

Dr. Safeer Ali Mirani

PhD | AI & 3D Development Specialist

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■ PROFILE

Researcher and engineer building GPU-accelerated, real-time systems for visualising and analysing large-scale neuroscience data. The PhD (University of Sassari, 2026) delivered the **NeuroConstellation** platform family, rendering up to **5.28 million human hippocampus CA1 neurons in real time** across five platforms spanning desktop, mixed reality (HoloLens 2), immersive VR (Varjo XR-4), and the open web (WebGPU). In parallel, analysed full-scale single-cell **CA1 connectomes** (human and mouse) on the GPU, reporting one of the first matched cross-species comparisons at this scale and a conserved GABAergic neurogliaform rich-club. The work spans **3D graphics, extended reality, and computational neuroscience**, grounded in deep learning, NLP, GPU compute, and neural simulation (NEST). Collaborates with EBRAINS-Italy, CNR Palermo (Migliore lab), and INS Aix-Marseille.

■ RESEARCH INTERESTS

Real-time visualisation of large-scale neural network activity · computational neuroscience · deep learning, NLP, and large language models (LLMs) · GPU-accelerated rendering and compute (HLSL, WGSL, 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), Department of Biomedical Sciences, Italy

Defended 6 May 2026

Degree conferred at convocation: 16 June 2026.

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

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

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

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

Output: 2 peer-reviewed publications, 1 under review (*iScience*), 2 under revision, 5 first-author manuscripts in preparation, and 3 published conference abstracts. First author on eight doctoral manuscripts; co-author on a peer-reviewed *Scientific Reports* paper (2026). Full list on Google Scholar. Listed below by status.

Peer-Reviewed Publications

1. 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 Open Access, 20 March 2026 Q1, Multidisciplinary Sciences; JCR IF 3.9 (2024)
2. Aftab, M.U., Qin, Z., Zakria, **Ali, S.** (S.A. Mirani), 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), Chengdu, China, pp. 35–39.
DOI: 10.1109/ICCWAMTIP.2018.8632578

Under Review

1. **Mirani, S.A.**, Memon, P., Enrico, P., Urgese, G., & Solinas, S.M.G. (2026). *NeuroConstellation: Interactive Visualisation and Analysis of Million-Neuron Datasets Using Game Engine Technology*. *iScience*.
Under review (R1)
Unity 3D platform rendering up to 5.28M neurons at interactive frame rates.

Under Revision

1. **Mirani, S.A.**, Memon, P., Enrico, P., Bologna, L.L., Ali, M., Migliore, M., & Solinas, S.M.G. (2026). *HoloNeV: Advancing Human–Computer Interaction in Neuroscience Through Mixed Reality Neural Visualisation*. Full journal paper (MDPI Electronics); resubmission in progress. A short conference abstract appears under Conference Presentations below.
2. **Mirani, S.A.**, Memon, P., Enrico, P., & Solinas, S.M.G. (2026). *Single-Draw-Call Immersive Visualisation of 5.28 Million Neurons with Hand-Tracked Interaction in Video Pass-Through Mixed Reality (Varjo XR-4)*. Revision underway; adding connectivity and activation visualisation.

Ready for Submission

1. **Mirani, S.A.**, Memon, P., Enrico, P., & Solinas, S.M.G. (2026). *Mixed Reality Visualisation of Simulated Mouse Hippocampus CA1 Activity with Hand-Gesture Interaction on Microsoft HoloLens 2*.
2. **Mirani, S.A.**, Memon, P., Enrico, P., & Solinas, S.M.G. (2026). *NeuroConstellation Web: Client-Side WebGPU Compute for Interactive Visualisation and Analysis of Million-Scale Neural Activity*. Target: IEEE Access.
Live: neuroconstellation.netlify.app
3. **Mirani, S.A.**, Memon, P., & Solinas, S.M.G. (2026). *A Conserved GABAergic Neurogliaform Rich-Club Organises the Mammalian CA1 Connectome*. First matched cross-species (human/mouse) single-cell connectome comparison.
4. **Mirani, S.A.**, Memon, P., Enrico, P., & Solinas, S.M.G. (2026). *A Web-Based WebGPU Explorer for Single-Cell Connectomes of the Mammalian CA1*.
Live: mouse-ca1-connectome.netlify.app · human-ca1-connectome.netlify.app
5. **Mirani, S.A.**, Solinas, S.M.G., & Memon, P. (2026). *Degree Dominates: A Collinearity-Aware Variance Decomposition of Structure-to-Function Predictability in a Full-Scale CA1 Connectome*.

Conference Presentations & Published Abstracts

1. **Mirani, S.A.**, Memon, P., Migliore, R., Migliore, M., Mercante, B., Enrico, P., & Solinas, S.M.G. (2026). *HoloNeV: Holographic Visualisation Tool for Neural Network Activity*. CNS*2025, Florence (Poster P201). Abstract in *Journal of Computational Neuroscience*, 54(Suppl. 1), S227, Springer.
programme entry

2. Ali, M., Smiriglia, R., Spera, E., **Mirani, S.A.**, Solinas, S.M.G., Migliore, M., Ascoli, G.A., & Bologna, L.L. (2026). *Neural Circuit Visualizer: A Web-Based Platform for the Simulation and Visualisation of Full-Scale Point-Neuron Circuits*. CNS*2025, Florence (Poster P335). Abstract in *Journal of Computational Neuroscience*, 54(Suppl. 1), S361, Springer.
programme entry

3. Mirani, S.A., Enrico, P., & Solinas, S. (December 2024). *Holographic Visualisation of Neural Network Activity*. EBRAINS Italy, Naples, Italy.
GPU-accelerated indirect instancing on Microsoft HoloLens 2.

■ SOFTWARE & INTERACTIVE DEMOS

NeuroConstellation Web: browser-native WebGPU visualiser of large-scale neural activity (six validated modes).
Live: neuroconstellation.netlify.app

CA1 Connectome Explorer: client-GPU single-cell connectome browser: cell types, wiring tours, structural rich-club, and activity playback.
Live: mouse-ca1-connectome.netlify.app (mouse) · human-ca1-connectome.netlify.app (human)

CA1 Morphology Viewers: representative NeuroMorpho.org reconstructions per cell type, shown individually and placed at real soma positions.
Live: ca1-morphology-lab.netlify.app · marphology-cloud.netlify.app

Datasets: full-scale mouse CA1 (288,027 neurons) and human CA1 (5,280,000 neurons) scaffold models (Gandolfi, Mapelli, Solinas & Migliore; EBRAINS / EU Human Brain Project), NEST-simulated on CINECA Galileo100; preprocessing and HDF5 pipelines released alongside the visualisers.

■ TECHNICAL EXPERTISE & PROFICIENCIES

Programming	Python, C++, C#, JavaScript, MATLAB, Java, SQL, PHP, HTML5/CSS3, HLSL, WGSL
AI & Machine Learning	Machine learning, deep learning & neural networks; NLP & transformers; large language models (LLMs); generative AI; computer vision; TensorFlow, PyTorch, Keras; 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; EBRAINS CA1 scaffold-model 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), Department of Biomedical Sciences, Supervisors: Prof. S.M.G. Solinas & Prof. P. Enrico Italy

- **Built the NeuroConstellation platform family**, a cross-platform GPU-accelerated framework for real-time visualisation of large-scale neural activity, deployed across desktop, mixed reality, VR, and the 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), running client-side with no installation.
- **Ran an ethics-approved, GDPR-compliant user evaluation** with neuroscientists and PhD students at EBRAINS-Italy 2024 and the BRANDY Summer School 2025.
- **Collaborated with CNR Palermo (Migliore lab) and EBRAINS-Italy**; co-author on a published *Scientific Reports* paper (Neural Circuit Visualizer, 2026).

Monitoring & Evaluation Officer

SZABIST-ZABTech iTVE Institute, Sindh, Pakistan

Jan 2022 – Jun 2022

Educational Programme Management

- **Managed data collection and analysis** for technical and vocational education programmes.
- **Ran Training-of-Trainers (ToT) workshops** for instructors.
- **Implemented quality-assurance frameworks** aligned with international education standards.
- **Built monitoring dashboards** in Python and Excel to track programme KPIs and student performance.

Quality Assurance Spot Checker

Aga Khan University Examination Board (AKUEB), Pakistan

Jul 2021 – Nov 2021

Examination Quality Control

- **Conducted spot checks** across examination centres during the 2021 Annual and Re-sit sessions.
- **Identified and resolved** procedural discrepancies under AKUEB protocols.

Research Assistant, NLP Lab

University of Electronic Science and Technology of China (UESTC)

2017 – 2019

Machine Learning Research

- **Developed deep-learning models** (LSTM, CNN, transformer) for text emotion detection as part of Master's thesis research.
- **Researched Role-Based vs Attribute-Based Access Control**, resulting in a published paper.
- **Built NLP pipelines** for text preprocessing, sentiment analysis, and emotion classification in Python, TensorFlow, and PyTorch.

IT Intern

HBL Bank Pakistan Pvt. Ltd.

2015

Banking Technology Department

- **Assisted development** of internal banking applications in Java and SQL.
- **Worked with enterprise IT infrastructure** and security protocols in banking.

■ CURRENT RESEARCH ACTIVITIES

International Research Mobility (Completed)

Institut de Neurosciences des Systèmes (INS), Aix-Marseille Université, France

August 2025 – January 2026

Six-month mobility hosted by Dr. Pierpaolo Sorrentino. Fano-factor analysis of recurrent network dynamics using NEST simulations on the Galileo100 cluster (CINECA), alongside EEG preprocessing (artefact rejection, source reconstruction, spectral analysis).

- **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

A unified GPU-accelerated architecture for real-time visualisation of large-scale neural activity, deployed across **five platforms**: a Unity desktop application (six visualisation modes with parallel GPU analysis, validated against a NumPy/SciPy reference), static and dynamic mixed reality on HoloLens 2 (distributed workstation/headset rendering with MRTK hand tracking), immersive VR on Varjo XR-4 (Ultraleap hand tracking), and a zero-install WebGPU browser port supporting mouse and human CA1 datasets. Corresponding manuscripts are listed under Research Publications.

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 (Jan 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 (Sept 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 Students Spring Sports.
- **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; Professor & Senior Researcher
Institute of Biophysics
National Research Council (CNR), Palermo, Italy

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