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 that recently had defended his thesis on quantum machine learning. He was nominated as the Most Outstanding Student of Engineering Physics in 2019 by the Rector of Institut Teknologi Bandung for excellence in academic and non-academic activities. Currently, he participates in quantum machine learning projects with CERN, ML4Sci, and IBM Quantum. 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, **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.
- Nominated as the Most Outstanding Student of Engineering Physics in 2019 for excellence in academic and non-academic activities.
- Selected as Ganesha Karsa 2018 Awardee, an honor given to ITB students who have one of the best achievements in science and technology.

Tokyo University of Agriculture and Technology (TUAT)

Tokyo, Japan

Exchange Student in Applied Physics, **3.91**/4.00 — *Sep 2018 - Jan 2019*

- Achieved the highest score of academics GPA among all of the AIMS exchange students batch 2018 across the South-East Asia region.
- Received a fully-funded Japan Student Services Organization (JASSO) scholarship.

Research and Working Experience

CERN

Remote

CERN openlab Summer Student — *Jun 2021 - Aug 2021 (expected)*

- Will be working on quantum machine learning research in high-energy physics applications with CERN's quantum team. The details of the project are still being discussed. Had received the acceptance letter, the project will be carried in June.
- Supervisor: Dr. Sofia Vallecorsa

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

Remote

Student Developer — *May 2021 - Present*

- Currently developing Quantum Convolutional Neural Network algorithms to classify images of particles from high-energy physics events.
- The results and code used for this project will be made public as a Python package and tutorial.
- Mentors: Prof. Sergei V. Gleyzer, Dr. Emanuele Usai, and Raphael Koh

IBM Quantum

Remote

Qiskit Advocate Mentorship Program Mentee — *Mar 2021 - Present*

- Currently working on the code implementation of the algorithm from the Data re-uploading for a universal quantum classifier by Pérez-Salinas, A. et al. and Quantum Graph Neural Networks by Verdon, G. et al. research papers in Qiskit framework.
- This code will be presented as Qiskit Textbook on Qiskit's website.
- Mentor: Dr. Anna Phan

TamanSiswa

Remote

Physics Tutor — *Aug 2020 - Present*

- Taught first-year students of Bandung Institute of Technology fundamental physics. Prepared them for university exams, assessed and made practice problems.
- Materials covered: mechanics, fluid dynamics, thermodynamics, vibrations and waves, electrodynamics, propagation of sounds and lights, and modern physics.

Undergraduate Research, Quantum Technology Lab (Prof. Andriyan Bayu Suksmono)

Bandung, Indonesia

Undergraduate Thesis Student — *Aug 2020 - Mar 2021*

- Developed the variational quantum algorithm to classify the MNIST dataset. Two methods were used to reduce the image dimension, PCA and quantum convolution.
- Designed variational quantum circuits that work similarly to convolution filters in CNN for the quantum convolution. 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.

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 covered: Wave Phenomena (Aug - Dec 2020), Electric Circuits and Electronics (Aug - Dec 2019), Fluid Mechanics (Jan - May 2019), Introduction to Information Technology (Jan - May 2018), Engineering Drawing (Aug - Dec 2017).

Nodeflux Inc. — *Jakarta, Indonesia*

AI Engineer Intern — *Dec 2019 - Jan 2020*

- Developed a real-time face tracking and blemish removal system to create a filter application for the webcam. 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 (ICoDeS) Lab (Prof. Yul Yunazwin Nazaruddin) — *Bandung, Indonesia*

Researcher — *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 Platform infrastructure for the company's AI platform.

Undergraduate Research, GV Lab (Prof. Gentiane Venture) — *Tokyo, Japan*

Researcher — *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.

Scientia Indonesia — *Bandung, Indonesia*

Physics Olympiad Tutor — *Sep 2016 - Jul 2018*

- Taught students theoretical physics in mechanics, electrodynamics, thermodynamics, and modern physics as a preparation for their participation in National Science Olympiad. Made and assessed test problems as exercises.

Publications

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

2021 **Event Classification with Layerwise Learning for Data Re-uploading Classifier in High-Energy Physics**, (submitted and undergoing review)

2021 **An Approach for the Localization Method of Autonomous Vehicles in the Event of Missing GNSS Information**, (submitted and undergoing review)

2020 **Localization Method for Autonomous Car Using Virtual Sensing System**, (published, doi: 10.1109/ICEVT48285.2019.8993992)

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

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

Honors & Achievements

2021 **Runner-up**, Xanadu's QHack Quantum Machine Learning Open Hackathon 2021 (Project title: Event Classification with Layerwise Learning for Data Re-uploading Classifier in High-Energy Physics)
2021 **Gold Level Translator**, Qiskit Localization Contributor
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 College Students (Paper title: Sustainable Development of Machine Learning-based Supply Chain System)
2016-2021 **All Semesters**, Dean's List

Summer School, Workshop & Training

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, Seminars & Workshop: Introduction 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 Equipment Certification**, Research Center for Nanoscience and Nanotechnology, ITB

edX Certified Online Courses

Mar 2021 **Introduction to Quantum Computing for Everyone 2**, University of Chicago
Aug 2020 **Quantum 101: Quantum Computing & Quantum Internet Professional Certification**, TU Delft

Coursera Certified Online Courses

Jan 2021 **Generative Adversarial Networks (GANs) Specialization**, DeepLearning.AI
Jan 2021 **Deep Learning Specialization**, DeepLearning.AI
Dec 2020 **Addressing Large Hadron Collider Challenges by Machine Learning**, HSE University
Dec 2020 **The Introduction to Quantum Computing**, St. Petersburg State University
Sep 2020 **Mathematics for Machine Learning Specialization**, Imperial College London
Sep 2020 **Quantum Computing. Less Formulas - More Understanding**, St. Petersburg State University
Aug 2020 **Physical Basics of Quantum Computing**, St. Petersburg State University

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.
- Translated more than 15000 words.

Engineering Physics Student Association

Bandung, Indonesia

Head of the 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.

ITB Fire Fighting Robot Competition Team (KRPAI ITB)

Bandung, Indonesia

Team Leader — *Jan 2019 - Jun 2019*

- Created the robot's technical master plan (mechanical and electrical grand design, algorithm, and budgeting).
- Led the coordination between divisions to do research, design, manufacture, and test the robot.
- Created the robot's mechanical detailed design using SolidWorks.

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	Quantum ESPRESSO, SolidWorks
Microcontrollers	Arduino, STM32 Nucleo
Languages	English (full professional proficiency), Indonesian (native)