THESIS SUPERVISOR'S REPORT

I. IDENTIFICATION DATA

Thesis title:	**Machine Learning for Robotic Exploration**
Author's name:	**Jáchym Staněk**
Type of thesis :	bachelor
Faculty/Institute:	Faculty of Electrical Engineering (FEE)
Department:	Department of Cybernetics
Thesis reviewer:	Ruslan Agishev
Reviewer's department:	Department of Cybernetics

II. EVALUATION OF INDIVIDUAL CRITERIA

Assignment

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challenging

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How demanding was the assigned project?

The work on the thesis assignment required from the student to have knowledge in such fields as neural networks and dense SLAM (in robotics). The student should not only to have general theoretical background in the topics, but also to apply them to real engineering tasks. The following main skills were needed: processing of noisy sensory data (RGB-D and point clouds), usage of deep learning frameworks to train neural networks for depth image completion, applying coordinate transformations, usage of ROS (robotics framework) for sensory and coordinate data propagation and visualization.

Fulfilment of assignment

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fulfilled

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How well does the thesis fulfil the assigned task? Have the primary goals been achieved? Which assigned tasks have been incompletely covered, and which parts of the thesis are overextended? Justify your answer.

The primary goal (development of the Depth Completion module) of the assignment was completed. The module was implemented as a depth completion neural network. The proper data set was chosen (KITTI depth completion) and the network was trained with the help of the target differentiable SLAM pipeline. In addition, a desired loss function was used (for the calculation of reconstruction error, we utilized Chamfer loss). The localization error function was also implemented and required experiments with it were conducted. However, it didn't give promising results. That's why only the reconstruction loss was chosen in the final implementation.

The last task that was studied in the work is effect of the designed Depth Completion module on SLAM performance. Mapping part (reconstruction) was improved as a result. Localization was not improved, and this result was explained in the thesis and supported by necessary experiments.

Activity and independence when creating final thesis

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A - excellent.

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

From the beginning of the work on the thesis, regular weekly meetings were established to monitor the progress as well as to discuss next steps to achieve long- and short-term goals. The student was prepared for each meeting and had relevant questions. The work was done gradually without major delays or problems.

Technical level

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A - excellent.

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Is the thesis technically sound? How well did the student employ expertise in his/her field of study? Does the student explain clearly what he/she has done?

Although before completion of the thesis several topics related to the project were new for the student (dense SLAM, working with ROS), he was able to learn the necessary theory and apply the expertise to the assignment. Additional tools for progress tracking and documentation were used during the work on the project (like the version control system GitHub). This turned out to be a good practice for the student to communicate intermediate progress.

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

Are formalisms and notations used properly? Is the thesis organized in a logical way? Is the thesis sufficiently extensive? Is the thesis well-presented? Is the language clear and understandable? Is the English satisfactory?

The student proved to have reasonable English writing skills with minor issues. The necessary technical terms were used in correct way and in proper context. All required components and conducted experiments were described, as well as a description of SOTA works and motivation to tackle the problem were given in the thesis.

However, due to involvement of several components and tools (depth completion network, differentiable SLAM, noisy sensory data processing, etc.) required to solve the assignment, the overall description of the system in the thesis is slightly difficult to understand for a reader.

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

Does the thesis make adequate reference to earlier work on the topic? Was the selection of sources adequate? Is the student's original work clearly distinguished from earlier work in the field? Do the bibliographic citations meet the standards?

The relevant works were cited for each sub-topic involved in the project. In general, the bibliographic citations meet the standards. However, works describing a general pipeline to approach the assignment were not described In the thesis. This could be considered as the supervisor's mistake.

Additional commentary and evaluation (optional)

Comment on the overall quality of the thesis, its novelty and its impact on the field, its strengths and weaknesses, the utility of the solution that is presented, the theoretical/formal level, the student's skillfulness, etc.

The student showed to have proper personal motivation and dedication to work on the project. Possible future work on the project was discussed, and a publication target was established.

III. OVERALL EVALUATION, QUESTIONS FOR THE PRESENTATION AND DEFENSE OF THE THESIS, SUGGESTED GRADE

Summarize your opinion on the thesis and explain your final grading.

The grade that I award for the thesis is A - excellent.

Date: **24.5.2022**   Signature: