - SPCAI Professional Certification

### Academic Honors:

- Allama Iqbal Scholarship for Afghan Students (HEC Pakistan) - Full tuition coverage
- Mathematics Olympiad Society Member (GIK Institute)

## LANGUAGES & ADDITIONAL QUALIFICATIONS

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**Languages:** English, Pashto (Native), Persian/Dari (Fluent), Urdu (Fluent)

**Research Skills:** Systematic Literature Review, Statistical Analysis, Experimental Design, Data Visualization, Technical Writing, Grant Writing, Peer Review

**Leadership & Collaboration:** Cross-functional Team Leadership, International Research Collaboration, Mentoring Junior Students, Public Speaking, Project Management

## FUTURE RESEARCH DIRECTIONS

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### Immediate Research Goals:

- Advancing brain-computer interface technology for assistive applications and neural rehabilitation
- Developing explainable AI systems for critical healthcare decision-making
- Exploring federated learning approaches for privacy-preserving medical AI
- Investigating multimodal AI systems combining vision, language, and physiological signals

## ACADEMIC REFERENCES

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**Dr. Shahnawaz Qureshi**

Associate Professor of Computer Science

Pak-Austria Fachhochschule Institute of Applied Sciences & Technology

Email: [shahnawaz.queshi@paf-iast.edu.pk](mailto:shahnawaz.queshi@paf-iast.edu.pk)

*Research Supervisor - Machine Learning & Computer Vision*

**Dr. Arshad Iqbal**

Associate Professor & AI Research Laboratory Director

Pak-Austria Fachhochschule Institute of Applied Sciences & Technology

Email: [arshad.iqbal@spcai.paf-iast.edu.pk](mailto:arshad.iqbal@spcai.paf-iast.edu.pk)

*Research Mentor - IoT Systems & Edge Computing*

**Dr. Muhammad Imran Khan**

Assistant Professor of Biomedical Engineering

Pak-Austria Fachhochschule Institute of Applied Sciences & Technology

Email: [imran.khan@fbse.paf-iast.edu.pk](mailto:imran.khan@fbse.paf-iast.edu.pk)

*Collaborator - Biomedical AI Applications*