Eraraya Ricardo Muten

$\frac{1}{\sqrt{2}}$ [|Quantum Physicist⟩ + |ML Engineer⟩]

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Education

Bandung Institute of Technology (ITB)

Bandung, Indonesia

Bachelor of Science in Engineering Physics (First Class Honours), **3.94**/4.00 — *Aug 2016 - Mar 2021*

- Thesis title: Quantum Image Classifier Design with Data Re-uploading Quantum Convolution and Data Re-uploading Classifier Scheme. Advisors: Prof. Andriyan Bayu Suksmono and Dr. Nugraha.
- This thesis explored the variational quantum algorithm to classify the MNIST dataset. Two methods were used to reduce the image dimension, PCA and quantum convolution with variational quantum circuits that work similarly to convolution filters in CNN. The proposed architectures achieved up to 99.7% of testing accuracy, an improvement compared to some previous related works.

Research and Working Experience

Indonesian National Research and Innovation Agency

Remote

Research Assistant | Dr. Agung Budiyono & Dr. Ahmad R. T. Nugraha — *Oct 2021 - Present*

- Currently developing a novel Monte Carlo simulation within epistemically-restricted phase-space formulation of quantum mechanics for quantum many-body systems. This novel method allows for a better calculation time at a large sampling with reasonable accuracy. Used TensorFlow to code the simulation and for automatic optimization.

CERN

Remote

openlab Summer Student | Dr. Sofia Vallecorsa — *Jun 2021 - Sep 2021*

- Investigated the Quantum Generative Adversarial Networks algorithm to simulate the $t\bar{t}H(b\bar{b})$ production processes in the LHC experiment. Benchmarked the results with the classical models, studied how the quantum model affects the performance. Used TensorFlow Quantum to build and train the model.

Google Summer of Code, Machine Learning for Science (ML4Sci)

Remote

Student Developer | Prof. Sergei V. Gleyzer — *May 2021 - Aug 2021*

- Conducted research on the potential of Quantum Convolutional Neural Networks in classifying images of particles from high-energy physics events. Benchmarked the results with the classical models, studied how the quantum model affects the performance. The results and codes used for this project are publicly available here as an open-source project.

IBM Quantum

Remote

Qiskit Advocate Mentorship Program Mentee | Dr. Anna Phan — *Mar 2021 - Jun 2021*

- Studied the quantum machine learning model of Data Re-uploading Quantum Classifier (Pérez-Salinas, A. et al.) and Quantum Graph Neural Networks (Verdon, G. et al.). Made code implementation of those models using Qiskit. Ran simulations to find the unknown Hamiltonian parameters of simple transverse-field Ising models with Quantum Graph Neural Networks.

Bandung Institute of Technology

Bandung, Indonesia

Teaching Assistant — *Aug 2017 - Dec 2020*

- Delivered academic and hands-on tutorials (software, programming languages, practicum kits). Provided students with assistance on exam preparations, laboratory activities, assessed quizzes, and homework.
- Subjects: Wave Phenomena, Electric Circuits & Electronics, Fluid Mechanics, Intro. to Information Technology, Engineering Drawing.

Nodeflux Inc.

Jakarta, Indonesia

AI Engineer Intern — *Dec 2019 - Jan 2020*

- Designed a real-time face tracking and blemish removal system to create a webcam filter application. A numerical threshold in HSV color space and elliptical kernel dilations was applied to the image to detect the skin. Blemishes were detected by utilizing CLAHE and blob detection. Trained a YOLO model to track the face using PyTorch. Coded algorithms for blemish removal using OpenCV. Achieved 85-90% of blemishes removal.

Instrumentation, Control, and Decision Systems Lab, Bandung Institute of Tech.

Bandung, Indonesia

Student Researcher | Prof. Yul Yunazwin Nazaruddin — *Sep 2019 - Nov 2019*

- Conducted research in utilizing Error-state Kalman Filter and Diagonal Recurrent Neural Network & LSTM to make the localization of an autonomous car more reliable in the absence of GPS signal, reducing 70% of localization errors. Gathered the training data using CARLA Simulator. Trained and tested the model using Keras and TensorFlow.

IHI Corporation

Yokohama, Japan

Summer Research Intern — *Jul 2019 - Aug 2019*

- Developed Reinforcement Learning agents for solving classic control problems in the OpenAI Gym environment using the Deep Q-Learning algorithm. Designed Reinforcement Learning microservices for the company's AI platform.

GV Lab, Tokyo University of Agriculture and Technology

Tokyo, Japan

Student Researcher | Prof. Gentiane Venture

Oct 2018 - Jan 2019

- Did research in using Convolutional Neural Networks to classify types of touch interaction (poke, scratch, etc.) from humans by learning the data pattern from a force sensor (ShokacChip TS). Trained the model using Keras and TensorFlow. The model reached 88% real-time accuracy. Coded a robotic arm's servos using inverse kinematics in MATLAB to make it moves according to the type of touch being predicted by the network as a response.

Publications, Presentations & Panel Discussions

Nov 2021 **Efficient Monte Carlo Simulations with Epistemically-restricted Phase-space Representation**, (in preparation)

Oct 2021 **Modified Layerwise Learning for Data Re-uploading Classifier in HEP Event Classification**, (published, presented at the IEEE Intl. Conf. on Quantum Computing & Engineering and the Quantum Computing for High-Energy Physics Workshop)

Sep 2021 **An Approach for the Localization Method of Autonomous Vehicles in the Event of Missing GNSS Information**, (published, presented at the 2021 Society of Instrument and Control Engineers Annual Conference)

Aug 2021 **Quantum Generative Adversarial Networks on $t\bar{t}H(b\bar{b})$ Process Data Generation**, (presented at the 2021 CERN Summer Student Session)

Jul 2021 **Quantum Convolutional Neural Networks for High-Energy Physics Analysis at the LHC**, (presented at the 2021 Munich Center for Quantum Science and Technology Student Conference)

Apr 2021 **Panelist**, Panel Discussion: Innovation and Future Scope in Quantum Computing, IEEE SIES GST EPSILON 2021 Symposium

Nov 2019 **Localization Method for Autonomous Car Using Virtual Sensing System**, (published, presented at the 6th International Conference on Electric Vehicular Technology)

Dec 2018 **Learning Human Touch Interaction with Convolutional Neural Networks**, (presented in student conference at Tokyo University of Agriculture and Technology)

Apr 2018 **Sustainable Development of Machine Learning-based Supply Chain System**, (presented student conference paper at Sriwijaya University)

Achievements & Training

Achievements

2021 **Runner-up**, Xanadu's QHack Quantum Machine Learning Open Hackathon 2021

2020 **Qiskit Advocate**, IBM Quantum

2019 **Most Outstanding Student of Engineering Physics Department**, Bandung Institute of Technology

2018 **1st Place**, National Scientific Research Paper Competition for University Students, Sriwijaya University, Indonesia

2016-21 **All Semesters**, Dean's List

Summer School, Workshop & Certified Courses

Jul 2021 **Qiskit Global Summer School Mentor**, IBM Quantum

Jul 2021 **MCQST Summer Student**, Munich Center for Quantum Science and Technology

Sep 2020 **UCLQ Quantum Tech Summer Student**, UCL Quantum Science and Technology Institute

Feb 2020 **Quantum Information Workshop: Intro. to Quantum Communications and Quantum Key Distribution**, SpeQtral

2020-21 **Certified Online Courses in Quantum Computing & Machine Learning**, click here for the course list.

Volunteering & Extracurricular Activity

Indonesian Qiskit Documentation Localization Project

Remote

Founder & Team Leader

Aug 2020 - Present

- Managed an Indonesian localization team for IBM Qiskit Documentation to escalate the importance of quantum computation in Indonesia. We translate the documentation hoping that more people from Indonesia can engage and get interested in quantum computation.

Engineering Physics Student Association

Bandung, Indonesia

Head of Scientific and Professional Development Division

Mar 2019 - Mar 2020

- Managed a team of 10 members in organizing monthly scientific seminars and discussions related to the profession as an engineering physicist. The discussion results were written as articles and put together as a yearly issue. At the end of the term, the division was nominated as the best division of the year.

Skills

Quantum Programming Frameworks Qiskit, Cirq, TensorFlow Quantum, PennyLane, QuTiP

Programming Frameworks TensorFlow, Keras, PyTorch, OpenCV, Scikit-learn, Scikit-image, PySCF

Programming Languages Python, MATLAB, C++, C, LaTeX

Software | Microcontrollers Quantum ESPRESSO, SolidWorks | Arduino, STM32 Nucleo