

Assessment of the master thesis by Martina Dubeňová

## Visual Localization in Dynamic Environments

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The goal of the thesis was to investigate how to do visual localization in dynamic, i.e., changing, environments. This is an interesting and challenging topic that has not been sufficiently solved yet.

Classical visual localization uses 3D/image maps to represent static environment in which new, query, images are localized. As the environment changes, the quality of such localization degrades until it fails completely. Developing a system that is robust to changes in the environment poses several challenges. It is necessary to (i) construct a realistic data set representing the changing world for training and testing new methods, (ii) select a localization baseline to build on, and (iii) detect moving/changing objects, and (iv) modify the baseline localization method to be robust to the changes in dynamic environments. Altogether, it is a challenging technical task.

The thesis of Martina Dubeňová brings several contributions.

First, the thesis reviews previous work in visual localization, in particular original InLoc [2,4] and its reimplementations [7]. The review is sensible, and suffices to introduce the technicalities of the particular methods. On the other hand, in a publishable work, broader review of related methods and alternatives would be necessary.

Secondly, the thesis constructs new reference data sets. This is an important result that required much effort. I particularly value that Martina was able to acquire the data in Paris, build 3D models, annotate them and provide models in AI Habitat simulation environments. This effort was instrumental to achieving some of the important goals in EU H2020 SPRING project, but also sets an interesting and useful learning/evaluation data for future research.

Finally, the thesis proposes to detect objects that often move and mask out them from images before applying InLoc camera localization. This is a straightforward but sensible approach that needs to be evaluated before resorting to any other more sophisticated method. The interesting and important outcome of the thesis is that this approach indeed, slightly but undoubtedly, improves the localization. The result is interesting and suggests that masking may be one of the approaches how to improve the localization in changing environments. Still, to publish this result, more significant improvement would have to be reported.

Martina was a very good student. She worked very actively and independently and collaborated with other members of AAG team. In particular, much credit for her supervision should go to Michal Polic who actually was her immediate technical supervisor. Martina learned the visual localization technology, suggested a sensible approach to dealing with changes in the scenes, implemented an improvement of previous work, constructed new reference data sets and demonstrated the performance of her method. She fulfilled all the goals set in the assignment and presented a sensible approach to solving a challenging problem in visual localization.

Despite some minor drawbacks, I believe that the thesis is very good, and thus I grade it as very good (B).

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