WOMANIUM | QUANTUM

Womanium Quantum+AI Project

QML for Conspicuity detection

Team: **TheQries**

Named after Marie Curie

*Image credits: created via openart.ai

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01 The Team

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Womanium Quantum+AI Project

Manuela Profir

Giuliana Siddi Moreau

Team: **TheQries**

02 Problem Statement

Defect classification of Aluminium 5083 TIG welding

Analyze image data to find the weak points in the industrial process

Identify improvement actions in production process early stage

Classical methods are not suited for the task because time-consuming

Hybrid quantum algorithms

Accelerate the process of defective parts detection by means of hybrid QC

Compare different approaches

Contribute to QC algorithms benchmarking

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03 Our Solution in 5 Steps

Pennylane Codebook

Familiarity with Pennylane, basic and more advanced workflows

Variational classifier

Familiarity with QML

Focus on variational quantum classifier circuits to classify new data samples

Quanvolutional NN

Feature extraction from input data
Computational efficiency Ability to handle complex data

Learn the sine function

The reference method* we used is claimed to avoid overfitting during regression of sinusoidal function noisy data exploiting quantum dropout

Real data

Use data from industry

Implement a QML model to detect a defective production part.

Pennylane tutorial on quantum dropout, see ipynb

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04 Success

New Python skills

Preprocessing of Image Data and resize/reshape

Conspicuity detection

Application of Quanvolutional NN with 3x3 quantum filter

Better results with Quanvolutional NN 2x2

New challenges

Tentative application of Variational classifier. Partial results. We faced the curse of narrowing down the data to feed the quantum circuit

New knowledge earned

Valuable opportunity to approach QC and QML

New way of learning

Efficient learning while performing the assignments

Huge field of application

We treasured what Womanium Quantum program offered us!

05 Future Scope

Delving into QML

This project was an appetizer on QML topics.
We are motivated to explore more methods and more ideas (transfer learning, wavelet transforms+quantum layer..)

Unsupervised learning

We would like to build a workflow for unsupervised learning around this dataset

Scalability

We are interested in seeing what methods are scalable beyond the ten qubit limit

Having fun

We did have a lot of fun during the Womanium Quantum +AI Project, so we will carry on!
Thank you all!

Team: **TheQries**

Thanks!

Do you have any questions?
Find us on Github
Users: **ManuelaPro** and **GSiddi Moreau**
Repo:
https://github.com/GSiddiMoreau/QML-for-Conspicuity-Detection-in-Production