SUPERVISOR'S OPINION OF FINAL THESIS

I. IDENTIFICATION DATA

Thesis name:	**Visual Navigation using Deep Reinforcement Learning**
Author's name:	**Jonáš Kulhánek**
Type of thesis :	bachelor
Faculty/Institute:	Faculty of Electrical Engineering (FEE)
Department:	Department of Cybernetics, FEE CTU
Thesis supervisor:	Erik Derner
Supervisor's department:	Department of Control Engineering, FEE CTU

II. EVALUATION OF INDIVIDUAL CRITERIA

Assignment	**challenging**

The task was to develop a method for visual navigation in 3D environments. The assignment presents a challenging research problem in the field of deep reinforcement learning, which has brought a lot of research interest recently.

Satisfaction of assignment	**fulfilled**

The candidate has not only fulfilled all the tasks given in the assignment, but he has even exceeded the requirements by a significant margin. He has developed a novel method with several new extensions of the state-of-the-art algorithms (design of the network architecture, addition of auxiliary tasks for visual navigation) and he has thoroughly evaluated the method on an extensive set of experiments.

Activity and independence when creating final thesis	**A - excellent.**

The candidate has been very active and motivated in the whole process of the development and implementation of the method and also in writing the thesis. We have agreed on ad-hoc meetings and consultations (either in person, by Skype or by e-mail) and the candidate had always prepared relevant questions that have helped to move the work forward efficiently. Even though the courses on the topics relevant for the thesis were covered in his study plan only marginally, he has familiarized himself with the needed concepts quickly through self-study.

Technical level	**A - excellent.**

The thesis is on an excellent technical level and the method is explained in detail in a well-structured manner. The understanding of the details is facilitated by the use of high-quality illustrations.

Formal and language level, scope of thesis	**A - excellent.**

The thesis is well organized and the candidate has a good sense for detail. He has gradually improved his English language skills throughout the process of preparation of the thesis, so the final text is very well written.

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

The candidate has performed thorough research of related work. The theoretical background needed for the understanding of the method is also well presented in the thesis. The work of the candidate is clearly distinguished from the work of other authors by a detailed description and through comparison of results in various experiments.

Additional commentary and evaluation

The candidate has developed a novel method and he has presented thoroughly its theoretical explanation as well as the experimental evaluation. A big advantage for the reusability of the work is that he has made the source codes publicly available on GitHub.

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III. OVERALL EVALUATION, QUESTIONS FOR DEFENSE, CLASSIFICATION SUGGESTION

The candidate has done great work in the development, implementation, and evaluation of a novel method and he has presented the results not only in the thesis, but he has also prepared a paper and submitted it to an international conference. Since the beginning, he has shown great motivation and diligence. Overall, the collaboration with the candidate has been a very good experience.

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

Questions for defense:

- What techniques can be used to speed up the training?
- What are the challenges of applying the visual navigation method to real-world environments?

Date: **6.5.2019**

Signature:

Erik Derner