Mohammad Orabe

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I'm a software developer interested in data analysis, machine learning, and neurotechnology. I build software solutions to address challenges at the intersection of these fields. Portfolio available on website.

Experience

Machine Learning Engineer (Research, Part-Time) Jul 2023 – Present
Quality in Artificial Intelligence Labs (QAI Labs) – joint research group at PTB, Charité

- **PTB – National Metrology Institute of Germany**
  Developed an open-source toolkit for evaluating uncertainty & calibration in brain source imaging.
  Implemented an automated framework to evaluate the reliability of inverse machine learning methods—covering data generation, performance evaluation, and visualization.
- **Charité – Universitaetsmedizin Berlin**
  Contributed methods for analyzing brain connectivity (how different regions interact) to a widely used open-source software package.
  Implemented advanced methods for electrophysiological data analysis and preprocessing.

Data Science (Student Research Assistant) Jul 2021 – Jun 2023
Winter Lab, Berlin
Implemented ML pipelines and statistical toolboxes across five projects in tracking environments.
Applied computer vision for object detection and developed reproducible analytics workflows.

Technical Support Feb 2017 – Jul 2020
Institute for International Communication (IIK), Berlin
Provided IT support and maintained Linux/Windows systems.
Assisted with system troubleshooting and automated routine administrative tasks.

Education

M.Sc. in Computer Science Feb 2022 – Sep 2025
Technische Universität (TU Berlin)
Focused on machine learning, data science, and intelligent systems, with coursework covering deep learning, probabilistic modeling, and software engineering.
Thesis: ongoing, to be submitted by 30 September 2025

B.Sc. in Computer Science Oct 2018 – Sep 2021
Technische Universität (TU Berlin)
Core curriculum included algorithms, programming, computer architecture, and applied machine learning. Developed a strong foundation in software development and data-driven systems.
Thesis: Pose Estimation and Multi-Object Tracking with Deep Learning.

Internships

Software Development Jul 2020 – Oct 2020
DAI Lab
Contributed to the development of distributed eHealth and agent-based systems. Prototyped electrical circuits for wearable sensor platforms.

Open-Source Software – Lead Developer (Selected)

CaliBrain – Model Uncertainty Evaluation (Python)
Designed a modular benchmarking framework to evaluate and visualize model reliability and calibration in data-driven inverse problems.

GaitMod – Real-Time Gait Detection Toolkit (Python)
Built a library for real-time classification of impaired movement using invasive human brain signals. Implemented deep learning models (LSTM, Transformers) for state prediction and adaptive feedback.

GroupMouseTrack – Multi-Object Tracking (Python)
Developed a deep learning tool for multi-object tracking and pose estimation—integrating sensor data with computer vision to preserve individual identities over time.

ColonyRack – Behavioral Data Processing Toolbox (R)
Created a toolbox for processing and analyzing large-scale time-series data in behavioral studies to enable efficient extraction of activity patterns and social interaction metrics.

Teaching & Mentorship

Founder & Lead Instructor 2023 – Present
MathCodeLab
Launched a tech education platform offering in-person & online courses in coding and data science. Taught 10+ intensive 12-week courses. Built a vibrant community of over 240 learners.

Teaching Assistant Winter Semester 2024/2025
TU Berlin (Uncertainty, Inverse Modeling and Machine Learning Group)
Assisted in a Master's-level seminar focused on advanced machine learning for biomedical data science. Supported students with project supervision, course logistics, and technical Q&A.

ML & Data Science Projects (Selected)

Medical Image Analysis – Tumor Segmentation from MRI Scans
Trained deep learning models (UNet, SegResNet) to detect and segment brain tumors in medical imaging data, supporting clinical diagnosis.

Multi-Modal Learning with Variational Autoencoders – Image & Label Translation
Built a generative model (M-VAE) that learns shared patterns from images and associated labels, enabling conversions between data formats.

Open-Source Software Contribution – Signal Analysis Toolbox (MNE-Python)
Contributed advanced coherency-based methods for analyzing brain-related signals to a widely used open-source scientific library.

Simulation Framework for Brain Research (neurolib)
Extended open-source software to support simulations of brain activity using anatomical models.

Technical Skills

Programming Languages: Python, R, Java, MATLAB, C/C++
ML Libraries & Frameworks: TensorFlow, Keras, PyTorch, scikit-learn, NumPy, pandas, SciPy, Numba, OpenCV, matplotlib, seaborn
Applied ML Domains: NLP, Computer Vision, Time Series, Signal Processing
Machine Learning Architectures & Models: CNN, LSTM, Transformers (LLMs), UNet, SegResNet; Generative Models: GANs, AEs; Reinforcement Learning, Transfer Learning
Cloud & DevOps: Docker, AWS, Azure, CI/CD, RESTful APIs
Data Engineering: SQL, ETL Pipelines, Apache Kafka, Apache Spark
Software Development Tools: Git, GitHub, Bash, SSH, gdb, Unit Testing, API Design, Open-Source

Languages & References

Languages: English (Fluent), German (Professional)
References: Available upon request