

# Muhammad Ali Farooq (he/ him)

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## Career Objectives

A dynamic and results-oriented professional with extensive experience in both research and development and project management. Possessing advanced expertise in the domains of generative AI, computer vision, image enhancement, machine vision, medical imaging, edge computing, circuit design and sensor fusion algorithms, with a keen focus on achieving tangible business objectives and academic research goals.

## Education

### September 2019 - August 2022, Ph.D., Electrical and Electronic Engineering, National University of Ireland Galway

Grade: Successful Ph.D. remote defence

Thesis: [Evaluations of Thermal Imaging Technology for Automotive Use Cases](#)

Other Projects: Medical Image Analysis, Digital image processing, and enhancement, Facial depth map estimations, 3D face construction using deep learning.

Subjects: Research Integrity

### August 2014 - May 2017, Master of Science (MS), Electrical Control Engineering, National University of Sciences and Technology Pakistan

CGPA: 3.50 on a scale of 4.00

Thesis: [Automatic Lesion Detection System for Skin Cancer Classification using SVM and Neural Classifiers](#)

Other Projects: Digital Incubation System using PID Controller.

Subjects: Computer Vision, Advanced Control System, Advanced Embedded Systems design, Advanced Digital Signal Processing, Digital Data Acquisition, Probability, and Statistics

### August 2008 - December 2012, Bachelor of Engineering (BE), Electronic Engineering, IQRA University

CGPA: 3.24 on a scale of 4.00

Final Year Project: [Advanced Digital Incubation System using Arduino Controller](#)

Other Projects: Smart Grid, Switch Mode Power Supply, PIC Micro-Controller based Home Automation System

Subjects: Digital Electronics, Power Electronics, Digital Logic Design, Industrial Electronics, Applied Mathematics, Circuit Analysis, and Digital Communication Systems

## Research and Work Experience

### October 2024 – Currently Working as a Research Fellow, at University of Galway and Machine Learning Researcher, at Tobii/ Fotonation Galway

- Leading multiple large-scale EU and SFI funded projects including Prive-Sense (Privacy-Responsive Intelligent Safe sENSing and Situational Enhancement), DTIF and Adapt project. The project focuses on building intelligent AI perception pipelines by the combinations of multimodal imaging including near-Infrared (NIR), thermal-Infrared (LWIR) and neuro-morphic (event) camera technologies for real world and consumer electronic applications.
- Working towards building new multi-modality synthetic datasets using text-to-image and image-to-image and text-to-video transformations.
- Exploring efficient image and video grounding techniques, prompt engineering and using large language models (LLM's) for robust training of customized vision language models.
- Managing a multidisciplinary team of PhD scholars, research associates, and postdoctoral researchers across various AI research projects.
- Further developed and deployed advanced generative AI models, including stable diffusion and few-shot learning approaches, for the synthesis of high-quality, domain-specific multimodality datasets in medical imaging, face biometrics, and child data. Demonstrated proficiency in integrating vision-language models for data augmentation and improving model robustness across various medical modalities.

### September 2022 – November 2024, Postdoctoral Researcher, at University of Galway and Machine Learning Intern, at Tobii/ Fotonation Galway

- As an established researcher I worked on ADAPT project. The main objective is the development of a multimodal (sound and vision) AI processing platform with low cost and low power consumption to be used for consumer electronic applications.
- Working with various image modalities which includes thermal, RGBD, event neuromorphic and further integrating it with ML algorithms for building smart imaging pipelines for different computer vision applications.
- Working towards generating large-scale synthetic datasets using the composite structure of computer vision algorithms which includes Image-to-Image translation based Generative Adversarial Networks and Text-to-Image based stable diffusion models for optimal training and validation of deep learning networks.
- Optimizing the CNN networks using various quantization methods for deploying it on low powered edge devices for real time testing.
- Managing and working with other team members and fellow colleagues for producing effective research outcomes and further presenting the work at various forums.
- Focusing on deep learning model tuning, validation for deployment on single board low-powered edge devices for real-time data processing.
- Previously I was working on the Disruptive Technologies Innovation Fund '[DTIF-DAVID](#)' project funded by Enterprise Ireland (EI).
- Mentoring Ph.D. and master's students in their research projects by providing technical assistance and helping them in drafting publications and research-based ethical approvals.
- Served as Program Chair for the [25<sup>th</sup> Irish Machine Vision and Image Processing \(IMVIP23\)](#) Conference where I successfully set up the program committee, paper submission portal, decision announcement of full and short papers via Microsoft CMT in due time frames, designing the conference program and conducted a training workshop on Image synthesis and its potential usage for real-world applications.
- Moreover, I have been involved in designing the course content, teaching, and conducting labs of Mobile Devices, Embedded System design, and Analog Electronics modules for bachelor and master's students.

**September 2019 – August 2022 Ph.D. and Machine Learning Researcher, Xperi Corporation and University of Galway**

- Worked on industry based European Union (EU) funded '[HELIUS](#)' project as a part of my Ph.D. research project/ work placement with overall funding of 485,873.75 Euros allocated for National University of Ireland Galway.
- Research and implementation of state-of-the-art algorithms from the domains of computer vision, machine learning, deep neural networks, and edge computing for implementation of smart in-cabin driver monitoring and road monitoring system (smart forward sensing perception system).
- Integrating various image modalities which includes thermal, visible (RGB) and depth data with machine learning algorithms to build AI-based artificially intelligent imaging pipelines.
- Data Acquisition, optimization, and deployment of trained machine learning (ML) networks on graphical processing unit (GPUs) and low-powered single board edge devices.
- During this project, I have worked and successfully deployed various in-cabin and out-cabin applications which include autonomous thermal gender classification, large-scale synthetic thermal data generation, face localization, and facial landmarks detection on thermal facial frames, object detection in thermal spectrum using SoA YOLO-v5 and YOLO-V8 framework, neural network optimization using TensorRT and Tensorflow-Lite tools and deploying the optimized network engines on resource-constrained edge-GPU devices which includes Nvidia Jetson Nano and Xavier development boards.
- Collaborating with a team of research engineers and professionals from different European companies which include Xperi Corporation based in Ireland, Lynred based in France, Next2U based in Italy, and Denso based in Germany working under Helius project as the consortium partners for effective cross-fertilization of ideas.
- Drafting and publishing the research findings at various international computer vision conferences and engineering Journals.
- Collaboration with other Ph.D. researchers for brainstorming on different ongoing projects which include human facial depth estimation using single 2D images, creating new large-scale synthetic datasets for computer vision applications, etc.

**August 2016 - July 2019 Computer Vision Engineer, PNEC-NUST, Karachi-Pakistan**

- Lead and provide in-depth research expertise in the domains of computer Vision, machine learning, deep neural networks, and graphical processing unit (GPU) Servers Management for an intelligent security system to be replaced with the conventional CCTV camera system for enhanced university campus security.
- Successfully integrated and deployed intelligent facial recognition and automatic number plate recognition system with conventional CCTV camera system on various entrance points of the university campus.
- Develop plans and strategies for ongoing research projects under the supervision of higher management to outline time & cost-based feasible methods to be followed as per university guidelines.
- Recommend process improvements and pitch new ideas to improve the efficiency and capabilities of existing systems.
- Writing research grants for large-scale projects focused on building safe and smarter cities using artificial intelligence (AI).

- Preparing presentations, and user guide manuals of different project modules for technical and non-technical staff.
- Drafting and publishing the research findings and experimental results at various international conferences.

### **January 2014 – February 2015 Trainee Engineer, Aga Khan University Hospital, Karachi-Pakistan**

- Efficiently log in complaints received via phone, email, and web portal through the ticket management system.
- Work with vendor representatives and operations teams to coordinate, escalate, troubleshoot, and resolve service interruptions as expeditiously as possible, ensure service levels are met, and adverse impacts are kept to a minimum.
- Communicate with global users and provide support for various IT activities that include remote installation, troubleshooting of software, and email configuration.
- Monitor and maintain computer systems and networks.
- Troubleshoot system and network problems, diagnose, and solve hardware/software faults.
- Provide support, including procedural documentation and relevant reports.
- Support the roll-out of new applications.
- Respond to website-related queries and escalate them to the appropriate IT group.
- Create Oracle PeopleSoft accounts and roles assignments for the new staff members.
- Provide technical support on production servers.

### **Selected Publications**

#### **Journal Publications**

1. "Evaluation of Thermal Imaging on Embedded GPU Platforms for Application in Vehicular Assistance Systems" published in *IEEE Transactions on Intelligent Vehicles*, doi: 10.1109/TIV.2022.3158094.  
Muhammad Ali Farooq, Waseem Shariff, and Peter Corcoran  
IF: 14, [[Paper](#)], [[Github](#)]
2. "Object Detection in Thermal Spectrum for Advanced Driver-Assistance Systems (ADAS)," published in *IEEE Access*, doi: 10.1109/ACCESS.2021.3129150.  
Muhammad Ali Farooq, Peter Corcoran, Cosmin Rotariu and Waseem. Shariff  
IF: 3.9, [[Paper](#)], [[Github](#)]
3. "ChildGAN: Large Scale Synthetic Child Facial Data Using Domain Adaptation in StyleGAN" published in *IEEE Access*, doi: 10.1109/ACCESS.2023.3321149.  
Muhammad Ali Farooq, Wang Yao, Gabriel Costache, and Peter Corcoran  
IF: 3.9, [[Paper](#)], [[Github](#)], [[Project Website](#)], [[Dataset](#)]
4. "Performance estimation of the state-of-the-art convolution neural networks for thermal images-based gender classification system," published in SPIE Journal of Electronic Imaging, doi: 10.1117/1.JEI.29.6.063004.  
Muhammad Ali Farooq, Hossein Javidnia, Peter Corcoran  
IF: 1.1, [[Paper](#)], [[Github](#)]
5. "On the Role of Thermal Imaging in Automotive Applications: A Critical Review," published in *IEEE Access*, doi: 10.1109/ACCESS.2023.3255110.  
Muhammad Ali Farooq, Waseem Shariff, David O'Callaghan, A. Merla and Peter Corcoran  
IF: 3.9, [[Paper](#)]
6. "A Study on the Effect of Ageing in Facial Authentication and the Utility of Data Augmentation to Reduce Performance Bias Across Age Groups," published in *IEEE Access*, doi: 10.1109/ACCESS.2023.3312612.  
Wang Yao, Muhammad Ali Farooq, Joe Lemley, and Peter Corcoran  
IF: 3.9, [[Paper](#)]
7. "Towards Monocular Neural Facial Depth Estimation: Past, Present, and Future," published in *IEEE Access*, doi: 10.1109/ACCESS.2022.3158950.  
Faisal Khan, Muhammad Ali Farooq, Waseem Shariff, Shubhajit Basak and Peter Corcoran  
IF: 3.9, [[Paper](#)]
8. "Automatic Inspection of Seal Integrity in Sterile Barrier Packaging: a Deep Learning Approach," published in *IEEE Access*, doi: 10.1109/ACCESS.2023.3348779.  
Julio Z. Diaz, Muhammad Ali Farooq, and Peter Corcoran  
IF: 3.9, [[Paper](#)]
9. "Neuromorphic Driver Monitoring Systems: A Computationally Efficient Proof-of-Concept for Driver Distraction Detection," published in *IEEE Open Journal of Vehicular Technology*, doi: 10.1109/OJVT.2023.3325656.  
Waseem Shariff, Mehdi S, Paul Kiely, Joe Lemley, Muhammad Ali Farooq, Peter Corcoran  
IF: 6.4, [[Paper](#)]
10. "Optimization of Event Camera Bias Settings for a Neuromorphic Driver Monitoring System". published in *IEEE Access*, doi: 10.1109/ACCESS.2024.3371487.  
Mehdi Sefidgar Dilmaghani, Waseem Shariff, Muhammad Ali Farooq, Joe Lemley, Peter Corcoran  
IF: 3.9, [[Paper](#)]
11. "Visual Cardiac Signal Classifiers: A Deep Learning Classification Approach for Heart Signal Estimation from Video", published in *IEEE Access*, doi: 10.1109/ACCESS.2024.3472508.

Mohammad Moustafa, [Muhammad Ali Farooq](#), Amr Elrasad, Joseph Lemley and Peter Corcoran.  
IF: 3.9, [[Paper](#)]

## Conference Publications

1. "Automatic lesion detection system (ALDS) for skin cancer classification using SVM and neural classifiers." published in IEEE 16th International Conference on Bioinformatics and Bioengineering (BIBE). IEEE, 2016.  
[Muhammad Ali Farooq](#), Muhammad Aatif Mobeen Azhar, and Rana Hammad Raza [[Paper](#)]
2. "Infrared Imaging for Human Thermography and Breast Tumor Classification using Thermal Images," published in 31st IEEE Irish Signals and Systems Conference (ISSC), 2020.  
[Muhammad Ali Farooq](#) and Peter Corcoran [[Paper](#)]
3. "Development, optimization, and deployment of thermal forward vision systems for advance vehicular applications on edge devices" published in SPIE Fifteenth International Conference on Machine Vision (ICMV) 2022.  
[Muhammad Ali Farooq](#), Waseem Shariff, Faisal Khan, Peter Corcoran [[Paper](#)], [[Github](#)]
4. "Synthetic Speaking Children - Why We Need Them and How to Make Them" published in IEEE International Conference on Speech Technology and Human-Computer Dialogue (SpeD) 2023.  
[Muhammad Ali Farooq](#), Dan Bigioi, Rishabh Jain, Wang Yao, Mariam Yiwere, Peter Corcoran [[Paper](#)], [[Github](#)]
5. "Derm-T2IM: Harnessing Synthetic Skin Lesion Data via Stable Diffusion Models for Enhanced Skin Disease Classification using ViT and CNN", published in IEEE Engineering in Medicine and Biology Society (EMBC) 2024 conference.  
[Muhammad Ali Farooq](#), Wang Yao, Michael Schukat, Mark A Little, Peter Corcoran [[Paper](#)], [[Github](#)], [[Dataset](#)]
6. "Synthesizing CTA Image Data for Type-B Aortic Dissection using Stable Diffusion Models", published in IEEE Engineering in Medicine and Biology Society (EMBC) 2024 conference.  
[Aymen Abaid](#), [Muhammad Ali Farooq](#), Ihsan Ullah, Peter Corcoran [[Paper](#)]

## Open-Source Dataset Publication

1. "C3I Thermal Automotive Dataset", available via IEEE Dataport, [Muhammad Ali Farooq](#), Waseem Shariff, Faisal Khan, Peter Corcoran, Cosmin Rotariu, March 26, 2022.  
[[Dataset](#)]

## Skills

### Technical Skills

1. IP Algorithms: Segmentation, Filter Design, Noise Removal, Compression, Super Resolution
2. Imaging Modalities: Thermal (LWIR and NIR), Neuromorphic (Event data), Medical (Dermatoscopic, CTA, XRAY), RGB and RGBD
3. Object Det: SSD, YOLO-NAS, YOLOX, YOLO World, Faster R-CNN, DETR, GroundingDINO, YOLOv8  
OCR docTR, PaddleOCR, EasyOCR, Tesseract OCR, MmOCR
4. DL techniques: Tracking, Optical Flow, Particle Filtering, Pose Estimation
5. CV Algorithms: Image Classification and Detection, Tracking
6. Network optimization: TensorRT, TensorflowLite, OpenVINO
7. Programming Lang: Python, Keras, C++, Unix Shell Scripting
8. Deployment: Docker and Kubernetes
9. Editor: Visual Studio Code, PyCharm, Jupyter Notebook
10. OS: Windows 10, Ubuntu 18.04, Ubuntu 20.04, Redhat, Windows Server 2016
11. APIs: PyTorch, TensorFlow, Caffe, OpenCV, Flask, Django
12. Robotics/ Simulators: CircuitLab, Proteus, Matlab Simulink, AutoCAD
13. Electronics: Digital Circuit Desing, Analog Electronics, PLC's, Industrial Electronics

**Management Skills:** Project management, team player, time management, problem-solving, effective communication, determination.

## Honors and Achievements

- Serving as Senior Member IEEE (Membership no: 99096332)
- Won the prestigious European Union (EU) H2020 Ph.D. scholarship.
- Active reviewer in various prestigious engineering conferences and journals which includes IEEE ACM-Multimedia, IEEE International Joint Conference on Neural Networks (IJCNN), IEEE Transactions on Intelligent Vehicles (IEEE-TIV), IEEE Access, SPIE Journal of Electronic Imaging (SPIE-JEI), SPIE Journal of Applied Remote Sensing (SPIE-JARS), Nature Scientific Reports.
- Awarded NUIG employability award, lifts leadership award, and Alive presidential award for being an active member as an event manager in the University Postgraduate society, Seas Suas volunteer, and student union class representative.
- Published several research papers in high-tier conferences (EMBC, ACCV, IJCNN, and ICCE) and impact factor journals.
- Awarded various technical certifications which include Convolution Neural Networks by Andrew NG, Research Integrity (Engineering and Technology) from Oxford University Press, IT security awareness and protecting PII by KnowBe4, and Journal reviewer certifications from SPIE.

## Personal Portfolio

 : <https://scholar.google.com/citations?user=Km-BcFoAAAAJ&hl=en>

 : <https://github.com/MAli-Farooq>

## Hobbies

Travelling, cycling, cooking, dronography, exploring technical concepts and methods by reading books and research papers, and making interactive videos.