## I. IDENTIFICATION DATA

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| **Thesis name:** | **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:** | Jean-Baptiste Weibel |
| **Reviewer's department:** | TU Wien (external) |

## II. EVALUATION OF INDIVIDUAL CRITERIA

### Assignment                                                challenging

*Evaluation of thesis difficulty of assignment.*

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

*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.*

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

*Assess that student has chosen correct approach or solution methods.*

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

*Assess level of thesis specialty, use of knowledge gained by study and by expert literature, use of sources and data gained by experience.*

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    A - excellent ▾

Date: 05/30/22                     Signature: