CTU
CZECH TECHNICAL UNIVERSITY IN PRAGUE

THESIS REVIEWER'S REPORT

I. IDENTIFICATION DATA

Thesis title:	**Car Detection Methods from 2D LIDAR Data Collected with a Mobile Robot**
Author's name:	**Jiří Janota**
Type of thesis :	bachelor
Faculty/Institute:	Faculty of Electrical Engineering (FEE)
Department:	Department of Cybernetics
Thesis reviewer:	Zhi Yan
Reviewer's department:	University of Technology of Belfort-Montbéliard (UTBM), France

II. EVALUATION OF INDIVIDUAL CRITERIA

Assignment **extraordinarily challenging**

How demanding was the assigned project?
Please insert your comments here.

Fulfilment of assignment **fulfilled**

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.
Please insert your comments here.

Methodology **outstanding**

Comment on the correctness of the approach and/or the solution methods.
Please insert your comments here.

Technical level **A - excellent.**

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?
Please insert your comments here.

Formal and language level, scope of thesis **A - excellent.**

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?
Please insert your comments here.

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?
Please insert your comments here.

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.

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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.

This thesis, completed by Mr. Jiří Janota, studies 2D lidar-based car detection, which is a very interesting and challenging problem. The candidate's work is demand-oriented (being part of a collaborative research project between Chronorobotics Laboratory and Skoda), and the results he obtained have good prospects for industrial applications. Specifically, the candidate studied three machine learning methods, from traditional methods (SVM) to modern deep neural networks (PointNet and U-Net), to obtain point-wise binary classification results (i.e., car or non-car). The candidate also studied a wheels fitting method to locate the wheels. The candidate annotated a real-world dataset and conducted qualitative and quantitative experiments on this basis. Through the comparison and analysis of the results of the studied methods, convincing conclusions are given.

The thesis is very well structured. Section 1 clearly states the background and motivation of the work. Section 2 reviews some existing methods, and I enjoyed reading it very much. Section 3 provides a very clear overview of the theoretical basis of the methods selected by the candidate. Section 4 describes the developed system. Section 5 introduces the real-world dataset. Section 6 gives the experimental results. Section 7 summarizes the thesis and puts forward suggestions for future work.

In summary, the assigned tasks are fulfilled and the work done is outstanding. I believe that Mr. Jiří Janota's work is an important cornerstone of the future, especially for the development of parking robot. I therefore express a very favorable opinion on Mr. Jiří Janota's thesis defense with a view to obtaining the bachelor's degree from CTU.

Some minor comments:

Page 2: 2nd paragraph, a slight explanation of the motivation for using 2D lidar rather than 3D lidar is suggested.

Page 2: It is recommended to replace "I" with "we" or "this thesis" to conform to academic publication habits.

Page 4: "in section 5." → "in Section 5."

Page 6: 3rd paragraph, "2D radar data ... each radar point" → "2D lidar data ... each lidar point"

Page 7: Section 2.5, 2nd paragraph, suggested reading: Yang et. al. "LaNoising: A data-driven approach for 903nm ToF LiDAR performance modeling under fog", IROS'20.

Page 10: "subsection 2.4" → "Section 2.4"

Page 11: "segmentation.[39]" → "segmentation [39]."

Page 18: "detection algorithm.." → "detection algorithm."

Page 19: Section 4.2.1, 2nd paragraph, I don't quite understand this paragraph.

Page 20: Figure 13, should the red and blue dots show similar shapes if the left and right lidars are extrinsically calibrated and the sensory data is synchronized?

Page 20: "The 3rd element is set to 0.4 if it comes from the right LIDAR, 0.7 if from the left LIDAR, and 1 otherwise." It is recommended to further explain the reasons behind the selection of these values.

Page 22: "However, I reduced its size." It is recommended to further explain the reasons behind it.

Page 24: "2. Euclidean distance to the object from the robot." It is recommended to clarify the distance between which two points, e.g. the center of mass of the robot and the center of the cluster?

Page 29: "for the classification" → "for the classification."

Page 30: "More specifically ... how many wheels the found cars consisted of." I don't quite understand how to use these metrics to evaluate the methods.

Page 36: References 32 and 33 (and others) are incomplete.

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

Date: **29/05/2021** Signature: