

I. IDENTIFICATION DATA

Thesis name:	Terrain Classification and Traversability Assessment from Exteroceptive Data
Author's name:	Prágr Miloš
Type of thesis :	master
Faculty/Institute:	Faculty of Electrical Engineering (FEE)
Department:	Department of Cybernetics
Thesis reviewer:	Dominik Belter
Reviewer's department:	Institute of Control, Robotics and Information Engineering, Poznan University of Technology

II. EVALUATION OF INDIVIDUAL CRITERIA

Assignment	challenging
<i>Evaluation of thesis difficulty of assignment.</i>	
The thesis deals with online terrain traversability assessment for a hexapod robot. The problem is interesting and very challenging. The proposed algorithm has to deal with limited sensing capabilities of walking robot and utilize real-life data from RGB-D camera to determine the cost of transport.	

Satisfaction of assignment	fulfilled
<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 assignment was satisfactorily fulfilled. The problem is clearly stated and introduced in the thesis. The solution to the terrain traversability assessment problem is given in the following chapters. The convincing experimental results are provided and discussed in the thesis.	

Method of conception	correct
<i>Assess that student has chosen correct approach or solution methods.</i>	
The proposed method estimates the cost of transport (CoT) from visual and geometrical data obtained from the RGB-D sensor. The proposed approach is justified by the broad literature review provided in the thesis. A thorough experimental analysis of different terrain descriptors is provided. Then, the best performing features are selected. The best results were obtained using the Incremental Gaussian Mixture Network method.	

Technical level	A - excellent.
<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>	
The technical level of the thesis is excellent. The thesis is based on the recent methods from robotics and computer science. The method presented in this thesis is novel and based on the knowledge gained from the literature.	

Formal and language level, scope of thesis	B - very good.
<i>Assess correctness of usage of formal notation. Assess typographical and language arrangement of thesis.</i>	
The thesis is well organized and easy to follow. The problem is well defined at the beginning of the thesis. Then, the solution is provided based on the very good literature review and experiments on the real robot. The conclusions are well justified by the numerical results. My only concerns are related to the technical organization of the thesis. Figures are sometimes far from the place where they are first mentioned which makes the reading difficult.	

Selection of sources, citation correctness	A - excellent.
<i>Present your opinion to student's activity when obtaining and using study materials for thesis creation. Characterize</i>	

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 literature review is well prepared. The references to the literature are provided in the whole thesis to justify the selection of the *state of the art* methods. All used methods are correctly distinguished from results and ideas presented in the thesis. The bibliographic citations are complete.

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 thesis shows that incremental learning approach can be applied for terrain traversability estimation for a six-legged walking robot. This approach increases the autonomy of walking robots. This method also opens future applications in which the robot learns from experience how to deal with rough terrain.

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.

This diploma thesis deals with a problem of terrain classification and traversability assessment for a hexapod walking robot. The robot utilizes data from the RGB-D sensor to predict power consumption and speed of the robot while traversing the particular terrain.

The goal of the thesis is challenging and the obtained results confirm skills and author's knowledge in robotics and computer science. The thesis is very interesting and provides good experimental verification. The description of the performed tasks is well organized and the contribution is clearly stated.

I've got only one question related to the future work: How information about the traversability cost can be utilized by the motion planner? It seems to be straightforward for methods like A* which directly use the cost of a path. What is the proper approach if the planning method does not use directly the traversability cost but computes motion which can be executed by the robot with given constraints (collisions stability, the workspace of the robot)? Is it possible to use the predicted traversability cost proposed in the thesis to bias the foothold selection algorithm to avoid risky obstacles?

I evaluate handed thesis with classification grade A - excellent.

Date: **05/06/2018**

Signature: