Womanium Quantum+AI 2024 Project Presentation

# Conspicuity Detection in Production by Classical-to-Quantum Transfer Learning

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# Problem Statement

- Problem:
Image classification of the welding process

- Dataset:
Successful welding (10947 images) and unsuccessful welding (22307 images)

- Goal:
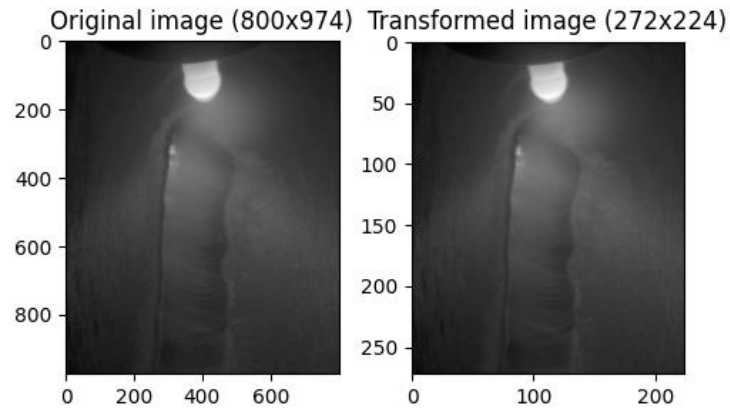Build a model to determine whether welding is successful from images.
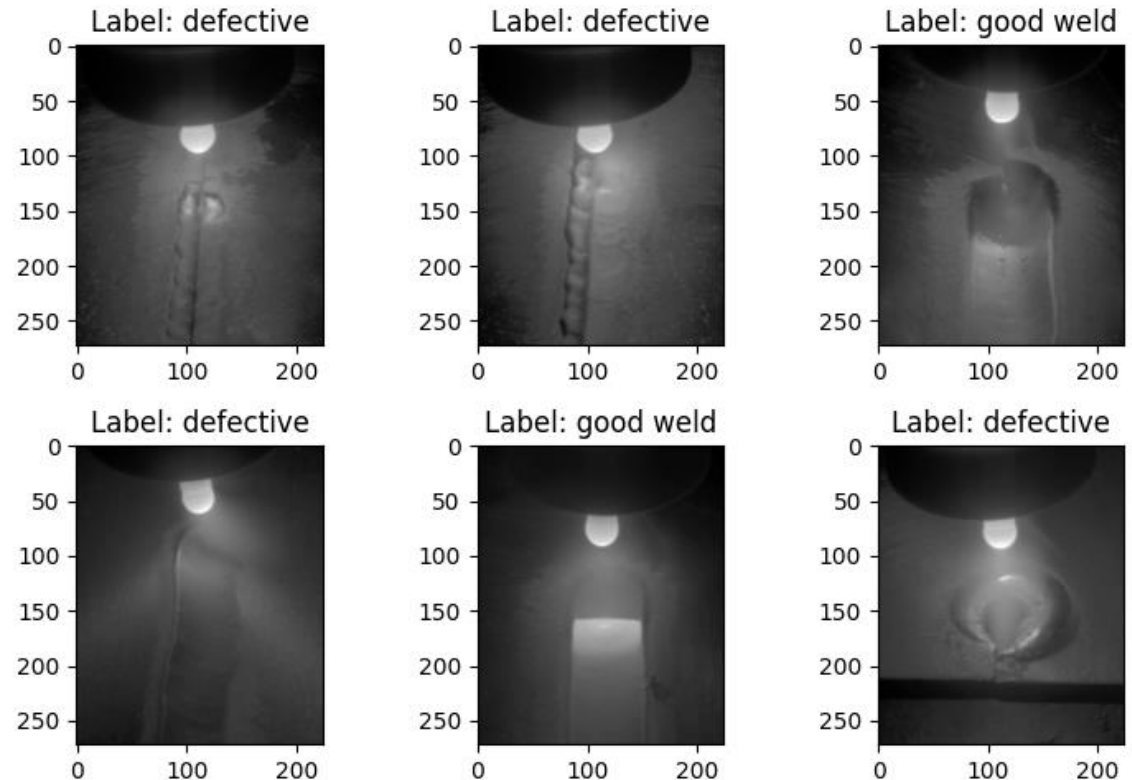


Reference:
D. Bacioiu, G. Melton, M. Papaelias, and R. Shaw, *Automated Defect Classification of Aluminium 5083 TIG Welding Using HDR Camera and Neural Networks*, J. Manuf. Process. **45**, 603 (2019).
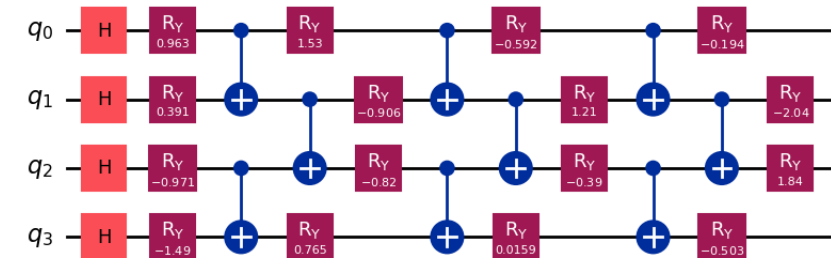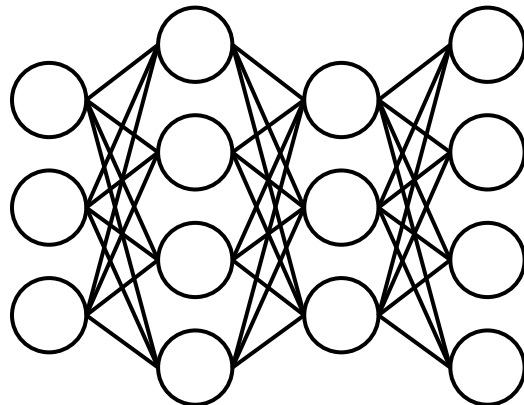
# Model Architecture

① Image Preprocessing

Linear layer
+
Feature rescaling
by tanh function

③ Trainable Variational Quantum Circuit



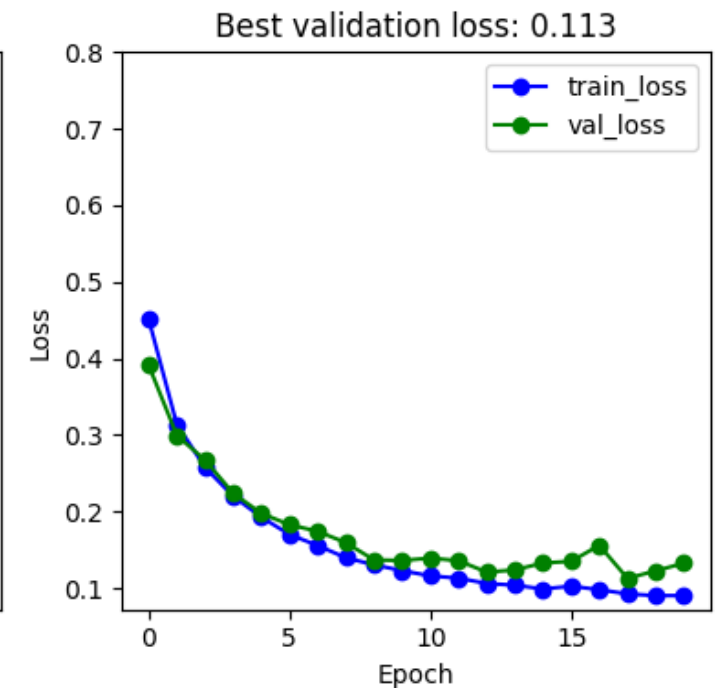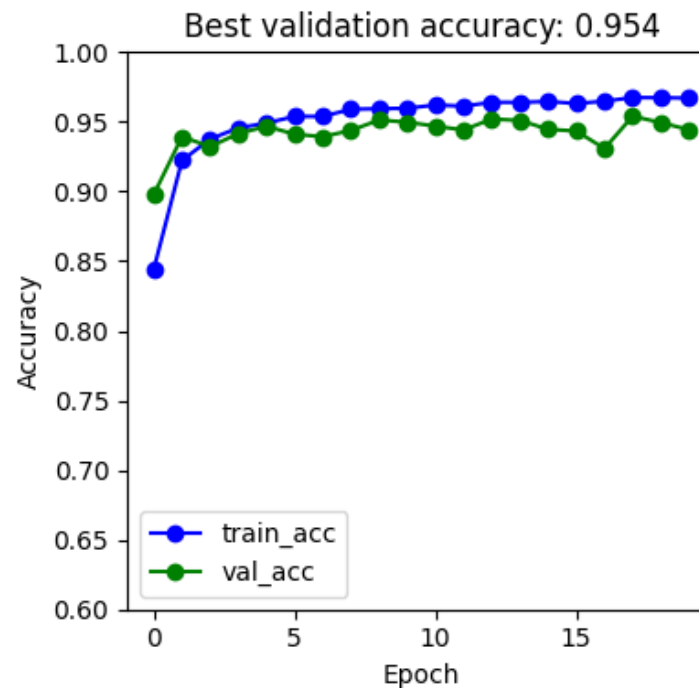② ResNet18 (Pre-trained Classical Model)

④ Measurement & Postprocessing

Linear layer

"good weld"
or
"defective" ?

# Result

- Best test accuracy was 95.4%.

- The original paper's best accuracy was 95.6%, comparable to the classical-quantum hybrid model created.

# Future scope

- The power of quantum computers can only be exploited by using large quantum circuits.

- However, setting the number of qubits > 4 suffered from overfitting of the model.

- It may be beneficial to know how to increase the size of quantum circuits while preventing overfitting.