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ČESKÉ VYSOKÉ
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REVIEWER'S OPINION OF
FINAL THESIS

I. IDENTIFICATION DATA

Thesis name:	**Efficient Exploration of Body Surface with Tactile Sensors on Humanoid Robots**
Author's name:	**Maksym Shcherban**
Type of thesis :	master
Faculty/Institute:	Faculty of Electrical Engineering (FEE)
Department:	Department of Cybernetics
Thesis reviewer:	Dr.-Ing. Rania Rayyes
Reviewer's department:	Institut für Robotik und Prozessinformatik, TU Braunschweig, Germany

II. EVALUATION OF INDIVIDUAL CRITERIA

Assignment	challenging

Evaluation of thesis difficulty of assignment.

In this thesis, an artificial skin for iCub robot is implemented in Gazebo simulator. Implementing and developing this new tool as well as the interface with YARP middleware is quite challenging.

Satisfaction of assignment	fulfilled with minor objectio

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.

Implementing an artificial skin for iCub in Gazebo is fulfilled. However, testing different force measurements is missing, in contrast to the real robot's skin. The tool is tested with different learning algorithms which provides a new testing platform for cognitive robot research. However, more explanations and details should have been provided.

Method of conception	correct

Assess that student has chosen correct approach or solution methods.

The main work seems to be focusing on implementing the new tool for Gazebo. The chosen learning algorithms for testing it are relevant.

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.

The first part of the thesis consists of developing and implementing the artificial skin for iCub which was a missing tool in Gazebo and can support a lot of research in cognitive robotics field. The technical and software implementations are challenging technically. The thesis also solved a technical problem "contact jitter" in Gazebo. The author demonstrated in videos. I appreciate the provided open access code. The second part of testing and comparing different methods still need more investigation and improvement.

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 thesis is well written and readable. The reader can easily follow. The software implementation is well documented. However, the second part with active learning and curiosity was a bit shallow. The technical terms need to be better defined.

Selection of sources, citation correctness	B - very good.

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 related work has been covered well for the simulators. The author did a good job in comparing different simulators with their features. However, still main references for intrinsic motivation are missing.

In the literature view of intrinsic motivation pages 11-12, there are main two categories the author should have mentioned them: competence-based and knowledge-based. See:

P.-Y. Oudeyer and F. Kaplan, "What is intrinsic motivation? a typology of computational approaches," Frontiers in Neurorobotics, vol. 1, p. 6, 2009.

V. Santucci, G. Baldassarre, and M. Mirolli, "Which is the best intrinsic motivation signal for learning multiple skills?" Frontiers in Neurorobotics, vol. 7, p. 22, 2013.

In addition, the curiosity is quite a huge field and a lot of measures has been proposed, where the author gave only an example for it.

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 I appreciate the technical software part, the second experimental part needs to be improved. I would like to mention additional points and I recommend including them in the thesis:

1) The author needs to be more precises in defining the technical terms, e.g., Goal Babbling, inverse models (e.g., Kinematics),..

2) The implemented tool seems only detecting touch action without measuring the forces in contrast to the real artificial skin for iCub. The artificial skin with the tactile sensors of the real robot can measure a force and return a value between 0-255, while in simulation it returns only 0 and 1 to detect touch/no-touch. This is important point to be considered and discussed in the future work chapter.

3) The test set that author used is more a validation test as it is recorded for further processing (as mentioned in p.22)

4) In the results section Fig 5.5, the author should provide not only the mean error but also the standard deviation for the results and mentioned how many experiments have been done to calculate the mean

5) Figure 5.4 why the goals are scattered all over the workspace outside the body? This needs to be clarified

6) in the comparison of inverse models page 27, although NN achieved the best results so far, however it is very subjected to outliers which might be a serious issue for real-robot experiment.

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 | B - very good. |

Date: | 08/19/21 | Signature: