

I. IDENTIFICATION DATA

Thesis title:	Histological image registration using optical flow estimation and deep learning
Author's name:	Brejtr Vojtěch
Type of thesis :	bachelor
Faculty/Institute:	Faculty of Electrical Engineering (FEE)
Department:	Department of Circuit Theory
Thesis reviewer:	Michal Neoral
Reviewer's department:	Department of Cybernetics

II. EVALUATION OF INDIVIDUAL CRITERIA

Assignment	challenging
<i>How demanding was the assigned project?</i>	
In my view, the topic of image registration using optical flow methods is challenging for a student in a bachelor's program. The subject of optical flow estimation (OF) is part of specialised magister program.	

Fulfilment of assignment	fulfilled
<i>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.</i>	
The student fulfilled all points of the assignment, even the optional task. The only subtask which has not been fulfilled completely was applying existing optical flow methods directly on the ANHIR dataset. However, there is a discussion which sufficiently justifies the missing subtask.	

Methodology	correct
<i>Comment on the correctness of the approach and/or the solution methods.</i>	
The chosen methodology is correct. The proposed method is based on a state-of-the-art optical flow method, and all the steps of development described in the thesis are meaningful.	

Technical level	A - excellent
<i>Is the thesis technically sound? How well did the student employ expertise in the field of his/her field of study? Does the student explain clearly what he/she has done?</i>	
The technical level of the thesis is suitable (up to the points mentioned in the next section). From my point of view, there is no problem with a reconstruction of the method following the thesis. Also, the presence of an attached implementation is beneficial for the community.	

Formal and language level, scope of thesis	C - good
<i>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?</i>	
The length of the thesis is enormous (95 pages from introduction to conclusion + 22 appendix pages). Language is understandable, except for some minor cases of wrongly used punctuation or unnecessary long sentences. I cannot judge English grammar, but the overall reading experience was outstanding. However, I have some reservations about formalisms and notations:	
(a) lots of equations in the thesis have poor descriptions of the used symbols (e.g. equations 3.2-3.11, etc.);	
(b) some figures are not referenced in the text (e.g. Figure 4.1, Figure 5.1., etc.);	
(c) some illustration figures are not helpful, since they contain only a fraction of the information (e.g. Fig 7.2, Fig 7.3, etc.);	
(d) some abbreviations are used before explanation (e.g. label of figure 2.1, appr. five pages before explanation + figure is also without any reference in the text);	
(e) almost all figures have an insufficient description (maybe they are explained well in the text, but not referenced);	
(f) equation 7.3 and 7.4 are using the same symbol for two different things;	
(h) minor note: some values with uncertainties are expressed with the useless number of decimal places (e.g. 0.989 ± 0.0136 from equation 7.5).	

Selection of sources, citation correctness

B - very good

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 thesis explains the state-of-the-art optical flow estimation methods and commonly used synthetic training datasets. However, there is no description of the concurrent methods for histological image registration. This missing part of the text is crucial for understanding why there was a need to develop a new method (using OF) and clear what the usual procedure is for that task. The lack of related work section information causes that it is not easy to decide if the method pipeline could have not been designed differently or if there is an existing knowledge on which the proposed method is based on. The bibliographic citations are OK, but sometimes there is a missing type of citation source (book, article, name of a conference).

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 thesis has abnormal length for a bachelor's thesis, which is both, strength and weakness, at the same time:

(positives) Everything connected with the proposed method is explained in the thesis;

(negatives) There is a lot of unnecessary information for the sake of the thesis (e.g. subsections 2.2, 2.3).

I cannot objectively decide the novelty and the impact on the field because of the missing text mentioned in the paragraph "Selection of sources, citation correctness".

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. Pose questions that should be answered during the presentation and defense of the student's work.

Except for the problems mentioned earlier, the overall quality of the rest of the thesis is excellent. I suggest the grade **B**, but I would like to agree with grade **A** if the commission considers mentioned shortcomings less significant.

The grade that I award for the thesis is **B - very good**.

Date: 31st May 2022

Signature: