

I. IDENTIFICATION DATA

Thesis title:	Estimating object properties through robot manipulation - dataset and benchmark
Author's name:	Jiří Hartvich
Type of thesis :	bachelor
Faculty/Institute:	Faculty of Electrical Engineering (FEE)
Department:	Department of Cybernetics
Thesis reviewer:	Mgr. Matěj Hoffmann, Ph.D.
Reviewer's department:	Department of Cybernetics

II. EVALUATION OF INDIVIDUAL CRITERIA

Assignment	challenging
<i>How demanding was the assigned project?</i>	
The student had to conceive and develop from scratch a database of object models and their physical properties. This involved also pilot data collection on a real robot setup.	

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 assignment was fulfilled in all respects.	

Activity and independence when creating final thesis	A - excellent.
<i>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.</i>	
The student was regularly coming to the laboratory to work on the assignment, worked independently and consulted the status when needed.	

Technical level	A - excellent.
<i>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?</i>	
Given the diverse set of topics the student had to cover, all of them were adequately covered and described.	

Formal level and language level, scope of thesis	A - excellent.
<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 does not contain a lot of mathematical apparatus – which was not required. It is organized in a logical way and sufficiently extensive. There is a good number of schematics and visualizations that facilitate reading and understanding. English is very good.	

Selection of sources, citation correctness	A - excellent.
<i>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?</i>	
The related work section is appropriate. Table 2.1 and Figs. 2.1 and 2.2 provide a new conceptualization and overview. Student's original work is clearly distinguished. Citations are correct.	

Additional commentary and evaluation (optional)
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THESIS SUPERVISOR'S REPORT

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.

III. OVERALL EVALUATION, QUESTIONS FOR THE PRESENTATION AND DEFENSE OF THE THESIS, SUGGESTED GRADE

This is an excellent Bachelor thesis. Moreover, it constitutes an important building block for CTU's participation in a European project (<https://sites.google.com/view/ipalm>). While working on the thesis, the student has already interacted with the international project partners.

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

Date: **31.5.2022**

Signature:

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Department:	Department of Cybernetics
Thesis reviewer:	Jean-Baptiste Weibel
Reviewer's department:	TU Wien (external)

II. EVALUATION OF INDIVIDUAL CRITERIA

Assignment	challenging <input checked="" type="checkbox"/>
<i>Evaluation of thesis difficulty of assignment.</i>	
The topic of the thesis stems from the objective of the IPALM project and focuses on the development of dataset and benchmarks tools suitable for physical properties beyond the ones accessible from an RGB or RGB-D sensor. This is an important and challenging topic for the robotic research community. The specific topic is at the intersection of server, database and robotics, requiring a familiarity with all those domains and therefore constitutes an ambitious bachelor's thesis work.	

Satisfaction of assignment	fulfilled <input checked="" type="checkbox"/>
<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 thesis addressed all 5 points defined in the original guidelines. In more details, existing datasets and benchmarks for robot manipulation are reviewed, the software created provides a database suitable for object instances' physical properties stemming from measurements. Querying that database can easily provide prior distributions of categories properties, given enough measurements being available. The database measurement's definition can handle any of the data generated by exploratory actions defined. Setup and grasp proposals are also stored as part of the experiment definition. While more details would have been appreciated about it in section 4, the setup has been tested with some YCB objects and a few extras ones. Considerations are presented regarding a benchmarking protocol. Finally, the interface presented is suitable for extensions, and provides tools to ease contributions from external contributors.	

Method of conception	outstanding <input checked="" type="checkbox"/>
<i>Assess that student has chosen correct approach or solution methods.</i>	
The methods presented rely on suitable and reliable tools. The choice of python is good as, beyond its ease-of-use, it is one of the two language supported by the ubiquitous robotic framework ROS, simplifying the transition. It could have been interesting to also propose contributions methods more integrated with ROS as the formal definition of measurements could have been also enforced through the use of messages. Providing a decorator function is also an elegant way to lower the barrier to contributions. The relational database is efficiently and meaningfully defined. The schema provides means of storing all the relevant information for a given measurement. The implementation of the different exploratory actions, while seemingly less central to the thesis is well-grounded. One minor caveat would be that the method to estimate the distribution on the category distribution might not be sound, or at least would require more details. It seem to share some conceptual similarities with "Dropout as a Bayesian approximation: representing model uncertainty in deep learning", from Yarin Gal et al. (ICML16) which is better theoretically grounded.	

Technical level	B - very good <input checked="" type="checkbox"/>
<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>	

As mentioned in the assignment section, the work presented required familiarity with several highly technical fields, not only on a theoretical level but at a practical level too, which was demonstrated by the experiments presented.

Formal and language level, scope of thesis

B - very good

Assess correctness of usage of formal notation. Assess typographical and language arrangement of thesis.

The notation conventions and language is very good and the terminology is correctly used. Minor mistakes are present like the use of aperture instead of opening in 2.3, or the lack of definition for the REST acronym in 3.3.1, and broken citations (beginning of section 4) but do not affect the clarity. One minor point to note is that some of the section would be better suited in the section 3 still, letting the section 4 focus on the actual experiments ran with the setup described.

Selection of sources, citation correctness

A - excellent

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.

The citation of sources is very satisfactory, using relevant work, and cited appropriately during the presentation of the work. MobileNet-v3 and Detectron2 are the only omitted relevant citations.

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.

The work achieved the original goal set and present an interesting way of keeping track of robotic experiments across setups and laboratories, opening up the door to different ways of benchmarking things based on consistency when no obvious groundtruth value can be obtained.

III. OVERALL EVALUATION, QUESTIONS FOR DEFENSE, CLASSIFICATION SUGGESTION

Summarize thesis aspects that swayed your final evaluation. Please present apt questions which student should answer during defense.

I evaluate handed thesis with classification grade

Date:

Signature: