Eraraya Ricardo Muten

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

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A highly motivated, persistent, and quick learner. Eraraya Ricardo Muten is a bachelor of science with two years of research experience in machine learning and one year in quantum computing. He was nominated as the Most Outstanding Student of Engineering Physics for a superb academic performance. In 2021, he secured a runner-up position at QHack, an international quantum machine learning hackathon by Xanadu Inc. He is excellent at working in a team with a diverse culture, as he has done many research projects with people abroad and actively participating in quantum computing international communities.

Education

Institut Teknologi Bandung (ITB)

Bandung, Indonesia

Bachelor of Science in Engineering Physics (Cum Laude), **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. Thesis 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. For the quantum convolution, I designed variational quantum circuits that work similarly to convolution filters in CNN. The reduced images are then fed to another variational circuit to classify the digits. The proposed architectures achieved up to 99.7% of testing accuracy, an improvement compared to some previous related works.

Research and Working Experience

CERN

Remote

openlab Summer Research Intern | Supervisor: Dr. Sofia Vallecorsa *Jun 2021 - Present*

- Currently developing Quantum Generative Adversarial Networks algorithm to simulate the $t\bar{t}H$ production processes in the LHC experiment as part of the CERN openlab Summer Student Programme.
- The results of this project will be written as a research paper.

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

Remote

Student Developer | Mentors: Prof. Sergei V. Gleyzer, Dr. Emanuele Usai, and Raphael Koh *May 2021 - Present*

- Currently researching the potential of Quantum Convolutional Neural Networks in classifying images of particles from high-energy physics events.
- The results and code used for this project will be made public as a Python package, research paper and tutorial.

IBM Quantum

Remote

Qiskit Advocate Mentorship Program Mentee | Mentor: Dr. Anna Phan *Mar 2021 - Present*

- Currently working on the code implementation of the Data Re-uploading Quantum Classifier and Quantum Graph Neural Networks in Qiskit framework.
- This code will be presented as Qiskit Textbook on Qiskit's website.

Institut Teknologi Bandung

Bandung, Indonesia

University 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*

- Developed a real-time face tracking and blemish removal system to create a webcam filter application. Trained a YOLO model to track the face using PyTorch. Designed and coded algorithms for blemish removal using OpenCV.
- 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. Achieved 85-90% of blemishes removal.

Undergraduate Research, Instrumentation, Control, and Decision Systems Lab

Bandung, Indonesia

Researcher | Lab Head: Prof. Yul Yunazwin Nazaruddin *Sep 2019 - Nov 2019*

- Conducted research in utilizing Error-state Kalman Filter as the state-estimator and Diagonal Recurrent Neural Network & LSTM to make the localization of an autonomous car more reliable. In the absence of location data from GPS, the neural network will give displacement predictions as a replacement to the state-estimator, 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.
- Conducted research on the best way to convert the programs into microservices using the SRI Microservice infrastructure for the company's AI platform.

Undergraduate Research, GV Lab *Tokyo, Japan*

Researcher | Lab Head: Prof. Gentiane Venture *Oct 2018 - Jan 2019*

- Did research in using Convolutional Neural Network to classify several types of touch interaction (poke, scratch, etc.) from humans by learning the data pattern from a force sensor (ShokacChip TS). The sensor was attached to a robotic arm.
- Trained the model using Keras and TensorFlow. The model reached 88% real-time accuracy.
- Coded the 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

2021 **Data Re-uploading Quantum Convolution for Image Classification**, (in preparation, undergraduate thesis)

May 2021 **Modified Layerwise Learning for Data Re-uploading Classifier in HEP Event Classification**, (undergoing review)

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

Apr 2021 **An Approach for the Localization Method of Autonomous Vehicles in the Event of Missing GNSS Information**, (accepted, will be published after the conference)

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

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

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

Achievements & Training

Achievements

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

2020 **Pass the selection test and accepted as a member**, IBM Quantum Qiskit Advocate

2020 **Advanced Level**, IBM Quantum Challenge

2019 **Most Outstanding Student of Engineering Physics Department**, Outstanding Student Selection

2019 **1st Place**, Interdisciplinary Engineering Idea Challenge Competition (Project title: Machine Learning-based Automated Labeling & Quality Control System for Paragon Tech. and Innovation Inc.)

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

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

Summer School, Workshop & Certified Courses

Jul 2021 **MCQST Summer Student (had received the acceptance letter)**, Munich Center for Quantum Science and Technology

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

Jul 2020 **Qiskit Global Summer Student**, IBM Quantum

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

Nov 2019 **Asia Computational Material Design Workshop**, Quantum Engineering Design Course, Osaka University

Apr 2019 **Material Characterization Workshop & Hands-on Certification**, Research Center for Nanoscience & Nanotechnology, ITB

2020-21 **Certified Online Courses in Quantum Computing & Machine Learning**, click the link 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 & Languages

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

Languages English (full professional proficiency), Indonesian (native)