

I. IDENTIFICATION DATA

Thesis name:	Development and Evaluation of a Concept for the Augmentation of Data to Train Neuronal Networks for Semantic Segmentation of LiDAR-Pointclouds
Author's name:	Till Schöpe
Type of thesis :	master
Faculty/Institute:	Faculty of Electrical Engineering (FEE)
Department:	Department of Control Engineering
Thesis reviewer:	Doc. Ing. Tomáš Svoboda, PhD
Reviewer's department:	Department of Cybernetics

II. EVALUATION OF INDIVIDUAL CRITERIA

Assignment <i>Evaluation of thesis difficulty of assignment.</i>	challenging
The topic is timely and important. Many concepts are much less developed for unorganized 3D point clouds than for images. Many questions are still unanswered which makes the topic challenging.	

Satisfaction of assignment <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>	fulfilled
The thesis fulfills the goals.	

Method of conception <i>Assess that student has chosen correct approach or solution methods.</i>	outstanding
A approach is correct and thorough. Perhaps even too much a bit. Explanation of generic concepts consumes much space and it takes long before the student explains his own new contribution/invention – mostly in chapter 4.	

Technical level <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>	B - very good.
This is perhaps the weakest part of the thesis. At the end, I was a bit disappointed with the results. It is good the student attempts to cover all combinations of empty scenes and number of objects. However, I consider this as not the most important. The real challenge is elsewhere. It is necessary to show that adding augmented data helps in recognition/detection/segmentation performance on other data. Selecting most important experimental results and leaving less important to an appendix might help. At the current state, the experiments convey message like: "it somewhat helped on our data". Second main objection is that I do not understand to which extent is the augmentation automated. Inserting 3D point clouds into some real-world 3D point clouds realistically is not an easy task. Doing it fully automatically would be a valuable contribution. As far I understand only empty scenes were augmented. Also, the process for capturing the data for the augmentation is not described in enough technical detail.	

Formal and language level, scope of thesis <i>Assess correctness of usage of formal notation. Assess typographical and language arrangement of thesis.</i>	A - excellent.
The language level, the writing, are excellent. The thesis is an easy and smooth read. My probably only concern is that it is quite lengthy. Up to page 29 or so, the thesis discusses a general introduction that could be part of many theses about artificial neural networks. Also, the discussion about machine learning taxonomy, capacity of NN is too generic without direct connection to the own contribution of the student. Spared place/energy could be invested into more thorough discussion about usage of NN on unorganized point cloud data. A kind of reading guide/advice would help. Something that would tell a reader who knows about artificial neural nets already that can jump to page 30 or even latter pages. The concept of false positives/negatives is discussed quite lengthy for someone who already knows about machine learning and is curious about what is new.	

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.

This part is comprehensive. The author convincingly shows he can work with sources.

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.

I already touched the concern in the comments above. The actual augmentation technique is described very shortly and superficially. If I understand correctly, only empty scenes were augmented. No mixing real-world scenes with object data.

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.

In the Conclusion it is claimed "The biggest contribution of this work is both the provision of a software framework allowing the augmentation of LiDAR-pointclouds and the analysis conducted on top of this research". The text of the thesis was not about a software framework. I did not find any user guide neither discussion about how to set parameters and alike.

Page 48, it said that "253 pointclouds have been annotated". What does the number refer to? To a scene/scenario or to a pointcloud from one position?

Despite my rather critical comments above I evaluate the diploma thesis very high. The author demonstrated his ability to work on difficult complex problems convincingly. I evaluate the thesis with classification grade **A - excellent**.

Date: **4.6.2019**

Signature: