

# Eraraya Ricardo Muten

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## Education

### Bandung Institute of Technology (ITB)

Bandung, Indonesia

Bachelor of Science in Engineering Physics (Cum Laude), **3.94/4.00** | Prof. Andriyan B. Suksmono & Dr. Nugraha.

Aug 2016 - Mar 2021

- Thesis: Quantum Image Classifier Design with Data Re-uploading Quantum Convolution and Data Re-uploading Classifier Scheme.
- Thesis work: Developed a variational quantum algorithm to classify the MNIST dataset. Used PCA and quantum convolution to reduce the image dimension. Designed VQCs that work similarly to convolution filters in CNN for quantum convolution. The proposed architectures achieved up to 99.7% of accuracy, an improvement compared to related works.

## Research, Teaching and Work Experience

### Indonesian National Research and Innovation Agency

Remote

Research Assistant (Intern) | Dr. Agung Budiyo & Dr. Ahmad R. T. Nugraha

Oct 2021 - Present

- Currently developing a novel Monte Carlo simulation within epistemically-restricted phase-space formulation, inspired by CV quantum neural networks, for quantum many-body systems. Led the code development, coded the algorithm with TensorFlow. Benchmarked the algorithm on bosonic systems vs the regular VMC. Preparing the work for journal submission.

### CERN

Remote

openlab Summer Student | Dr. Sofia Vallecorsa

Jun 2021 - Sep 2021

- Investigated the Quantum GANs to simulate the  $t\bar{t}H(b\bar{b})$  production process 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. Presented the work at the 2021 CERN Summer Student Session.

### 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 in HEP. Benchmarked the results with the classical models, studied how the quantum model affects the performance. Presented the work at the 2021 MCQST Student Conference. Published the code as an open-source project.

### IBM Quantum

Remote

Qiskit Advocate Mentorship Program Mentee | Dr. Anna Phan

Mar 2021 - Jun 2021

- Studied the Quantum Graph Neural Networks (Verdon, et al.) and translated the algorithm to Qiskit code. With the code, presented a demo of simulations for finding the unknown Hamiltonian parameters of transverse-field Ising models using Quantum Graph Recurrent Neural Networks at the Qiskit Advocate Monthly Meetup.

### 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 covered: Wave Phenomena, Electric Circuits and Electronics, Fluid Mechanics, Introduction to Information Technology, Engineering Drawing.

### Nodeflux Inc.

Jakarta, Indonesia

AI Engineer Intern

Dec 2019 - Jan 2020

- Designed a real-time blemish removal face-filter application. HSV color threshold and elliptical kernel dilations were used for skin detection. Blemishes were detected by utilizing CLAHE and blob detection, coded the algorithms using OpenCV. Trained a YOLO model for face detection using PyTorch. 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 Diagonal RNN & LSTM to make the localization of an autonomous car more reliable in the absence of GPS signal, reducing 70% of localization errors. Built and trained the models with TensorFlow and Keras. The works resulted in two conference publications.

### IHI Corporation

Yokohama, Japan

Summer Research Intern

Jul 2019 - Aug 2019

- Developed reinforcement learning agents to solve control problems in OpenAI Gym as the first testbed for the company's AI platform, which would later become the cornerstone for the company's machine learning software. Designed microservices for that platform to make it easier in building and training a reinforcement learning agent.

### GV Lab, Tokyo University of Agriculture and Technology

Tokyo, Japan

Student Researcher | Prof. Gentiane Venture

Oct 2018 - Jan 2019

- Did research in using CNN to classify types of touch interaction from humans by learning the data pattern from a force sensor. Trained the model using Keras and TensorFlow. The model reached 88% real-time accuracy. Presented the work at the TUAT AIMS Program Student Conference.

## Publications, Presentations & Panel Discussions

- Dec 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 6<sup>th</sup> 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 & Fellowships

- 2022 **Xanadu's QHack Quantum Machine Learning Open Hackathon**, awarded in three categories: 1<sup>st</sup> in Open Hackathon Experiment on Amazon Braket Simulators, 1<sup>st</sup> in Hybrid Algorithms Challenge, 3<sup>rd</sup> in Quantum Finance Challenge
- 2022 **First Place in Xanadu's QHack Quantum Machine Learning Coding Challenges**, out of 800+ teams from 100+ countries
- 2021 **Runner-up in Xanadu's QHack Quantum Machine Learning Open Hackathon**, out of 400+ teams from 85+ countries
- 2019 **Most Outstanding Student of Engineering Physics Department**, top 1 of holistic achievements out of 270 students
- 2019 **First Place in Paragon Inc. Interdisciplinary Engineering Idea Challenge Competition**, out of 60+ teams, 400+ students
- 2018 **First Place in National Scientific Research Paper Competition for University Students**, vs 10+ universities in the final
- 2016-21 **Dean's List: Bandung Institute of Technology**, top 5% of GPAs
- 2021 **MCQST Summer Student Program 2021**, 19 awardees from 200+ global applicants
- 2020 **IBM Quantum Qiskit Advocate 2020**, the first one from South-East Asia
- 2020 **UCLQ Quantum Tech Summer School 2020**, 20 awardees from global pool of applicants
- 2018 **AIMS Exchange Programme to Tokyo Univ. of Agriculture and Tech.**, 4 awardees selected from the whole university

## Volunteering & Extracurricular Activity

### Indonesian Qiskit Documentation Localization Project

Remote

Founder & Team Leader

Aug 2020 - Present

- Managed an Indonesian localization team for Qiskit Documentation. We translate the documentation hoping that more people from Indonesia can engage and get interested in quantum computation. The team has grown to nineteen members from only three at the beginning. Have personally translated more than 15000 words.

### Qiskit Global Summer School 2021: Quantum Machine Learning

Remote

Mentor

July 2021

- Answered questions in quantum computing and machine learning from students. Discussed career opportunities and shared my personal experience with the students. Provided extra Qiskit tutorials to students who still got confused after the main classes.

### 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 summaries of the discussions were published at the end of the term. Was nominated as the best division of the year.

## Skills

### Quantum Programming Frameworks Programming Frameworks Programming Languages Software | Microcontrollers

Qiskit, Cirq, TensorFlow Quantum, PennyLane, QuTiP

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

Python, MATLAB, C++, C, LaTeX

Quantum ESPRESSO, SolidWorks | Arduino, STM32 Nucleo

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