

I. IDENTIFICATION DATA

Thesis title:	Benchmarking 6D Object Pose Estimation for the Pick and Place Task
Author's name:	Bc. Vít Zeman
Type of thesis :	master
Faculty/Institute:	Faculty of Electrical Engineering (FEE)
Department:	Department of Cybernetics
Thesis reviewer:	Ing. Viktor Kozák
Reviewer's department:	Czech Institute of Informatics, Robotics, and Cybernetics

II. EVALUATION OF INDIVIDUAL CRITERIA

Assignment	challenging
<i>How demanding was the assigned project?</i>	
<p>The student had to study a substantial amount of relevant literature on RGB-based 6D object pose estimation and set up and effectively utilize selected methods for 6D pose estimation. Additionally, the student had to investigate available methods for creating 3D models of objects and properly employ these methods to generate a benchmark dataset containing all necessary elements for testing 6D pose estimation methods and obtaining relevant evaluation metrics. Furthermore, testing the selected methods for object localization and grasping on a real robot is a challenging task by itself. Overall, I assess the assignment of this thesis as challenging.</p>	

Fulfilment of assignment	fulfilled with minor objections
<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>	
<p>The thesis fulfills all the objectives outlined in its assignment. The deployment of selected methods and created models on a real robot could benefit from more attention and a deeper evaluation in the thesis. Conversely, the creation of the benchmark dataset exceeded the specified requirements, as the student employed multiple approaches for generating 3D models of selected objects and compared their performance.</p>	

Methodology	correct
<i>Comment on the correctness of the approach and/or the solution methods.</i>	
<p>The student approached the work systematically and there are no major problems with the methodology. The student selected and correctly applied both methods for 6D pose estimation and methods for reconstructing object models. The created dataset and employed evaluation metrics align with current standards, enabling further utilization of the obtained results for evaluating new methods or for their training and deployment.</p>	

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>	
<p>The thesis is technically sound, and the student clearly differentiated his own contributions and the adopted methods and frameworks. All principles behind the benchmark dataset creation, experimental setup, and the real world deployment were clearly outlined. The theory and practical application of the methods are well-described.</p>	

Formal and language level, scope of thesis	B - very 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 thesis is well-organized with proper use of formalisms and notations. The length and extent of the presented content are also satisfactory. However, there is room for improvement in the English language, as some sentences lack clarity or contain errors in phrasing and composition. Despite these occasional shortcomings, the author effectively communicates his work and ideas throughout the thesis.

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 student used a sufficient number of relevant sources. I have no comments regarding the citation of sources. Additionally, all adopted methods and frameworks are properly distinguished from the student's own results.

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.

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.

The student chose a challenging topic that requires an in-depth knowledge of relevant works on 6D object pose estimation and principles for their evaluation and application. The student also had to utilize several systems for 3D object modeling. The outcome of the thesis is a dataset enabling the application and evaluation of methods for 6D object pose estimation on selected objects. The result is further supported by its deployment with a real robot. The student achieved all the objectives of the thesis, and the completed work is of good quality.

Questions:

Your reason for selecting MegaPose for real environment deployment is the additional effort necessary to train the T6D method for new objects. The T6D method clearly outperformed MegaPose on the benchmark dataset (when used). You also stated that it allows for fast inference times. Can you expand on this and give some estimates for the necessary effort for T6D? Can you also give an estimate on the inference time, since runtime is often an important factor in automation.

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



THESIS REVIEWER'S REPORT

Date: **20.1.2024**

Signature: