HBO-ICT | Hogeschool van Amsterdam

Project Pasqal

Modeling the world in quantum

PASQAL

Using differentiable quantum circuits to model non linear differential equations

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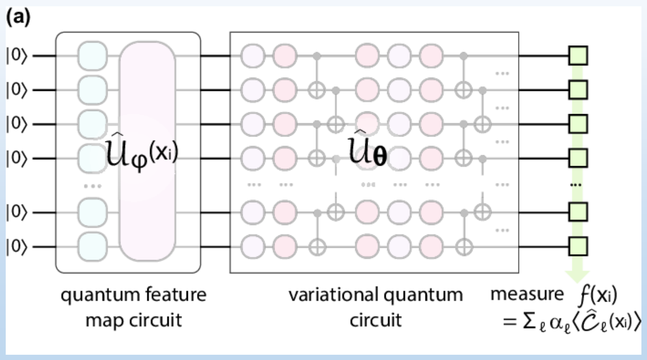
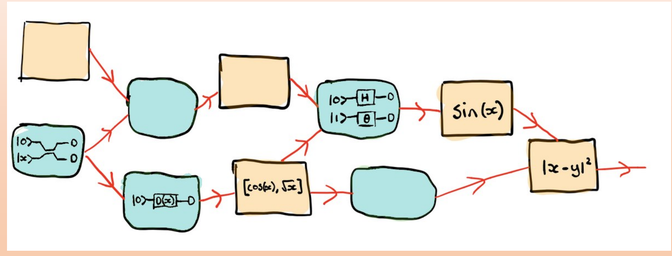
Introduction

- The world is mainly described by non linear differential equations
- Though on classical computers
- Neural networks are used
- Add a quantum computer
  - Speedup
  - More accurate



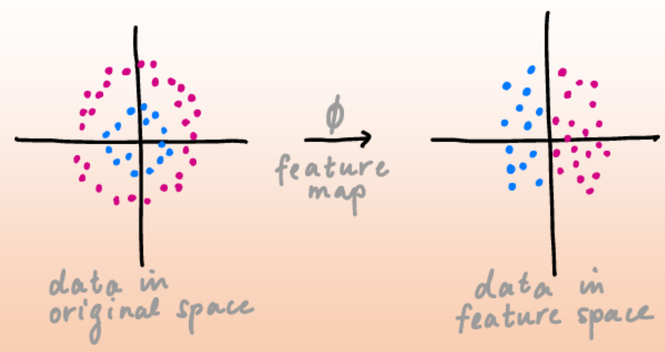
Problem

- Quantum Blocks backpropagation
- Block neural networks
- Differentiable quantum circuit or DQC fix
- How to encode the data?



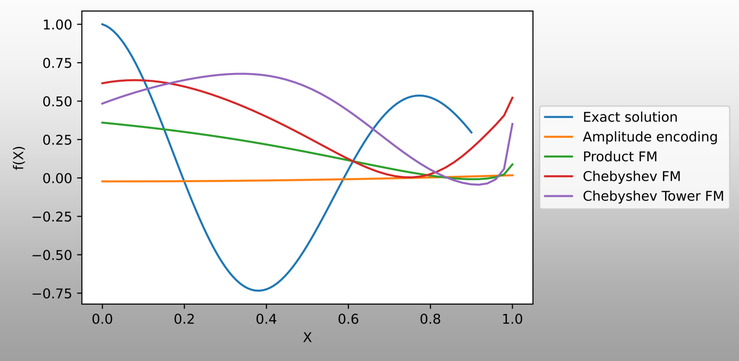
Method

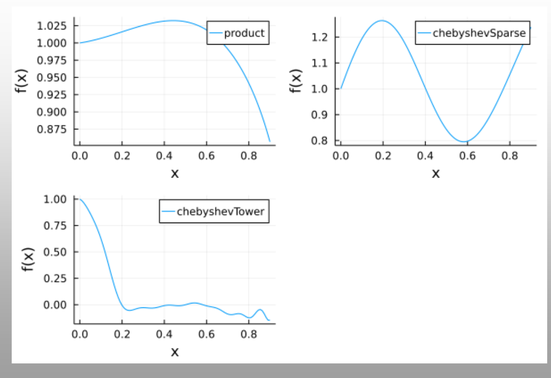
- Basic encoding is suboptimal
  - Not using full information density
  - Does not prepare data
- Feature map
  - Can utilize density
  - Transforms data into a more useful form
- Architectures:
  - Python/ Pennylane



Results

- Feature maps have an increased expressivity
- First step already creates strong correlation
- Chebyshev Tower works particularly well





Conclusion

- **Only the first step** so the results are not complete
- A correlation can already be seen
- Future
  - Properly test expressivity
  - Introduce the variable circuit