NSF International Research Experiences for Students (IRES)

An ASU SenSIP – UCY KIOS Collaboration

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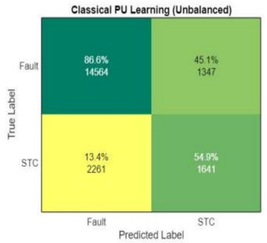
Quantum Positive Unlabeled Learning for PV Fault Detection

Presented by: Brent Brightwell, ECEE

Objective: Investigate positive unlabeled learning in a quantum environment and determine its usefulness in classifying solar fault detection.

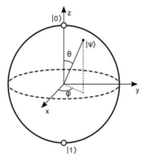


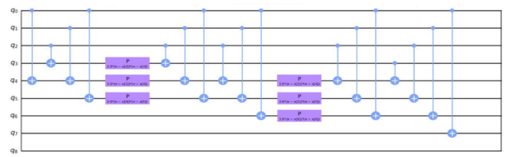
Process:

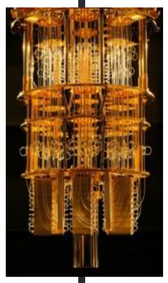
- Obtain partially unlabeled solar datasets from ASU solar research facility
- Preprocess data (standardization, one-hot encoding, train-test split)
- Develop optimal ML algorithm (Bagging, SVM, Deep Neural Binary Classifier)
- Process random selections of labeled and unlabeled data to get p-score
- Using p-scores, determine appropriate labels for unlabeled data
- Evaluate accuracy with known labeled datasets

Next Steps:

- Investigate PU Learning using SVM's
- Integrate a quantum algorithm into current PU Learning code
- Experiment with Asymmetric Loss Function for PUL







Classical vs Quantum Neural Networks for Fault Detection in Solar Cell Arrays

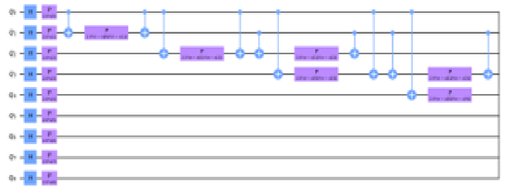
Presented by: Emma Skaggs, ECEE

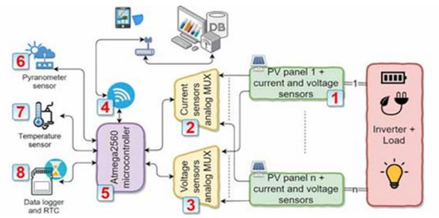
Objective: Detect and classify faults in large-scale solar systems.

Type	Qubit	Layers	Neuron vs gates	Epoch	Accuracy
Classical	N/A	3	150	150	~95%
Quantum	2	1	6	30	69.26%
Quantum	4	1	12	30	85.12%
Quantum	2	4	18	30	76.56%
Quantum	4	4	36	30	82.30%

Process:

- Clean & organize data (outliers, normalization, train/test/validation split)
- Test varying run conditions (activation functions, hidden layers, epochs)
- Create and compare different NN models
- Compare classical and quantum results

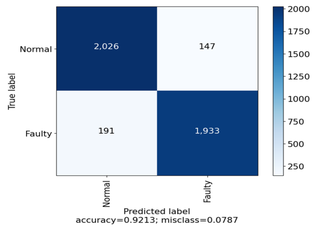




Improving Solar Array Performance Using QML

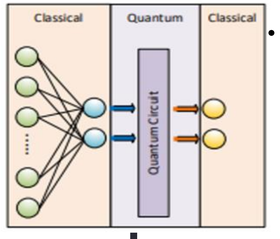
Presented by: Fiorella Yasmin Estrada, ECEE

Objective: Our objective is to utilize quantum machine learning and neural networks to enhance fault detection on solar panels, improving performance and maintenance of renewable energy systems.



Process:

- Preserve Natural Resources and Utilize Green Renewable Energy.
- Detect Solar Panel Array Faults Using Neural Networks Algorithms.
- Compare Classical Machine Learning to the Quantum Machine Learning.
- Predict Faults Causing Low Output Power to Develop Solutions.



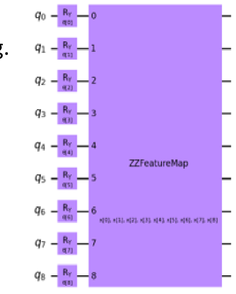
Quantum SVM Based Positive Unlabeled Learning for PV Fault Detection

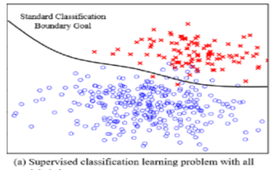
Presented by: Salil Naik, SCAI

Objective: Automatically detect solar panel faults with quantum machine learning.

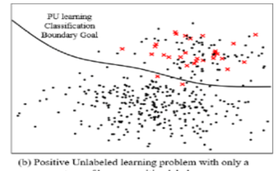
Process:

- Obtain solar data with 9 features and 2 classifications
- Preprocess data (normalization, binary encoding, train/test/validation split)
- Train positive unlabeled learning (PU learning) algorithms using:
  1. Quantum neural networks (QNN)
  2. Quantum support vector machines (QSVM)
- Compare each PU learning algorithm and determine feasibility of quantum PU learning in solar fault detection

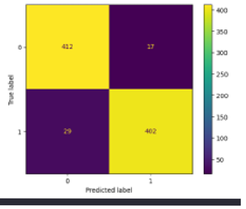




(a) Supervised classification learning problem with all labels known.



(b) Positive Unlabeled learning problem with only a percentage of known positive labels.



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