Erfan **Abedi**

Graduate in Masters of Quantum Science and Technology

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Education

University of California, Los Angeles — *Los Angeles, California, USA*

Master of Quantum Science and Technology — *Sept. 2022 - Sept. 2023*

Amirkabir University of Technology — *Tehran, Iran*

Bachelor of Science in Computer Engineering — *Sept. 2017 - Oct. 2021*

Research Experience

Quantum Light-Matter Cooperative — *Under the Supervision of Prof. Sergio Carbajo*

Research Assistant — *Jun. 2023 - Current*

- Working on numerical simulations of non-linear up-conversion processes using Recurrent Neural Networks.

QuOne Lab at Phanous Research and Innovation Centre (phanous.ir) — *Under the Supervision of Prof. Salman Beigi*

Research Assistant — *Jun. 2021 - Sept. 2022*

- Working on the theory and numerical simulations of a paper on Quantum Lazy Training.
- Assisting the senior researchers with their ongoing research on Quantum Machine Learning.
- Reading Papers and giving talks about various QML papers at the research group's weekly meetings.
- Designing assignments and educational material for the Center's 1000qubit workshop.

Publications

2022 **E. Abedi**, S. Beigi and L. Taghavi, *Quantum Lazy Training*, Quantum 7 (2023): 989, Journal Access.

2021 **E. Abedi**, *Maqenta: Generating music with Quantum Machine Learning*, BSc Thesis (in Persian).

2021 B. Bisgin, N. Oruz, J. G. Jarkovský, **E. Abedi** and M. Mauser, *QSVT in Qiskit*, IBM's Qiskit Hackaton Europe 2021 Project Paper.

Notable Projects

LaserSTM (On Github)

Developer

- LaserSTM is an ongoing part of a larger project to simulate an X-ray free electron laser using Neural Networks.
- A dataset generated from a Non-linear up-conversion process called 'dispersion-controlled nonlinear' shaping is used to simulate this laser using an LSTM architecture.
- The ML models are trained to solve the Non-Linear Schrodinger equation for a specific dataset intended to mimick the LCLS-II laser at SLAC National Laboratory.

Reimage-GPT (On Github)

Developer

- Reimage-GPT is an effort to make prompt-generation easier for using diffusion models.
- In this project, we fine-tuned a Large Language Model (LLM) to come up with a good prompt for a target image.
- First, an input image is separated into a text representation of its most important elements and their respective locations using Facebook's Detectron2 model.
- Then, a GPT-like model is instructed to come up with a good image-generation prompt using the text generated in the previous step.
- Then, GPT's output text is passed onto the Stable Diffusion model to get an output image.
- Finally, the distance between the output and input images is used as loss function to fine-tune the weights of the LLM.

QSVT in Qiskit (On Github) — *IBM's Qiskit Hackaton Europe 2021*

Researcher & Developer

- Quantum Singular Value Transformation (QSVT) is a framework that allows one to apply an arbitrary polynomial transformation to the singular values of a block-encoded unitary transformation.
- QSVT-implemented quantum search was implemented utilizing Fixed-point Amplitude Amplification.
- QSVT in Qiskit was selected as one of the top 3 winning teams of the Hackaton.

Maqenta (On Github)

Reseacher & Developer

- Maqenta is a software for generating music using Quantum Machine Learning.
- Maqenta uses methods such as QLSTM and QGAN for generating music and is built upon Pennylane and PyTorch.
- Maqenta processes digital musical files as input and tries to compose a novel musical piece based on the said input.

AUT-ICPC Programming Contest's website (ICPC.aut.ac.ir)

Back-End Developer

- AUT-ICPC's website is used by the contest's participants to register in and gather more information about the contest.
- AUT-ICPC's website is built using Django on the back-end and React.JS on the front-end.
- AUT-ICPC's website uses technologies such as Ngnix, PostgreSQL, REST framework and Redis.

Online Courses

- Quantum Machine Learning - University of Toronto (Audited)
- Quantum Physics 1 - MIT (Audited) — Quantum Physics 2 - MIT (Audited) — Quantum Physics 3 - MIT (Audited)
- Differential Equations - MITx on edX (Certificate available on Github)
- Statistics 110: Probability - HarvardX on edX (Certificate available on Github)
- The Fourier Transform and its Applications - Stanford University (Audited)

Honors & Awards

2021 **Top 3 Team,** IBM's Qiskit Hackaton Europe (Certificate on GitHub)

2017 **Top 0.8% place,** The Iranian Nationwide University Entrance Exam for BSc. in Math & Engineering.

2015, 2016 **Acceptance in the 1st stage,** Iran's Chemistry Olympiad.

Extracurricular Activities

Students' Scientific Chapter of AUT's Department of Computer Engineering (CEIT-SSC.ir)

Board Member & Head of Contests *Mar. 2019 - Sept. 2020*

- Organized and provided technical means for the 6th Amirkabir Programming League.
- Organized the 1st Amirkabir Artificial Intelligence Summer Summit. (AAISS.ceit.aut.ac.ir)
- Organized and provided technical means for the 19th Amirkabir ICPC. (ICPC.aut.ac.ir)
- Organized the 11th Amirkabir Linux Festival. (LinuxFest.aut.ac.ir)

Programming Languages and Frameworks

Programming Languages

Python · C/C++ · Rust · Q# · C# · Go · Java · JavaScript/TypeScript · Mathematica

Frameworks and Technologies

Pennylane · Qiskit · Cirq · QuTiP · PyTorch · NumPy · SciPy · Pandas · CUDA · OpenMP · AWS
Docker · Django · MongoDB · PostgreSQL · MySQL · Redis · Koa.JS · Express.JS · REST
GraphQL · Arduino