

Dr. Safeer Ali Mirani

PhD | AI & 3D Development Specialist

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PROFILE

Computational neuroscience researcher (PhD, University of Sassari, 2026) developing GPU-accelerated, cross-platform visualisation systems for large-scale neural network activity. PhD thesis introduces the **NeuroConstellation** platform family — a unified visualisation framework deployed across **five platforms**: desktop, static and dynamic mixed reality (HoloLens 2), immersive VR (Varjo XR-4), and browser (WebGPU) — with the largest deployment rendering 5.28 million human hippocampus CA1 neurons in real time. Background combines deep learning and NLP (Master's research on emotion detection) with extended reality, neural simulation (NEST), and EEG signal analysis. Six-month research mobility at INS Aix-Marseille (host: Dr. Pierpaolo Sorrentino) on Fano-factor analysis of recurrent network dynamics. Active collaborations with EBRAINS-Italy, CNR Palermo (Migliore lab), and INS Aix-Marseille; first author on five thesis manuscripts (one submitted, four ready for submission) and middle author on a 2026 *Scientific Reports* paper.

RESEARCH INTERESTS

Real-time visualisation of large-scale neural network activity · computational neuroscience · GPU-accelerated rendering and compute (HLSL, WGS, WebGPU) · extended reality for scientific data (mixed reality, immersive VR, hand-tracking interaction) · neural simulation and recurrent network dynamics (NEST, Fano-factor analysis) · EEG signal processing and brain-state classification · brain co-simulation and multi-scale modelling · open research and reproducible scientific software.

EDUCATION

PhD in Life Sciences and Biotechnologies (XXXVIII Cycle)

2023 – 2026

University of Sassari (UNISS), Italy — Department of Biomedical Sciences

Defended: 6 May 2026

Thesis: *Real-Time Visualisation of Large-Scale Neural Networks: GPU-Accelerated Methods for Desktop, Extended Reality, and Browser Platforms*

Supervisors: Prof. Sergio M. G. Solinas & Prof. Paolo Enrico

Funding: EBRAINS-Italy (Project IR00011, CUP B51E22000150006), PNRR — NextGenerationEU

International Mobility: Institut de Neurosciences des Systèmes (INS), Aix-Marseille Université, France — Host: Dr. Pierpaolo Sorrentino (Aug 2025 – Jan 2026)

M.S. in Software Engineering

2017 – 2019

University of Electronic Science and Technology of China (UESTC)

GPA: 3.57/4.00

Thesis: *Fine-Grained Emotion Detection from Text using Deep Learning*

Specialisation: Machine Learning, Natural Language Processing, Software Architecture

B.S. in Computer Science

2013 – 2016

University of Sindh, Pakistan

GPA: 3.66/4.00

Focus: Software Development, Database Systems, Web Technologies

Intermediate (Pre-Engineering)

2010 – 2012

New Banat High School, BISE Hyderabad

Grade: B (62.27%)

RESEARCH PUBLICATIONS & PRESENTATIONS

Core Thesis Publications

1. **Journal Paper — Submitted (Chapter 4).**

Mirani, S.A., Memon, P., Enrico, P., & Solinas, S.M.G. (2025). *NeuroConstellation: Real-time Visualisation and Analysis of Million-Neuron Datasets Using Game Engine Technology*. *iScience* [Submitted].

Focus: GPU-accelerated desktop visualisation platform rendering up to 5.28 million neurons in real-time.

Available at: <https://doi.org/10.5281/zenodo.17650645>

2. **Journal Paper — Ready for Submission (Chapter 5).**

Mirani, S.A., Memon, P., Enrico, P., Solinas, S.M.G., Bologna, L.L., Ali, M., & Migliore, M. (2025). *HoloNeV: Advancing Human-Computer Interaction in Neuroscience Through Mixed Reality Neural Visualisation*. *MDPI Electronics* [Ready for submission].

Focus: Human-AI collaborative mixed-reality visualisation tool for large-scale neural networks.

3. **Journal Paper — Ready for Submission (Chapter 6).**

Mirani, S.A., Memon, P., Enrico, P., & Solinas, S.M.G. (2026). *Mixed Reality Visualisation of Mouse Hippocampus CA1 Neural Activity with Hand Gesture Interaction on Microsoft HoloLens 2*. *Scientific Reports* [Ready for submission].

4. **Journal Paper — Ready for Submission (Chapter 7).**

Mirani, S.A., Memon, P., Enrico, P., & Solinas, S.M.G. (2026). *Immersive Virtual Reality Visualisation of Human Hippocampus CA1 Neural Activity with Hand Tracking Interaction in Varjo XR-4*. *Springer Nature Virtual Reality* [Ready for submission].

5. **Journal Paper — Ready for Submission (Chapter 8).**

Mirani, S.A., Memon, P., Enrico, P., & Solinas, S.M.G. (2026). *NeuroConstellation Web: Real-Time Visualisation of Million-Scale Neural Activity via WebGPU Compute Shaders*. *IEEE Transactions on Visualization and Computer Graphics* [Ready for submission].

Available at: <https://neuroconstellationweb.netlify.app>

Conference Poster Presentations

6. **Poster Presentation.**

Mirani, S.A., Enrico, P., & Solinas, S. (December 2024). *Holographic Visualisation of Neural Network Activity*. EBRAINS Italy, Naples, Italy.

GPU-Accelerated Indirect Instancing in Microsoft Mixed Reality HoloLens 2.

7. **Poster Presentation.**

Mirani, S.A., Memon, P., Migliore, M., Bologna, L.L., Ali, M., Enrico, P., & Solinas, S.M.G. (July 2025). *HoloNeV: Holographic Visualisation Tool for Neural Network Activity*. Organisation for Computational Neurosciences (OCNS), Florence, Italy.

Collaboration: University of Sassari & Institute of Biophysics CNR Palermo.

Collaborative Publications

8. **Collaborative Paper — Published.**

Ali, M., Smiriglia, R., Spera, E., Mirani, S.A., Solinas, S.M.G., Migliore, M., Ascoli, G.A., & Bologna, L.L. (2026). *Visualization and simulation of full-scale point-neuron circuits via the Neural Circuit Visualizer web platform*. *Scientific Reports*, 16, 14345.

DOI: [10.1038/s41598-026-44588-0](https://doi.org/10.1038/s41598-026-44588-0) (Open Access, published 20 March 2026)

Multi-institutional collaboration: Institute of Biophysics CNR Palermo, University of Sassari, George Mason University.

9. **Collaborative Poster Presentation.**

Ali, M., Smiriglia, R., Spera, E., Mirani, S.A., Solinas, S.M.G., Migliore, M., Ascoli, G.A., & Bologna, L.L. (July 2025). *Neural Circuit Visualizer: A Web-Based Platform for the Simulation and Visualisation of Full-Scale Point-Neuron Circuits*. Organisation for Computational Neurosciences (OCNS), Florence, Italy.

10. Conference Paper.

Aftab, M.U., Qin, Z., Zakria, Ali, S., Pirah, & Khan, J. (2018). *The Evaluation and Comparative Analysis of Role Based Access Control and Attribute Based Access Control Model*. 15th International Computer Conference on Wavelet Active Media Technology and Information Processing (ICCWAMTIP), pp. 35–39. DOI: 10.1109/ICCWAMTIP.2018.8632578

SOFTWARE & OPEN RESEARCH OUTPUTS

NeuroConstellation Web — citable open-source research artefact accompanying the thesis.
Live demo: neuroconstellationweb.netlify.app Archive (Zenodo): DOI 10.5281/zenodo.17650645
Repository: github.com/SafeerAliMirani

Datasets — mouse CA1 (288,027 neurons) and human CA1 (5,280,000 neurons) from the Blue Brain Cell Atlas (Migliore lab CA1 scaffold model, NEST-simulated); preprocessing and HDF5 loading pipelines released alongside the visualiser.

TECHNICAL EXPERTISE & PROFICIENCIES

Programming	Python, C++, C#, JavaScript, MATLAB, Java, SQL, PHP, HTML5/CSS3, HLSL, WGSL
AI & Machine Learning	TensorFlow, PyTorch, Keras; deep learning & neural networks; computer vision; NLP; EEGLAB, MNE-Python
3D, XR & GPU	Unity 2022 LTS, MRTK; HoloLens 2, Varjo XR-4, Meta Quest 3; Ultraleap hand tracking; WebGPU & WGSL; GPU indirect instancing, compute shaders
Neural Simulation & HPC	NEST simulator; Galileo100 cluster (CINECA); HDF5 large-dataset I/O; Fano factor & firing-variability analysis; Blue Brain Cell Atlas data
Research Methods	Scientific writing; experimental design; ethics-approved user evaluation; cross-platform validation; open research & data sharing

PROFESSIONAL EXPERIENCE

PhD Researcher — Computational Neuroscience Oct 2023 – May 2026
University of Sassari (UNISS), Italy — Department of Biomedical Sciences Supervisors: Prof. S.M.G. Solinas & Prof. P. Enrico

- **Designed and implemented the NeuroConstellation platform family**, a cross-platform GPU-accelerated framework for real-time visualisation of large-scale neural network activity, deployed across desktop, mixed reality, immersive VR, and the web browser.
- **Built XR interaction systems** for HoloLens 2 (Microsoft MRTK) and Varjo XR-4 (Ultraleap hand tracking), enabling researchers to inspect and manipulate neural datasets in immersive environments.
- **Ported the desktop pipeline to the browser** as NeuroConstellation Web (WebGPU/WGSL), released as open-source software and archived on Zenodo.
- **Conducted a feasibility user evaluation** of the toolset with neuroscientists and PhD students at EBRAINS-Italy 2024 and the BRANDY Summer School 2025; ethics-approved, GDPR-compliant.
- **Collaborated with CNR Palermo (Migliore lab), George Mason University (Ascoli lab), and EBRAINS-Italy**; co-author on a published *Scientific Reports* paper (Neural Circuit Visualizer, 2026).

Monitoring & Evaluation Officer Jan 2022 – Jun 2022
SZABIST-ZABTech iTVE Institute, Sindh, Pakistan Educational Programme Management

- **Managed comprehensive data collection** and analysis for technical and vocational education programmes, improving programme effectiveness through data-driven insights.
- **Conducted Training of Trainers (ToT) workshops**, enhancing the pedagogical skills of instructors in modern teaching methodologies.

- **Implemented quality assurance frameworks** ensuring compliance with international education standards and achieving high stakeholder satisfaction.
- **Developed monitoring dashboards** using Python and Excel for real-time tracking of programme KPIs and student performance metrics.

Quality Assurance Spot Checker

Jul 2021 – Nov 2021

Aga Khan University Examination Board (AKUEB), Pakistan

Examination Quality Control

- **Ensured examination integrity** by conducting spot checks across multiple examination centres during Annual and Re-sit 2021 sessions.
- **Identified and resolved** procedural discrepancies, maintaining compliance with AKUEB examination protocols.

Research Assistant — NLP Lab

2017 – 2019

University of Electronic Science and Technology of China (UESTC)

Machine Learning Research

- **Developed deep learning models** for emotion detection from text using LSTM, CNN, and transformer architectures as part of Master's thesis research.
- **Conducted innovative research** on Role-Based vs Attribute-Based Access Control systems, resulting in published paper.
- **Implemented NLP pipelines** for text preprocessing, sentiment analysis, and emotion classification using Python, TensorFlow, PyTorch.
- **Collaborated with international research team** on comparative analysis of access control mechanisms in cloud computing environments.

IT Intern

2015

HBL Bank Pakistan Pvt. Ltd.

Banking Technology Department

- **Assisted in development** of internal banking applications using Java and SQL.
- **Gained hands-on experience** with enterprise-level IT infrastructure and security protocols in the financial sector.

CURRENT RESEARCH ACTIVITIES

International Research Mobility (Completed)

Institut de Neurosciences des Systèmes (INS), Aix-Marseille Université, France August 2025 – January 2026

Six-month research mobility hosted by Dr. Pierpaolo Sorrentino. Conducted Fano factor analysis on a 10×10 connectivity grid (100 parameter combinations of $\text{PYR2PYR} \times \text{PYR2INH}$, each a 5,000 ms NEST simulation), plus four follow-up half-step runs — 104 NEST simulations in total, executed on the Galileo100 cluster (CINECA). Key finding: inhibitory connectivity dominates firing variability, while pyramidal-to-pyramidal recurrence raises firing rate without reorganising variance; resulting Fano factor values fell within the range reported from cortical recordings *in vivo*. Parallel work on EEG preprocessing: artefact rejection, source reconstruction, and spectral analysis.

- **PhD Thesis — Completed.** Successfully defended dissertation *Real-Time Visualisation of Large-Scale Neural Networks: GPU-Accelerated Methods for Desktop, Extended Reality, and Browser Platforms* on 6 May 2026 at the University of Sassari, Italy.
- **Journal Papers in Preparation.** Four thesis chapter manuscripts ready for submission to MDPI Electronics, Scientific Reports, Springer Nature Virtual Reality, and IEEE Transactions on Visualization and Computer Graphics; one manuscript submitted to *iScience*.
- **Fano Factor / Connectivity Analysis.** Continuing analysis of NEST simulation outputs from Aix-Marseille mobility, characterising the relationship between recurrent connectivity, firing variability, and biologically plausible network dynamics.
- **EEG Data Analysis.** Developing signal processing pipelines in MATLAB for EEG preprocessing, source reconstruction, spectral analysis, and machine-learning-based brain-state classification.
- **Brain Co-Simulation Framework.** Co-simulation tasks integrating multiple simulation platforms to bridge different scales of brain organisation; ongoing collaboration with EBRAINS-Italy.

SELECTED RESEARCH PROJECTS

NeuroConstellation Platform Family

2023 – 2026

Technologies: Unity 2022.3 LTS, C#, HLSL, WebGPU, WGSL, Python, MRTK 2.8.3, Ultraleap SDK, HDF5, NEST

GPU-accelerated visualisation system for large-scale neural network activity, spanning **five platforms** on a shared architectural foundation:

- **Desktop (Chapter 4)** — Game-engine-based desktop application for real-time visualisation and analysis of million-scale neural network activity. Six visualisation modes alongside parallel GPU-accelerated analysis (firing-rate maps, recruitment maps, spike-history trails); validated against a Python NumPy/SciPy reference pipeline.
- **HoloNeV — static MR (Chapter 5)** — Mixed reality visualisation of mouse hippocampus CA1 neural activity on Microsoft HoloLens 2, using a distributed workstation–headset architecture for high-resolution rendering of hundreds of thousands of neurons.
- **Dynamic MR with hand gestures (Chapter 6)** — Temporal spike dynamics on HoloLens 2 with MRTK hand-tracking interaction; three runtime visualisation modes (Spike, Static, Hybrid) selectable in real time.
- **Immersive VR — Varjo XR-4 (Chapter 7)** — Stereoscopic VR visualisation of human hippocampus CA1 neural activity with Ultraleap hand tracking; configurable dataset loading and confidence-based gesture interaction.
- **NeuroConstellation Web (Chapter 8)** — WebGPU/WGSL port supporting both mouse and human CA1 datasets in Chrome, Edge, Firefox, and Safari; zero installation, open-source release.
Live demo: neuroconstellationweb.netlify.app Archive: DOI [10.5281/zenodo.17650645](https://doi.org/10.5281/zenodo.17650645)

Collaborative project with the Institute of Biophysics CNR Palermo (Migliore lab) & the University of Sassari.

PROFESSIONAL CERTIFICATIONS & TRAINING

Artificial Intelligence & Machine Learning

- **Certified AI Developer (2024)** — Presidential Initiative for AI & Computing. ID: 2024010174408
- **Deep Learning with PyTorch: GAN (2021)** — Coursera. Certificate: BAF4V3RDDAQ2
- **ML Pipelines with Azure ML Studio (2021)** — Coursera. Certificate: U4J8ML525KFZ
- **Neural Style Transfer (2021)** — Coursera. Certificate: FCJ3S34H5TD3
- **AI for Everyone (2020)** — Deeplearning.AI by Andrew Ng
- **Data Science Fundamentals (2021)** — Corporate Finance Institute. ID: 39357993

Professional Development

- **Scientific Writing Course (2023)** — Multiomics. MO-22-SRW/19/094
- **Creative Writing (2022)** — DigiSkills.pk. ZF7HEBUXB
- **Virtual Assistant Course (2022)** — DigiSkills.pk. MFPQPJ9MK
- **Freelancing Course (2022)** — DigiSkills.pk. T86E62MXB
- **Social Media Marketing (2021)** — HP LIFE. 94bea76b-efdc-4e3d-95b1
- **Effective Presentations (2021)** — HP LIFE. e1f4c843-a443-4da1-9f7b

Technical Skills & IT Certifications

- **Linux Essentials (2022)** — CISCO Networking Academy
- **Python Programming Basics (2021)** — Huawei. EBG2020NCHW1100108
- **Math Basics (2021)** — Huawei. EBG2020NCHW1100109
- **Innovation Practice of IoT (2021)** — Huawei. EBG2021NCHW1200005
- **Web Development Diploma (2016)** — Icon Institute, Larkana
- **Certificate in IT (CIT) (2013)** — BBSYDP, DotCom Institute
- **Computer Hardware & Repairing (2010)** — Educator Computer Institute, Karachi
- **Computer & Information Technology (2005)** — DotCom Institute, Larkana

WORKSHOPS & SPECIALISED TRAINING

Historical Museum Guide — Special Lecture (2019)

University of Electronic Science and Technology of China (UESTC)

Part of the **first group of international students** invited to serve as museum guides in UESTC's 60-year history. Delivered special lecture introducing Chinese technological advancement to a global audience.

Featured in: news.uestc.edu.cn

- **The Predictive Role of Connected Dynamical Systems** (2026) — Online Workshop (January 20). Organised by F. de Pasquale & S. Della Penna.
- **environMENTAL Summer School** (2025) — Environmental & Computational Neuroscience. Aix-Marseille University, France (Oct 8–9).
- **1st EBRAINS-Italy School** (2025) — BRAin DYnamics Academy (BRANDY). Ala Birdi, Italy (September 4–11).
- **2nd Deep Learning Workshop** (2018) — UESTC School of International Education.
- **IEEE COMSOC Summer School** (2017) — UET Lahore & FAST University with IEEE.
- **Personal Development Workshop** (2018) — Build your SKAs — UESTC, China.
- **1st Sindh Youth Summit** (2017) — Sports & Youth Affairs Dept, Govt. of Sindh.
- **Data Analysis: SPSS & AMOS** (2016) — University of Sindh, Pakistan.

AWARDS, HONOURS & RECOGNITIONS

Academic Excellence

- **IEEE Conference Participation Certificate** (2021) — 15th International Conference on Open-Source Systems and Technologies.
- **Academic Achievement Award** (2018) — UESTC. Third prize for outstanding academic research performance.
- **Excellent Performance Award** (2018) — UESTC. Second prize for excellence in arts, sports, and voluntary work.
- **Best Senior Ever Award** (2017) — University of Sindh. Recognition for leadership and academic excellence.
- **Software Project Exhibition** (2017) — University of Sindh. First Prize in Final Year software project exhibition.
- **Prime Minister Laptop Scheme** (2015) — Awarded laptop for exceptional academic performance.
- **Certificate of Performance** (2015) — University of Sindh. Outstanding performance during bachelor studies.

Sports & Cultural Achievements

- **Tour of Sichuan Athlete** (2019) — International Cycling Competition.
- **Volleyball Champion** (2018) — Muslim Students Spring Sports.
- **Cricket Winner** (2018) — UESTC Summer Sports.
- **Cricket Tournament** (2018) — Muslim Student Spring Sport Activities.
- **Outstanding Performance** (2018) — Cultural Activities at UESTC.
- **Passion in Electronic Science** (2018) — Electronic Museum Award — UESTC.
- **International Students Olympics** (2018) — Winter Interdormitory Olympics.
- **Appreciation Certificate** (2015) — Organising seminars and cultural events.

COMMUNITY SERVICE & VOLUNTEER LEADERSHIP

ILM Ambassador — British Council Pakistan (2015–2016)

Education Ambassador for **ILM-POSSIBLE: Take a Child to School (TACS)** programme.

Impact: Contributed to enrolment of 110,000+ out-of-school children across Pakistan's four provinces.

britishcouncil.pk/110000-and-counting-take-child-school

- **VIP Member** — **Green Manor Club** (2018–2019) — Environmental & cultural organisation at UESTC.
- **ISU Election Officer** (2018) — International Students Union elections management.

- **Cultural Exchange Volunteer** (2018) — Shuangbai Community, Chengdu.
- **Conference Organiser** (2018) — China Soft Conference 2018, Chengdu.
- **Forum Volunteer** (2018) — 40th Anniversary of China's Reform Forum.
- **Welcome Committee** (2018) — UESTC International Freshers' Orientation.
- **Study in UESTC Ambassador** (2017) — Promotional interviews for international education.
- **Winter Cleaning Volunteer** (2019) — International Students Union initiative.

LANGUAGES & SOFT SKILLS

Languages

English Fluent (Professional)
 Sindhi Native
 Urdu Native
 Italian Learning (Basic)
 Chinese Basic (HSK Level 1)

Core Competencies

- Team Leadership & Project Management
- Cross-cultural Communication
- Creative Problem Solving
- Scientific Writing & Documentation
- Training & Workshop Facilitation

REFEREES

Prof. Sergio M. G. Solinas

Doctoral supervisor; Associate Professor
 Department of Biomedical Sciences
 University of Sassari, Italy

Prof. Paolo Enrico

Doctoral co-supervisor; Full Professor
 Department of Biomedical Sciences
 University of Sassari, Italy

Dr. Pierpaolo Sorrentino

Mobility host; Senior Researcher
 Institut de Neurosciences des Systèmes (INS)
 Aix-Marseille Université, France

Dr. Luca L. Bologna

Co-author; Senior Researcher
 Institute of Biophysics
 National Research Council (CNR), Palermo, Italy

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