

Review of a Doctoral Thesis at FIT BUT

Doctoral thesis (hereinafter referred to as "thesis"): Automatic surveillance camera calibration by observation of rigid objects

Name of the doctoral student (hereinafter referred to as "student" / "author"): Ing. Vojtěch Bartl

Name and institution of the reviewer:

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I. Thesis

Appropriateness and relevance

The description of the current state and the existing methods is extraordinary and complete. The author shows clearly what is the uniqueness of his work and what are the benefits / weaknesses.

Instead of multitask pipeline, which is described in the work, I would suppose end-to-end solution where the ground-truth 3D models of the cars are learned from a scene by a model without the necessity of define them explicitly. But, because the development in the area of deep learning and image processing is fast and the current state was strongly different at the beginning of the authors study, it is understandable why the task is solved in the 'old-fashion' manner. The attached papers show that the student can adapt to the actual state of the art and fit it into his work.

Regarding the results and the comparison with SOTA methods, more extensive benchmarks are missing.

A summary of the contributions of the thesis

The thesis consists of two parts, the main part describing the thesis topic, dealing with automatic camera calibration, and the enclosed papers.

The contributions of the thesis are slightly hidden, and a reader must find them. Many things are taken from different researchers, such as a car detector, dataset, landmark detector, or differential evolution algorithm. The contribution is to connect these parts together and to present a nearly fully automatic calibration method, which is fulfilled. Also, I evaluate the re-use of the existing components as a good way to speed-up own research. I have to emphasize that the secondary contribution is a new created dataset that can be reused by the scientific community.

Novelty and significance:

The novelty is given by the idea itself. The particular steps of the pipeline can be marked as standard.

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Evaluation of the formal aspects of the thesis:

The description of the task and solution is appropriate, language level is high, and the overall formal quality is of high standard as well. Still, there are some minor issues, such as not explained parameter lambda in Formula (3.1), missing units in Tables (3.1, 3.2), or the incorrect naming of Formula (3.4) as RMSE (in fact, it is a quadratic version of MAPE).

Quality of publications

The quality of the publications is above the requirements. The student is a coauthor of publications accepted in Core rank A/B conferences and Q1/Q2 journals in the area of the thesis. The publications are distributed in 2017-2023 and accepted by the community, which is supported by more than 70 citations on Google Scholar.

Other comments

There are many types of camera calibrations. The author should clearly state at the beginning of the work that there the only goal is spatial calibration and not, e.g., intensity calibration.

The attached papers were published, thus reviewed, but I am missing in Figure (4.11) ground truth visualization and a definition of how the ensemble has been made. According to the visualization, I suppose there is used union of predictions; a voting would reach higher robustness.

II. Student's overall achievements

Overall R&D activities evaluation:

There are several projects and grants where the student participated. Most of them focus on the same area, image processing / computer graphics, and some of them are directly related to the student's research presented in the thesis. In addition, the CV lists three pieces of produced software and regular teaching of related subjects. This demonstrates that the student's activity is very high.

III. Conclusion

The student has shown with this thesis, his publications, teaching, quantity of supervised theses, participation in the projects, and number of non-self citations that he is a part of scientific community now and should continue in his great work.

I acknowledge Ing. Vojtěch Bartl proved with the thesis his qualification and skills and I fully recommend him for the degree Doctor of Philosophy, Ph.D.

Ostrava 23.02.2024

Signature of the reviewer: