Hassan El Bouz

Quantum Engineering Student
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Education

M.Sc. in Quantum Engineering, ETH Zurich — Zurich, Switzerland *2025 – 2027*

- **Coursework**: Quantum Information Processing, Advanced Machine Learning, Information Theory, Quantum Mechanics, Qubits and Electronics.

B.S. in Physics and Pure Mathematics, American University of Beirut — Beirut, Lebanon *2022 – 2025*

- **GPA**: 4.22/4.0
- **Selected coursework**: Quantum Mechanics, Linear Algebra, Computational Physics, Machine Learning
- **Awards**: Merit Scholarship (Early Admission), AUB Honor List (every semester), Muhanna Foundation Award of Excellence (Mathematics), Teddy Christidis Excellence Award (Physics), Dr. Mohammad Chatah Excellence Award

Projects

Dynamic Structure Autoencoder (Capstone Project) — Python, PyTorch *2025*

- Developed a neural network in PyTorch that **dynamically changes its architecture**, reducing latent space dimension and hidden layer sizes during training.
- Designed for unsupervised representation learning; successfully generated and encoded images from the **MNIST dataset**.
- Extended ideas from entropy-based losses to enable **self-adaptive autoencoders**, enhancing sparsity and efficiency.

Publications

- Hassan El Bouz, supervised by Prof. Giuseppe Della Sala. *On the local behavior of chains on strongly pseudoconvex hypersurfaces in C^3*. Proceedings of the American Mathematical Society, Vol. 153, No. 7, 2025. Link.

Research Experience

On the Local Behavior of Chains on Strongly Pseudoconvex Hypersurfaces in C^3 — AUB · Math Dept · Supervisor: Prof. Giuseppe Della Sala *Jun 2023 – Jun 2024*

- Classified strongly pseudoconvex hypersurfaces up to biholomorphism using Fefferman's metric; analyzed null geodesics.
- Studied *chains* (images of stationary discs) and derived Chern–Moser normal form conditions for sphere equivalence.
- Published in *Proceedings of the American Mathematical Society*, Vol. 153, No. 7 (2025).

Derivation, Analysis and Simulation of a Spatio-Temporal Epidemiology Model with Memory — AUB · Math Dept · Supervisor: Prof. Fatima Mroueh *Jun 2024 – Present*

- Formulated a stochastic integro–differential epidemic model grounded in dynamical systems.
- Proved existence/uniqueness via functional analysis; implemented numerical solvers (Runge–Kutta + custom schemes).
- Submitted for publication.

Path-Integral Entropy Loss for Sparse Autoencoders — AUB · Physics Dept · Supervisor: Dr. Sara Najem *May 2025 – Present*

- Created an entropy-based loss inspired by path integrals to promote sparsity and neuron pruning in autoencoders.
- Implemented and tested in PyTorch; evaluating stability–accuracy trade-offs and pruning thresholds.

Distributed Quantum Systems — AUB · Engineering Dept · Supervisor: Prof. Mahdi Chehimi *Nov 2024 – Jul 2025*

- Analyzed conditions under which two-qubit gates can be teleported.
- Evaluated efficiency and cost of gate cuts for arbitrary gates.

Notable Coursework

- Computational Physics and Machine Learning
- Advanced Quantum Mechanics
- Applied Probability Models — Markov Chains
- Linear Algebra II and Modules and Rings
- Topology
- Symmetries in Physics

Skills

Languages: Python, C++, Java, MATLAB, JavaScript, LaTeX
Frameworks/Tools: PyTorch, NumPy, Pandas, Git, Linux, Qiskit
Areas: Quantum Information, Machine Learning, Numerical Optimization, Algorithms, Mathematical Physics
Seminars & Teaching:

- Delivered seminars on research projects: *Chern–Moser chains on pseudoconvex hypersurfaces* and *Spatio-temporal epidemic models.*
- Presented a seminar on *Jordan Canonical Forms.*
- Tutored undergraduate students in the AUB Math Tutoring Center and ran promotional campaigns to increase engagement.