

# 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. In 2021, he secured a runner-up position at QHack, an international quantum machine learning hackathon by Xanadu Quantum Technologies Inc. Currently, he is working on quantum machine learning research projects with CERN and ML4Sci. 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.

- 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.

### Public Senior High School 1 of Depok

Depok, Indonesia

High School Diploma in Mathematics and Science Specialization, **91.53/100.00**

Jul 2013 - May 2016

- National Camp Students for Asian Physics Olympiad (APhO) 2016: Selected as the top 15 among high school students of Indonesia in theoretical physics and received intensive training for 5 weeks on electrodynamics in preparation for the APhO 2016.
- Runner-up, Olimpiade Indonesia Cerdas (National Science & General Knowledge Quiz Contest for High School Student) 2014
- Runner-up, in Universitas Negeri Surabaya National Physics Competition 2015
- 1st Place, UIN Syarif Hidayatullah Jakarta National Physics Olympiad 2015
- Head of Physics Division, Science Olympiad Student Club

## Research and Working Experience

### CERN

Remote

openlab Summer Research Intern

Jun 2021 - Present

- Currently developing Quantum Generative Adversarial Networks algorithm to simulate the  $t\bar{t}H(b\bar{b})$  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.
- Supervisor: Dr. Sofia Vallecorsa

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

Remote

Student Developer

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.
- Mentors: Prof. Sergei V. Gleyzer, Dr. Emanuele Usai, and Raphael Koh

### IBM Quantum

Remote

Qiskit Advocate Mentorship Program Mentee

Mar 2021 - Jun 2021

- 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.
- Mentor: Dr. Anna Phan

## TamanSiswa

Remote

Physics Tutor

Aug 2020 - May 2021

- 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 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 (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 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, Presentations & Panel Discussions

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- Oct 2021 **Modified Layerwise Learning for Data Re-uploading Classifier in HEP Event Classification**, (accepted for 2021 IEEE International Conference on Quantum Computing and Engineering, will be published after the conference)
- Sep 2021 **An Approach for the Localization Method of Autonomous Vehicles in the Event of Missing GNSS Information**, (accepted for 2021 Society of Instrument and Control Engineers Annual Conference, will be published after the 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 6<sup>th</sup> 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)

## Honors & Achievements

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- 2021 **Runner-up**, Xanadu's QHack Quantum Machine Learning Open Hackathon 2021
- 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**, ITB 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
- 2016-2021 **All Semesters**, Dean's List

## Summer School, Workshop & Training

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- 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
- 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 Workshop & Hands-on Certification**, Research Center for Nanoscience & 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

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## 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 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

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## 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)