Womanium Quantum+AI 2024 Project Presentation

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

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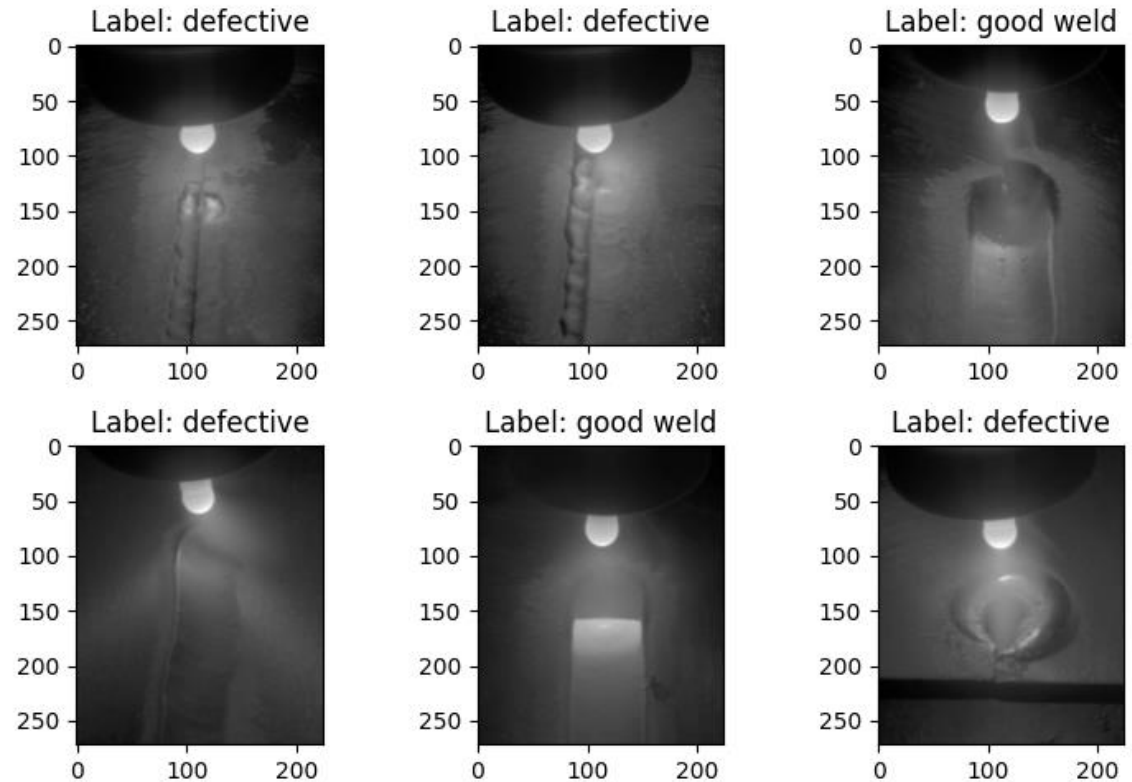# Problem Statement

- Problem:
  Image classification of the welding process

- Dataset:

Successful welding	10947 images
Unsuccessful welding	22307 images

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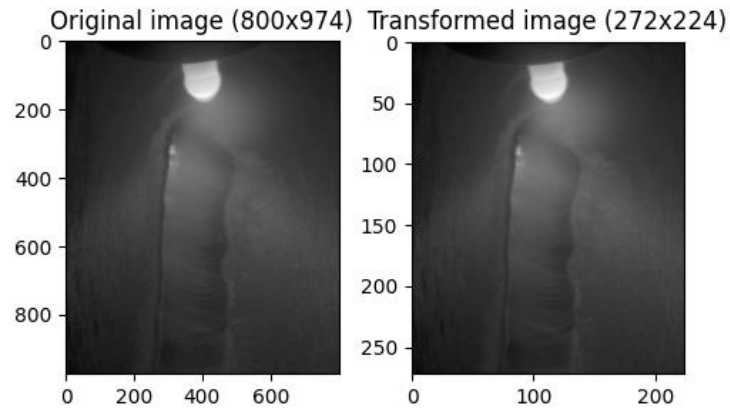 Build a model to determine whether welding is successful from images.

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).
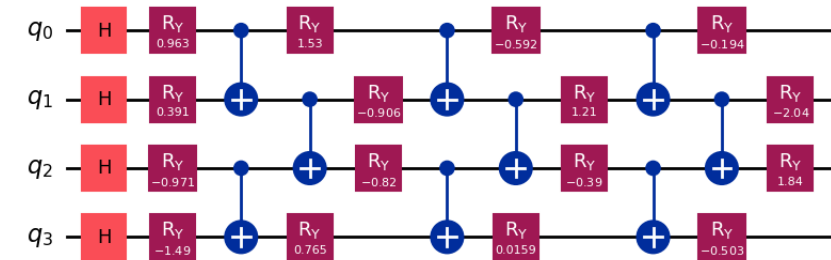
Model Architecture

① Image Preprocessing

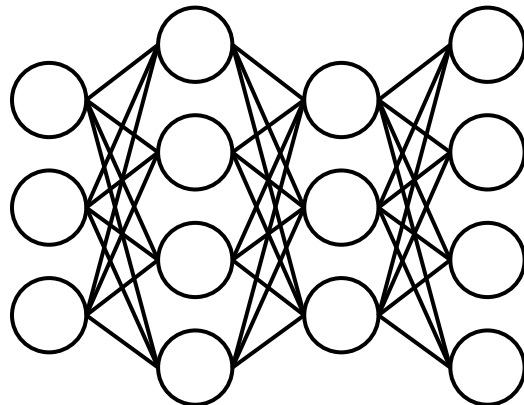Original image (800x974)   Transformed image (272x224)

Linear layer +
Feature rescaling
by tanh function

③ Variational Quantum Circuit

② ResNet18 (Pre-trained Classical Model)

④ Measurement & Postprocessing

Linear layer
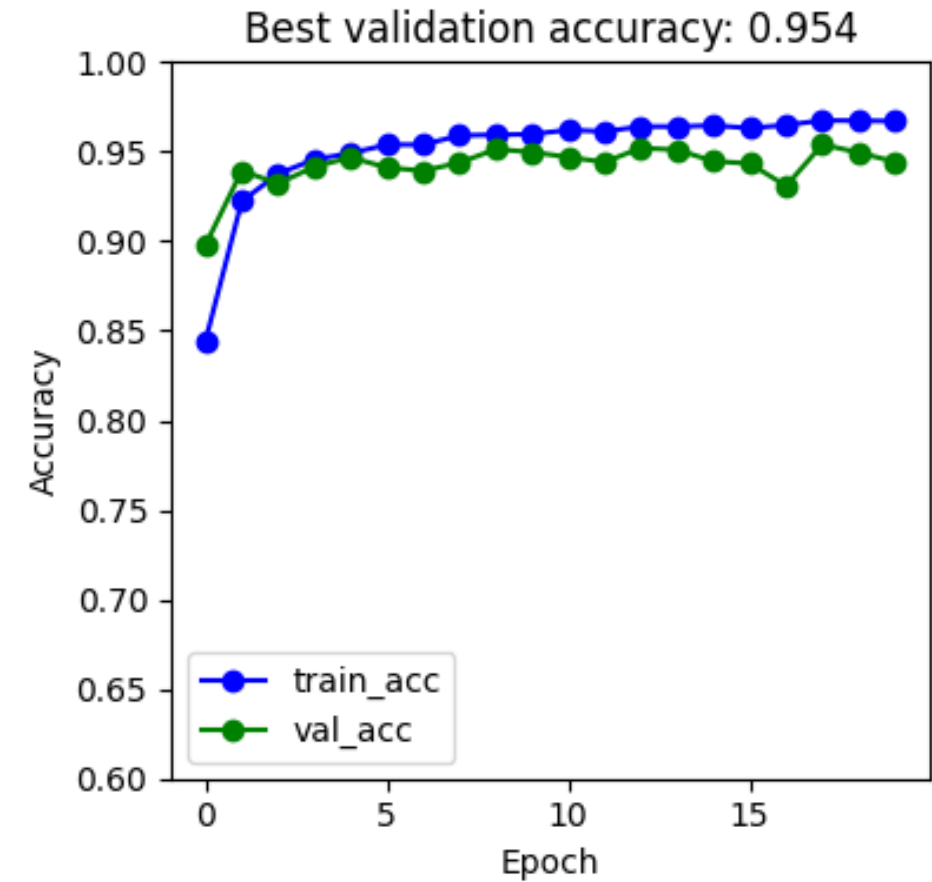
"good weld" == 0
or
"defective" == 1

Result

- Best test accuracy:

Classical-quantum hybrid model (This work)	95.4%
Original paper (Convolutional Neural Network)	95.6%

Better than most of the CNN models presented in the original paper!

Best validation accuracy: 0.954

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.

Thank you for your attention!