Muhammad Azaz Farooq

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Address: 40033, Bologna, Italy (Work)

ABOUT ME

Artificial Intelligence (AI) and Machine Learning (ML) Engineer (PhD) specializing in Digital Twin, Cloud technologies, Machine Learning Operations (MLOps), and IoT-Edge-Cloud Continuum. Building AI-enabled Digital Twin frameworks for Industry 4.0 that also use MLOps practices to automate and monitor the real-time analytics and predict anomalies. My work combines ML, data science, edge and cloud computing, and domain-specific AI to enable automation, scalability, and smarter decision-making in an IoT-Edge-Cloud Continuum.

EDUCATION AND TRAINING

01/11/2022 Bologna, Italy

DOTTORATO DI RICERCA (PHD) IN COMPUTER SCIENCE AND ENGINEERING University of Bologna

Thesis A Federated Digital Twin Framework Leveraging AI and MLOps for the IoT Cloud Continuum

01/09/2019 – 05/06/2022 Shenyang , China

MASTER OF ENGINEERING IN COMPUTER APPLICATION TECHNOLOGY Shenyang Aerospace University

Final grade 84% | **Thesis** Breast Cancer Detection from Ultrasound Images using Attention U- Nets Model

01/09/2011 – 24/07/2015 Bahawalpur, Pakistan

BACHELORS OF SCIENCE IN COMPUTER SYSTEMS ENGINEERING The Islamia University of Bahawalpur (IUB), Pakistan

Final grade 80% | **Thesis** Real-time People Detection and Counting in Surveillance Applications

RESEARCH EXPERIENCE

01/11/2022 – CURRENT

PhD Researcher (Industrial PhD) | University of Bologna & MARPOSS S.p.A | Bologna, Italy

- Developed a proof-of-concept Digital Twin framework using emerging AI cloud tools to meet the growing demand for automation in industrial processes.
- The main objectives of this work include analyzing industrial data and evaluating algorithms for industrial machines, supported by Azure Machine Learning Studio's no-code features, as well as MS Azure and Azure IoT Central.
- The project emphasizes creating lightweight machine learning models and deploying them with Docker, while also enabling automation through GitHub Actions–based pipelines.
- Additional goals include implementing Azure Functions/Function Apps, integrating industrial protocols such as MQTT with AutoML and ONNX-based workflows, and adopting Infrastructure as Code (IaC) practices to enable scalable, repeatable deployments.

01/11/2024 – 30/04/2025

Visiting PhD Researcher | National University of Ireland (NUIG) | Galway, Ireland

- Conducted a six-month research visit focused on Federated Learning (FL).
- Investigated and developed custom FL schemes by addressing the research problems with heterogeneous datasets of different clients/devices.
- Proposed a framework, FedAdapt-CAD: It incorporates Client-Aware Aggregation (CAA) and Dynamic Model Adaptation (DMA) to dynamically weigh client contributions based on data quality and local model performance.

01/09/2019 – 05/06/2022

Graduate Researcher | Lab of Medical Imaging, Shenyang Aerospace University | Shenyang, China

- Conducted research and development on a variety of Machine Learning and Deep Learning algorithms applied to medical imaging problems.
- Gained strong expertise in Python and its ML/DL ecosystem, including NumPy, Pandas, Scikit-learn, Matplotlib, and Seaborn.
- Acquired hands-on experience with advanced deep learning frameworks such as TensorFlow and Keras.
- Made a significant research contribution by enhancing the Attention U-Net model, integrating feature maps and saliency information.
- Introduced five additional attention blocks into the original U-Net architecture to extract more fine-grained and task-specific features.

PUBLICATIONS

Conference Proceedings

Farooq, M. A., Bellavista, P., Bujari, A., Mora, A., Nasir, J., & Ahmed, R. (2026). *FedAdapt-CAD: A federated learning framework for anomaly detection with client-aware aggregation and dynamic model adaptation*. In Proceedings of the International Conference on Computing, Networking and Communications (ICNC 2026) (pp. 143–149). IEEE.

Farooq, M. A., Bellavista, P., Bujari, A., & Sita, A. (2025). *Leveraging AI and MLOps for IoT-edge-cloud industrial digital twins: A practical case study*. In Proceedings of the IEEE Conference on Standards for Communications and Networking (pp. 1–6). IEEE.

Mehmood, M. H., Hassan, F., Rahman, A. U., Rauf, A., & **Farooq, M. A**. (2023). *Alzr-Net: A novel approach to detect Alzheimer disease*. In Proceedings of the 3rd International Conference on Communication, Computing and Digital Systems (C-CODE 2023) (pp. 1–6). IEEE.

Farooq, M. A., Gong, Z. X., Liu, Y., Zubair, M., Manzoor, A., & Zhang, G. (2022). *Breast cancer detection from ultrasound images using attention UNets model*. In Proceedings of SPIE—The International Society for Optical Engineering (Vol. 12342, pp. 161–174). SPIE.

Zhang, G., Liu, Y., Guo, W., Tan, W., Gong, Z., & **Farooq, M. A**. (2022). *Automatic heart segmentation based on convolutional networks using attention mechanism*. In Proceedings of SPIE—The International Society for Optical Engineering (Vol. 12342, pp. 1–8). SPIE.

ACADEMIC ACTIVITIES & PRESENTATIONS

Conferecne Paper Presentations

Oral Presentation at IEEE Conference on Standards for Communications and Networking (CSCN 2025), Bologna, Italy
Oral Presentation at 14th International Conference on Digital Image Processing (ICDIP 2022), Wuhan, China

Advanced Training

Attended the 9th ACDL Summer School on Advanced Course on Data Science & Machine Learning in Castiglione della Pescaia (Grosseto), Tuscany, Italy, in 2024.
Attended the SoBigData Summer School on Empowering Data for Social Good in Tuscany, Italy, in 2024.

HONOURS AND AWARDS

01/11/2022

PNRR Innovative PhD Scholarship – Italian Ministry of University and Research (MUR)

Awarded a competitive, fully-funded scholarship as part of the National Recovery and Resilience Plan (PNRR), funded by the Next Generation EU program.

01/09/2019

Chinese Government Scholarship – Chinese Scholarship Council (CSC)

A fully-funded scholarship awarded for Master of Engineering studies, covering tuition, accommodation, and a monthly stipend, based on academic merit.

WORK EXPERIENCE

LAB ENGINEER – THE NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY (NUST) – 02/02/2018 – 31/08/2019 – ISLAMABAD, PAKISTAN

Website: https://nust.edu.pk/

ASSISTANT OFFICER (ERP) – WILSHIRE LABORATORIES PVT. LTD – 01/07/2018 – 01/06/2019 – LAHORE, PAKISTAN

Website: https://www.linkedin.com/company/wilshirelabs/?originalSubdomain=pk

Worked extensively with Oracle Forms and Reports, developing complex analytical reports and forms in a collaborative team environment.
Contributed to designing and implementing new modules in a customized Oracle database system, including Quality Control, HRM, and Asset Management.

SKILLS

Research Skills

Data Science | Machine Learning | Deep Learning | Artificial Intelligence | Edge and Cloud Computing | IoT | IIoT | Digital Twins | Federated Learning | MLOps | Numpy | Pandas | Sci-kit learn | Matplotlib | Keras | Tensorflow

Programming Skills

Python | Java | C/C++ | PHP | HTML | CSS | LateX

Research Softwares & Tools

Microsoft Azure | Azure ML Studio | Azure IoT Central | Azure IoT Edge | Windows | Linux | Git | Gitbash | GitHub | Jupyter Notebook | VS Code | MATLAB | Docker | GitHub Actions | GitLab

LANGUAGE SKILLS

Mother tongue(s): **URDU**

Other language(s):

	UNDERSTANDING		SPEAKING		WRITING
	Listening	Reading	Spoken production	Spoken interaction	
ENGLISH	C1	C2	C1	C1	B2
ITALIAN	A1	A2	A2	A2	A2

Levels: A1 and A2: Basic user; B1 and B2: Independent user; C1 and C2: Proficient user

RECOMMENDATIONS

Prof. Paolo Bellavista Supervisor (PhD)

Department of Computer Science and Engineering, University of Bologna, Bologna, Italy

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Dr. Jamal Nasir Assistant Professor/Lecturer

School of Computer Science, University of Ireland, Galway, Ireland

Email jamal.nasir@universityofgalway.ie

Professor Guodong Zhang Supervisor (Master)

School of Computer Science, Shenyang Aerospace University, Shenyang, China

Email zhanggd@sau.edu.cn