I. IDENTIFICATION DATA

Thesis name:	**Quantum Machine Learning**
Author's name:	**Jan Svoboda.**
Type of thesis :	master
Faculty/Institute:	Faculty of Electrical Engineering (FEE)
Department:	Department of Control Engineering
Thesis supervisor:	Mgr. Jakub Mareček, Ph.D.
Supervisor's department:	Department of Computer Science

II. EVALUATION OF INDIVIDUAL CRITERIA

Assignment	**extraordinarily challenging**

Evaluation of thesis difficulty of assignment.

Quantum machine learning is a nascent, fast-moving field on the intersection of machine learning, theoretical computer science, and quantum physics. From the point of view of an undergraduate student, there are many challenges: non-trivial mathematical component, lack of undergraduate-level textbooks, many research papers exaggerating their claims, and the lack of quantum-computing hardware to test the approaches at scale. The student has approached the extraordinarily challenging assignment with grace.

Satisfaction of assignment	**fulfilled**

Assess that handed thesis meets assignment. Present points of assignment that fell short or were extended. Try to assess importance, impact or cause of each shortcoming.

The thesis has fulfilled the assignment. The student has demonstrated a novel approach to quantum machine learning in a quantum simulator.

Activity and independence when creating final thesis	**B - very good.**

Assess that student had positive approach, time limits were met, conception was regularly consulted and was well prepared for consultations. Assess student's ability to work independently.

The student has attended agreed consultations promptly, and often came well prepared. The student can study non-trivial questions independently, although sometimes may lack the biq picture and sometimes the ability to follow minute detail.

Technical level	**B - very good.**

Assess level of thesis specialty, use of knowledge gained by study and by expert literature, use of sources and data gained by experience.

The student has developed a good understanding of the research papers suggested by the supervisors, proven his ability to summarize the results, but also shown some limitations in his ability to extend the results further. While on the numerical side, the extensions are convincing, in terms of the analysis, the results are rather limited.

Formal and language level, scope of thesis	**B - very good.**

Assess correctness of usage of formal notation. Assess typographical and language arrangement of thesis.

The thesis is reasonably well written. While the introductory chapters are quite detailed, the chapter "Main concept" leaves something to be desired in its brevity and high-level treatment of the concept.

Selection of sources, citation correctness	**A - excellent.**

Present your opinion to student's activity when obtaining and using study materials for thesis creation. Characterize selection of sources. Assess that student used all relevant sources. Verify that all used elements are correctly distinguished from own results and thoughts. Assess that citation ethics has not been breached and that all bibliographic citations are complete and in accordance with citation convention and standards.

The student has fully understood the papers suggested by the supervisors and read a handful of further papers in detail. This is admirable, considering these are research papers, not summarized in any available textbooks.

Additional commentary and evaluation

Present your opinion to achieved primary goals of thesis, e.g. level of theoretical results, level and functionality of technical or software conception, publication performance, experimental dexterity etc.

The student has proven his ability to study a substantial body research, and to develop novel ideas within the field.

In particular, the approach suggested considers quantum kernel embeddings with rejection sampling from a certain random ensemble of unitaries for the kernel. The rejection sampling makes it possible to guarantee certain desirable properties of the kernel, which had been previously been shown to be missing in expectation in the same random ensemble. The complexity of simulating the rejection sampling classically makes it possible for the quantum kernel to have quantum advantage, which would not be available with classically simulable kernel. While the original suggestion comes from the supervisor, the implementation has been carried out independently and has been succinctly described by the student.

III. OVERALL EVALUATION, QUESTIONS FOR DEFENSE, CLASSIFICATION SUGGESTION

Summarize thesis aspects that swayed your final evaluation.

I evaluate handed thesis with classification grade **A - excellent.**

Date: **8.1.2025**   Signature:

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Faculty/Institute:	Faculty of Electrical Engineering (FEE)
Department:	Department of Control Engineering
Thesis reviewer:	Georgios Korpas
Reviewer's department:	Computer Science

II. EVALUATION OF INDIVIDUAL CRITERIA

Assignment	**ordinarily challenging**
Evaluation of thesis difficulty of assignment.	
Please insert your commentary.	

Satisfaction of assignment	**fulfilled**
Assess that handed thesis meets assignment. Present points of assignment that fell short or were extended. Try to assess importance, impact or cause of each shortcoming.	
Please insert your commentary.	

Method of conception	**correct**
Assess that student has chosen correct approach or solution methods.	
Please insert your commentary.	

Technical level	**C - good.**
Assess level of thesis specialty, use of knowledge gained by study and by expert literature, use of sources and data gained by experience.	
Please insert your commentary.	

Formal and language level, scope of thesis	**B - very good.**
Assess correctness of usage of formal notation. Assess typographical and language arrangement of thesis.	
Please insert your commentary.	

Selection of sources, citation correctness	**B - very good.**
Present your opinion to student's activity when obtaining and using study materials for thesis creation. Characterize selection of sources. Assess that student used all relevant sources. Verify that all used elements are correctly distinguished from own results and thoughts. Assess that citation ethics has not been breached and that all bibliographic citations are complete and in accordance with citation convention and standards.	
Please insert your commentary.	

Additional commentary and evaluation
Present your opinion to achieved primary goals of thesis, e.g. level of theoretical results, level and functionality of technical or software conception, publication performance, experimental dexterity etc.
Please insert your commentary (voluntary evaluation).

III. OVERALL EVALUATION, QUESTIONS FOR DEFENSE, CLASSIFICATION SUGGESTION

Summarize thesis aspects that swayed your final evaluation. Please present apt questions which student should answer during defense.

I evaluate handed thesis with classification grade **B - very good.**

Date: **24.1.2025**   Signature: *Georgios Korpas*