THESIS SUPERVISOR'S REPORT

I. IDENTIFICATION DATA

Thesis title:	**Exploring symmetries in deep learning**
Author's name:	Martin Krutský
Type of thesis :	bachelor
Faculty/Institute:	Faculty of Electrical Engineering (FEE)
Department:	Cybernetics
Thesis reviewer:	Gustav Šír
Reviewer's department:	Computer Science

II. EVALUATION OF INDIVIDUAL CRITERIA

Assignment	**extraordinarily challenging**

How demanding was the assigned project?

The topic concerns the current state-of-the-art in deep learning, which is well beyond the bachelor studies curriculum.

Fulfilment of assignment	**fulfilled**

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.

Fulfilled beyond expectations. All the primary goals have been achieved, plus the analysis of the XOR problem is superb.

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

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.

The student's level of independence and activity was extraordinary. Not only he had to study the whole deep learning domain from scratch, including the not-so-well documented state-of-the-art techniques, but he was proactively proposing additional experiments on a weekly basis.

Technical level	**A - excellent.**

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?

The technical level of the thesis goes well beyond the common, and is actually close to a publication level of research. Although this was meant to be an introductory exploration type of work, some of the techniques, e.g. the XOR weight-sharing schemas, are analyzed in great detail, beyond the currently published research. The hypotheses being tested and the experimental protocol are stated and followed very clearly throughout the thesis.

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

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 conceptualization and organization, format of presentation, as well as the English level are all excellent.

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?

Given the novelty and diversity of the analyzed topic, there is no classic "Related Works" section, but the student follows the citation etiquette throughout the thesis very carefully.

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.
Please insert your comments here.

The presented thesis addresses one of the most contemporary problems in deep learning research. The study of symmetries in neural architectures offers an elegant way to dissect their very principles and mutual connections, which are commonly hidden in implementations and not well understood by deep learning practitioners.

This exploratory work then offers a glance at the possibility of an organized, unified view of the zoo of advanced neural architectures being constantly proposed by deep learning researchers. Therefore, I believe that it could potentially have an important impact on the field, and I commend the student highly for his determination in working on this novel and challenging topic.

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.

As a supervisor, I have no questions. I unreservedly suggest the highest grade, and **recommend the thesis for the Dean's award**.

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

Date: **21.5.2021**   Signature: