Assessment of the master thesis by Tomáš Kremel

Evaluating Point Cloud Rendering Approaches for Camera Pose Verification

Doc. Ing. Tomáš Pajdla, Ph.D.
Master thesis supervisor

The goals of the thesis were to review and consolidate the image-based localization system InLoc, augment it with more advanced and better rendering mechanisms, including neural rendering techniques, and investigate how these mechanisms improve the quality of localization. The thesis addresses an advanced topic on the edge of current computer vision and machine learning research.

The thesis consists of three main parts. The first two parts review previous methods and introduce particular techniques used in the thesis. The third part of the thesis contains the main contribution, including the descriptions of implemented methods, data sets, and experimental evaluation and comparison of the methods.

The first part of the thesis reviews image-based localization. It introduces the InLoc localization method and discusses different aspects and potential shortcomings.

The second part of the thesis reviews some interesting point cloud rendering techniques. First, a general overview of the state-of-the-art methods is presented. Then, three rendering techniques used in the thesis, Neural Rendering in the Wild, Surface Splatting, and Ray Marching, are reviewed and explained.

The third part of the thesis concentrates on the camera pose verification step of InLoc. In this step, the best candidate for the camera pose in a scene is selected using a rendered image of the scene. After initial notes on camera pose representations, InLoc, ARtwin, and IMC datasets are described. Next, the thesis describes adaptations and integration of InLoc, Neural Rendering in the Wild, Surface Splatting, and the implementation of a Ray Marcher. Besides the new implementation of Ray Marcher, other adjustments and integration are also important engineering achievements that make the methods comparable and connected to the datasets for benchmarking. The remaining part of the chapter is devoted to experiments that compare different rendering methods qualitatively and quantitatively and how they influence the quality of the InLoc localization pipeline. This very well-organized experimental study sheds light on the tradeoff between quality and cost of the rendering. The results demonstrate that Neural rendering considerably improves the localization. This is a new and very useful result.

Tomáš Kremel presented a very professional work that fulfilled the goals set in the assignment. The work includes non-trivial implementations and very interesting experimental results. I value it as *excellent (A)*.

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doc. Ing. Tomáš Pajdla, Ph.D.
Thesis supervisor