QUANTUM RISK MANAGEMENT

IQRM

CHALLENGE BY

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WHO WE ARE

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Paolo Allione

Quantum engineering student and
QubiTo team member

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Edoardo Frulla

Quantum engineering student and
QubiTo team member

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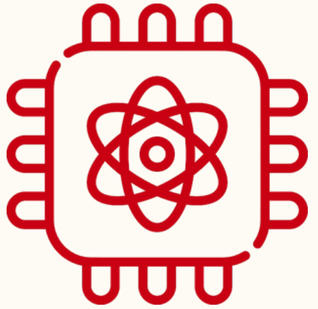
ROADMAP



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CONTEXT AND OBJETIVE

Credit risk assessment is a well-established problem in classical machine learning.

The **objective** of this project is to explore whether quantum and hybrid quantum–classical models can provide meaningful insights when compared to a strong classical baseline, particularly in small-data scenarios.

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PROBLEM AND DATASET

The task is to predict credit default risk as a binary classification problem, using personal, financial, and loan-related features.

The dataset consists of **3,000** anonymized loan records, including borrower characteristics, loan attributes, and financial ratios, with a binary target indicating default or non-default.

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CLASSICAL BASELINE

OUR CLASSICAL BASELINE DEFINES A RELIABLE REFERENCE FOR CREDIT RISK PREDICTION, PROVIDING BOTH PREFORMANCE AND CONFIDENCE ESTIMATION

BY THE NUMBERS:

- THREE CLASSICAL MODELS BENCHMARKED.
- PREFORMANCE EVALUATED ON A STRICT TEST SET.
- PREDICTION CONFIDENCE USED TO DEFINE.

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CLASSICAL MODEL COMPARISION

MODEL	ACCURACY	AUC-ROC	PRECISION (CLASS 1)	RECALL (CLASS 1)	F1 - SCORE (CLASS 1)
XGBOOST	0,9211	0,9150	0,8973	0,7005	0,7868
RANDOM FOREST	0,9156	0,9048	0,9173	0,6524	0,7625
MULTI-LAYER PERCEPTRON	0,8555	0.8631	0,6492	0,663	0,6560

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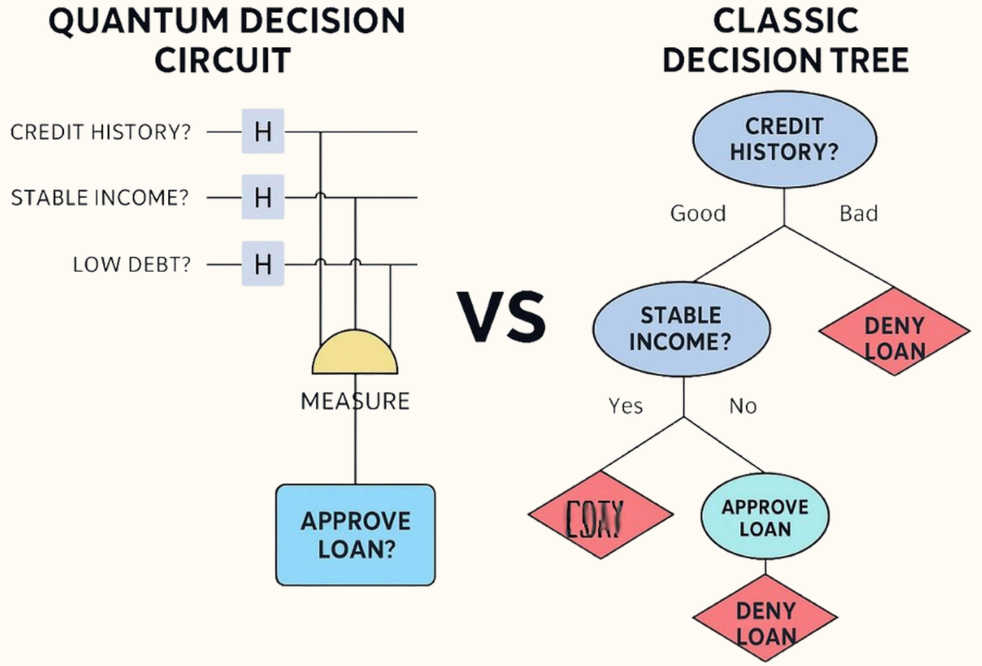
WHY QUANTUM?

Quantum computing enables high-dimensional feature embeddings.

These representations may improve separability in small-data, low-confidence regimes.
We focus on where classical models are uncertain, not a global replacement.



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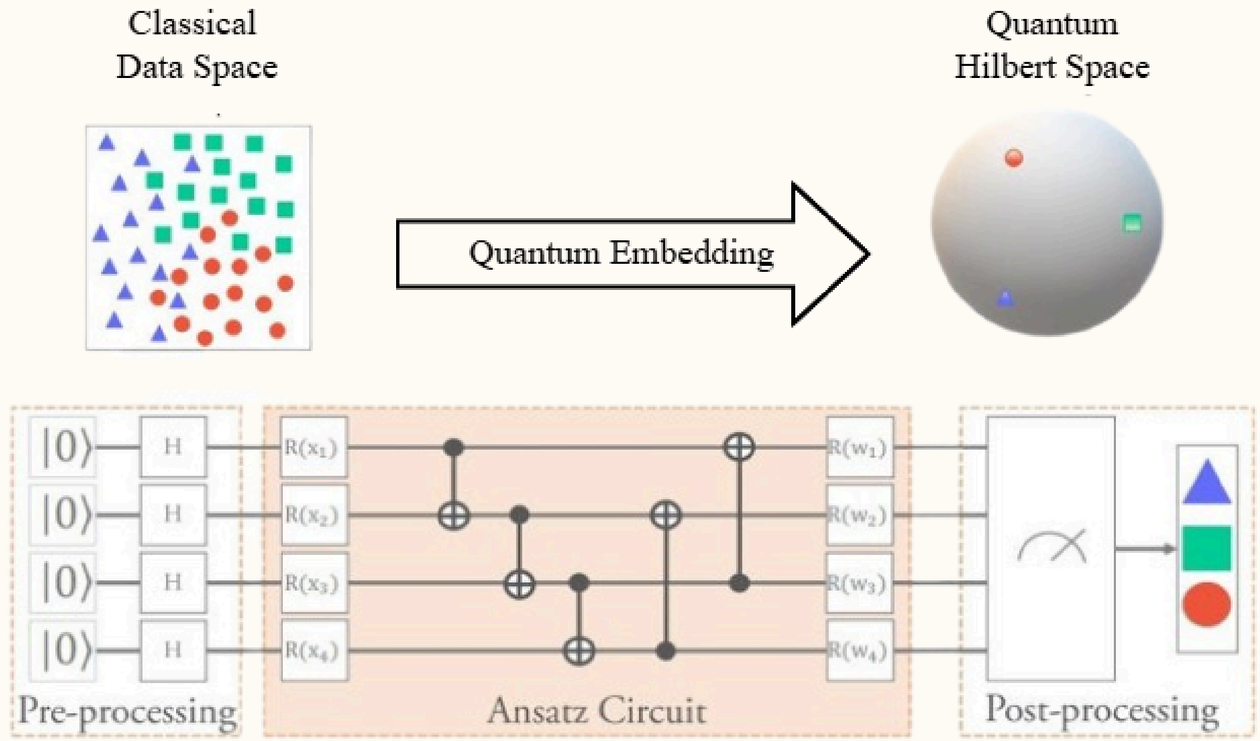
WHY QUANTUM?

Experimentally, incorrect classical model predictions had a lower confidence average.

Correct avg confidence: 0.9572
Incorrect avg confidence: 0.8583

We explore data nearer to the decision boundary.



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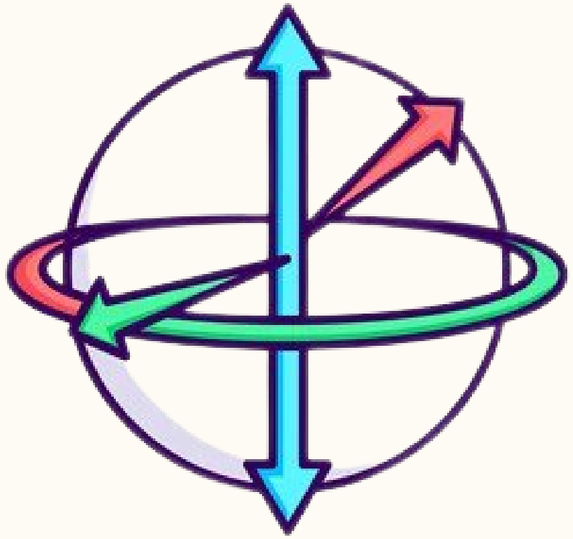
HYBRID MODEL

Quantum embedding



Kernel trick

Variational Quantum Circuit

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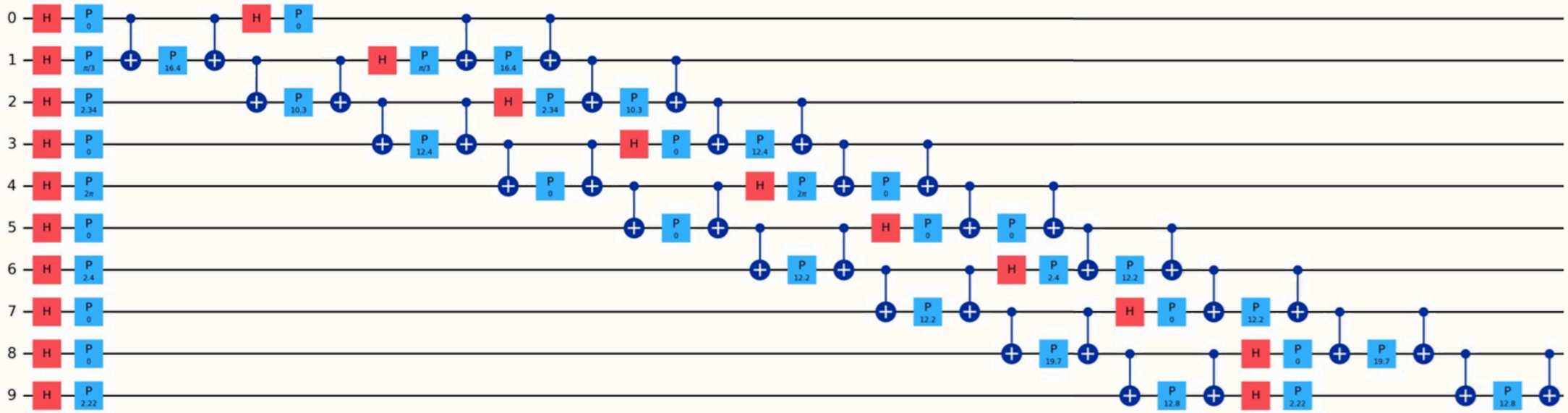
ZZ-FEATURE MAP



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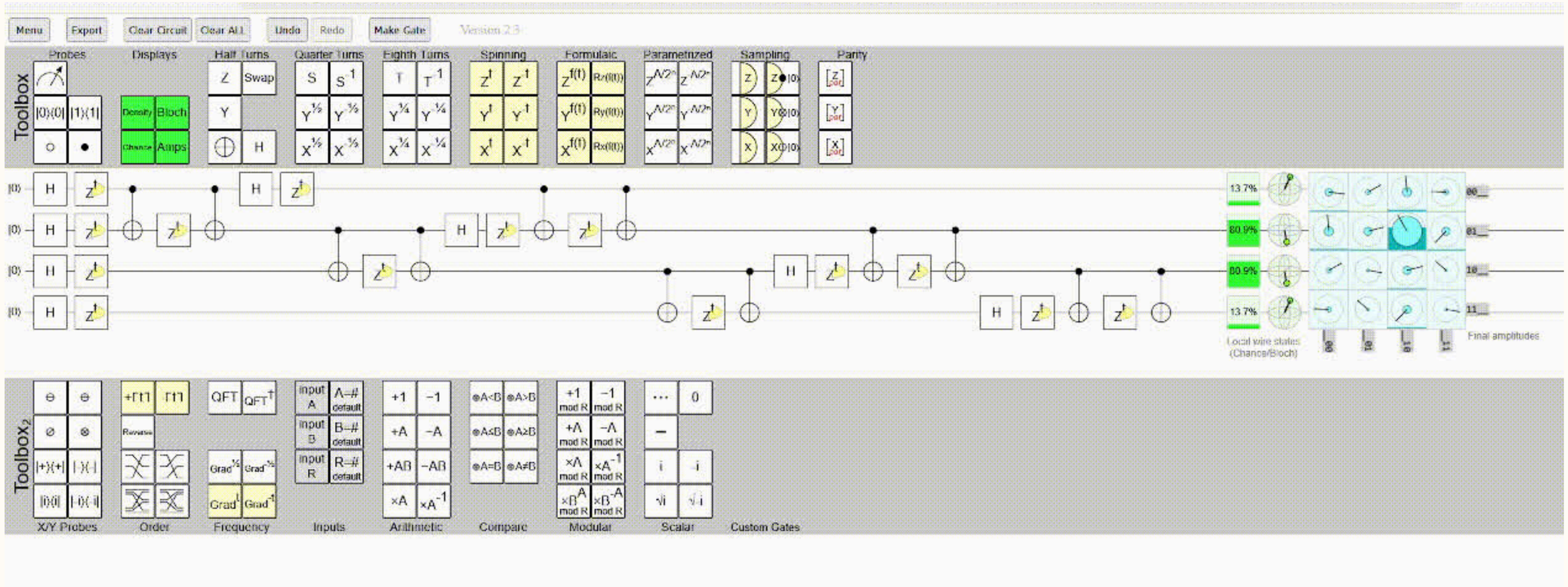
QUANTUM GATES DEMO



HTTPS://ALGASSERT.COM/QUIRK#CIRCUIT

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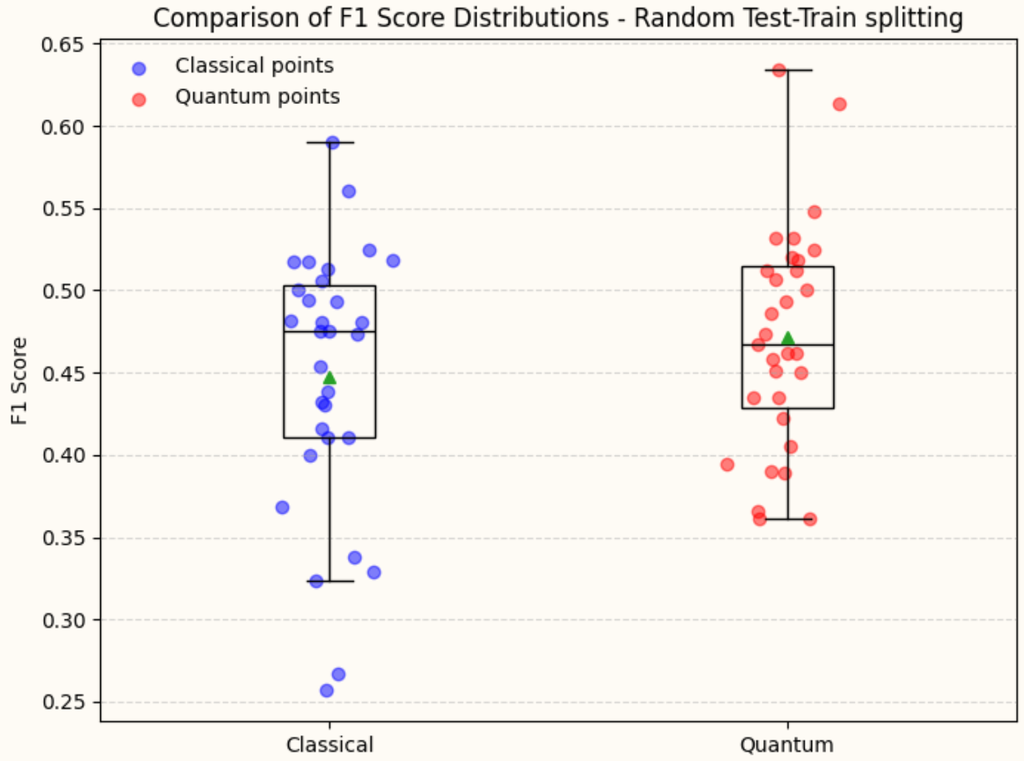
QUANTUM EMBEDDING



$$\langle Z_1 \rangle, \ldots, \langle Z_8 \rangle$$

$$\langle Z_1 Z_2 \rangle, \ldots, \langle Z_1 Z_8 \rangle, \ldots, \langle Z_8 Z_8 \rangle$$

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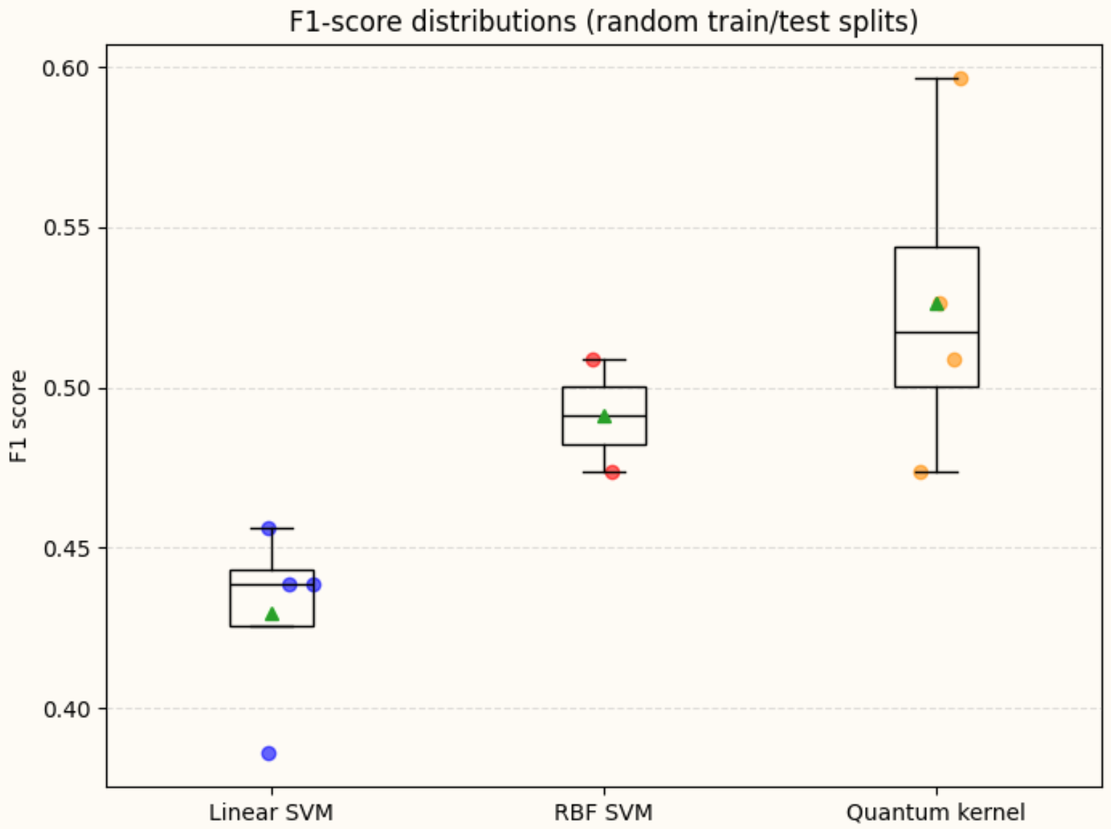
KERNEL TRICK



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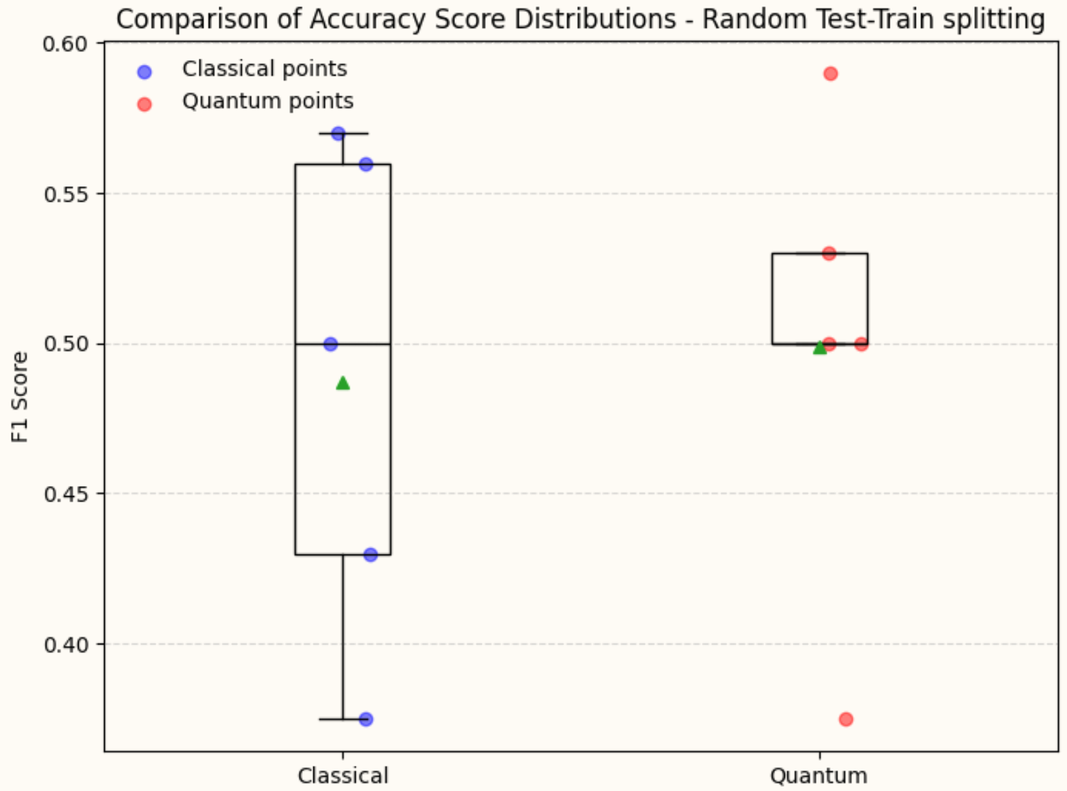
VQC



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CONCLUSIONS & TAKESWAY

Classical models deliver strong preformacce in credict risk prediction.

Confidence analysis reveals where they struggle.

Quantum embeddings can add higher-dimensional data that aids models in low-confidence regions.

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FUTURE WORK

Next steps focus on refining circuit design and feature encoding, with deeper analysis of low-confidence and borderline credit risk cases. Further work will assess scalability beyond the small-data regime and strengthen confidence-driven hybrid quantum–classical pipelines.

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THANK YOU

PROBABLY CLASSICAL. DEFINITELY CURIOUS.

https://github.com/luiscal4a/QuantumHack-QRM/

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