Thesis Changes Log

Name of Candidate: Andrey Kardashin

PhD Program: Computational and Data Science and Engineering

Title of Thesis: On Applications of Variational Quantum Circuits

Supervisor: Prof. Jacob Daniel Biamonte

The thesis document includes the following changes in answer to the external review process.

Suggested by Reviewer I

     1. In Section 1.2.4 (after Equation 1.18) and at the end of Section 2.1, added a discussion related to the number of measurements needed for measuring an expected value.

     2. Added Section 1.3.1 "Tensor network states"

     3. Fixed the citations for Equation 2.12.

     4. Added corrections regarding the phase transition, critical point, and the order parameter in the subsection "Photon polarization qubits", Section 2.1.1.

Suggested by Reviewer II

     1. Added Section 4.1.4 "Remarks on quantum channel discrimination"

Suggested by Reviewer III

     1. Where applicable, emphasized that the results are taken from the defendant's co-authored publications.

     2. Added Section 4.2.2 "Remarks on quantum machine learning".

     3. Added Figures 4-14 and 4-15; in Section 4.2.1, added a discussion regarding the classification performance for larger numbers of qubits.

     4. In Section 3.1, after Equation 3.6, added a justification for choosing the value of the required overlap to be 0.999.

Suggested by Reviewer IV

     1. Added a more detailed description of the noise model determined by Equations (2.13)-(2.15).

     2. Added Section 3.6 "Remarks on variational quantum algorithms".

     3. In Section 4.2.1, added Figure 4-11 and a paragraph about the dependence of the classification accuracy on the training set size.

     4. Renamed Chapter 4 to "*Quantum channel discrimination with variational quantum circuits*".

     5. Repaired the hyperlinks for the references, fixed the spotted typos and made suggested corrections.

Other

     1. Fixed Theorem 1.

     2. Fixed the definition of the Hadamard gate in Section 1.3.

3. Added a sentence clarifying one of the conclusions at the end of the "Entanglement breaking channel discrimination" subsection, section 4.1.3.

4. Added the acronym "MPS".

5. Changed the title of Section 1.3 to "Tensor diagrams".

6. In Section 4.2.1, added a discussion regarding the results on the discrimination of depolarizing channels, before Equation 4.30.

7. Renamed Chapter 3 to "Variational algorithms and tensor diagrams"

8. Replaced the phrase "tensor networks" by "tensor diagrams" in some parts of the text.

9. Made miscellaneous corrections in Introduction and Conclusion, made the statements and the results more specific.

10. Rescaled the plots in Figure 2-5. Increased the size of markers in Figure 2-4, the error bars now indicate the standard deviation. Fixed Figure 2.6.

11. Made minor clarifying corrections in Section 2.1.2.

12. At the end of Section B.2, made corrections about the utility of the post-measurement state in the swap test.

13. Updated Figure 4-8. In Section 4 and in Conclusion, added a conjecture about the dependance of the variational discrimination results on the trace distance between the output states.

14. Fixed issues with displaying multiple citations.

15. Other minor corrections (formatting, grammar, etc.).