

I. IDENTIFICATION DATA

Thesis name:	Geometry and Transformations in Deep Convolutional Neural Networks
Author's name:	Tomáš Jakab
Type of thesis :	bachelor
Faculty/Institute:	Faculty of Electrical Engineering (FEE)
Department:	Department of Cybernetics
Thesis supervisor:	Andrea Vedaldi
Supervisor's department:	Engineering Science, Oxford University, UK

II. EVALUATION OF INDIVIDUAL CRITERIA

Assignment	challenging
<i>Evaluation of thesis difficulty of assignment.</i>	
Due to its highly speculative nature, the project was challenging. Compared to many works in deep learning, which apply and perhaps optimize neural networks for specific problems, Mr. Jakab's thesis addresses the problem of understanding <i>how</i> these opaque models obtain their excellent performance. Even identifying the correct research question and the experimental design posed a significant challenge, let alone the numerical simulations, hiding numerous insidious details.	

Satisfaction of assignment	fulfilled
<i>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.</i>	
The nature of the work was highly risky, but Mr Jakab was able to meet very well all the main objectives as well as to go beyond them by designing and training transformer networks.	

Activity and independence when creating final thesis	A - excellent.
<i>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.</i>	
Mr Jakab's maturity and autonomy are outstanding. We only discussed the general content in the thesis, and Mr Jakab was able to produce a very good draft with very little input. Likewise, while we discussed a few times the experimental design and result, everything else, including the details of the experiment and the software implementation, were entirely done by Mr Jakab without further input.	

Technical level	A - excellent.
<i>Assess level of thesis specialty, use of knowledge gained by study and by expert literature, use of sources and data gained by experience.</i>	
Mr Jakab was able to familiarize himself and then master advanced concepts in deep learning in a very short time. His understanding of the topic is comparable to at least a second year PhD student.	

Formal and language level, scope of thesis	A - excellent.
<i>Assess correctness of usage of formal notation. Assess typographical and language arrangement of thesis.</i>	
The thesis form is excellent, almost publication-quality.	

Selection of sources, citation correctness	A - excellent.
<i>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.</i>	
While there is comparatively little work on understanding modern deep neural networks, all relevant sources are cited properly.	

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.

While the experiments are limited to the analysis of synthetic glyphs, there is actually a significant amount of technical sophistication in the thesis, including learning Siamese deep neural network and a novel transformer network that estimates the relative transformation between two images, which, to my knowledge, is novel. Results were sometimes counter-intuitive, and hence informative; ultimately they could be explained well expanding our understanding of deep neural networks in non-trivial ways.

III. OVERALL EVALUATION, QUESTIONS FOR DEFENSE, CLASSIFICATION SUGGESTION

Mr Jakob's work is superb, and I can easily see how six more months of work on this project may yield a solid publication. Therefore, I believe that Mr Jakob's thesis deserves the maximum grade.

A question for the defense may be why transformer networks failed to train without proper regularization of the classification subnetworks.

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

Date: **8.6.2016**

Signature: Andrea Vedaldi