Shah Rukh Qasim

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Professional Summary

Artificial Intelligence researcher with over nine years of research experience. My work spans reinforcement learning (RL), graph neural networks, and large language models in complex applications such as particle physics, epidemiology, and operations research. Expert in particle reconstruction, AI-based design of scientific instruments and complex scientific simulations. I have led applied research projects within international scientific collaborations, supervised PhD and graduate researchers, and built research software and simulations used for real-world experimental design. I am also interested in research and development in AI beyond these domains.

Work Experience

Postdoctoral Researcher *Jul. 2023 – Present*
Department of Physics & Department of Mathematical Modeling and Machine Learning (DM3L), University of Zurich – Zurich, Switzerland

- Led AI research projects in particle physics, epidemiology, and operations research.
- Member of the SHiP Collaboration at CERN; played a central role in designing the experiment's Muon Shield, a CHF 10M detector component, using AI.
- Supervise and mentor multiple Ph.D. and Master's students on applied machine learning research projects.
- Manage computational infrastructure for the research group, including GPU clusters and cloud computing resources.

Ph.D. Researcher, Computer Science *Oct. 2019 – Jun. 2023*
CERN – Geneva, Switzerland

- Enrolled at Manchester Metropolitan University; conducted doctoral research on-site at CERN.
- Designed graph neural network algorithms for particle detector reconstruction, producing the first end-to-end multi-particle reconstruction method for high-occupancy sensor data.

Research Intern (Technical Student) *Jan. 2018 – Jan. 2019*
CERN – Geneva, Switzerland

- Worked on dynamic graph neural networks and proposed a new method for processing large-scale sensor data.

Education

Ph.D., Computer Science *Oct. 2019 – Jun. 2023*
Manchester Metropolitan University – Manchester, United Kingdom

B.E., Electrical Engineering and Computer Science *2014 – 2019*
National University of Sciences and Technology (NUST) – Islamabad, Pakistan

Teaching & Supervision

- Co-Supervising Ph.D. Students, University of Zurich – two at the Department of Mathematical Modeling and Machine Learning (DM3L), one at the Department of Physics (2023 – Present).
- Thesis Supervisor – one Master's thesis (Politecnico di Milano), one Bachelor's thesis (Department of Physics, University of Zurich) (2023 – 2024).
- Teaching Assistant, *Introduction to Applied Deep Learning*, University of Zurich (2024 – 2025).
- Teaching Assistant, *Machine Learning for Sciences*, University of Zurich (2025 – 2026).
- Teaching Assistant, *Physics 1 & 2 for Natural Sciences*, University of Zurich (2023 – 2024).

Skills

Programming Languages: C++, Python, Java

Tools & Frameworks: TensorFlow, PyTorch, CUDA, Geant4, NumPy, NetworkX, OpenCV, Linux, SQL, HPC environments

Other: Large-scale computational optimization, distributed and GPU computing, cloud infrastructure (Google Cloud), team supervision and mentoring

Selected Publications

1. S. Zoccheddu, S.R. Qasim, P. Owen, N. Serra. Large Language Models for Physics Instrument Design. *Machine Learning: Science and Technology*, 7(4): 045005, 2026.
2. G. Hijano Mendizabal et al. Leveraging Reinforcement Learning, Genetic Algorithms and Transformers for Background Determination in Particle Physics. *Physica Scripta*, 101: 196002, 2026.
3. A. Figalli, S.R. Qasim, P. Owen, N. Serra. Designing Particle Physics Experiments with Artificial Intelligence. *Frontiers in Physics*, 14: 1765091, 2026.
4. G. Hijano et al. Towards Replacing Detector Simulations with Heterogeneous Graph Neural Networks in Flavor Physics Analyses. *Physical Review D*, 113(1): 012005, 2026.
5. L.F. Cattelan, S.R. Qasim, P. Owen, N. Serra. Ultra-Fast Muon Transport via Histogram Sampling on GPUs. arXiv:2512.10520, 2025. (Preprint)
6. S.R. Qasim, P. Owen, N. Serra. Physics Instrument Design with Reinforcement Learning. *Machine Learning: Science and Technology*, 6(3): 035033, 2025.
7. S.R. Qasim et al. End-to-End Multi-Particle Reconstruction in High Occupancy Imaging Calorimeters with Graph Neural Networks. *European Physical Journal C*, 2022.
8. S.R. Qasim, J. Kieseler, Y. Iiyama, M. Pierini. Learning Representations of Irregular Particle-Detector Geometry with Distance-Weighted Graph Networks. *European Physical Journal C*, 2019.
9. S.R. Qasim, H. Mahmood, F. Shafait. Rethinking Table Parsing Using Deep Learning. *15th International Conference on Document Analysis and Recognition*, 2019.
10. A. Gilani, S.R. Qasim, I. Malik, F. Shafait. Table Detection using Deep Learning. *14th International Conference on Document Analysis and Recognition*, 2017.

Full publication list (Google Scholar profile): https://scholar.google.com/citations?user=DcN-r2kAAAAJ

Invited Talks

- Physics Instrument Design with AI (Keynote), HAMLET Workshop, Copenhagen, Denmark, 2026.
- AI-Driven Physics Instrument Design: From Reinforcement Learning to Large Language Models, CERN Data Science Seminar, Geneva, Switzerland, 2026.
- AI for Instrument Design, Zurich Phenomenology Workshop, Zurich, Switzerland, 2026.
- AI-Driven Detector Design (Plenary), ML4Jets Conference, Caltech, USA, 2025.
- From Data to Discovery: Machine Learning in High Energy Physics at CERN Experiments, University of Zurich, Switzerland, 2024.

Peer Review

Reviewer for the following journals:

- Machine Learning: Science and Technology (ISSN 2632-2153)
- Discover Artificial Intelligence (ISSN 2731-0809)
- Archives of Computational Methods in Engineering (ISSN 1134-3060)
- Engineering Research Express (ISSN 2631-8695)

References

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