

Institut Pascal (UMR6602 UCA/CNRS) - Group ISPR/ComSee

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Thesis title : Semi-supervised learning for 3D reconstruction of environments from images

Thesis summary :

The 3D reconstruction of an environment from images is useful in a lot of applications including autonomous vehicles and virtual reality. Several methods of Computer Vision and Photogrammetry are needed to solve this problem: the estimation of point clouds and camera parameters, the surface reconstruction. One of the most promising ways of improvements is the use of deep learning methods to solve the surface reconstruction step. An objective is also to avoid the supervised methods, that need databases with 3D information recovered by a scanner. There are several reasons to do this: price/availability of the scanner and time/ease of acquisition. Here we propose to use a database composed of several large environments that are reconstructed by a previous method (that is not deep learning), with a minority of manual corrections. One idea is that the network learns to replace a segment of improbable or bad surface by a better one, eg by using a variational auto-encoder. Thanks to learning, we expect to improve the result of previous surface reconstruction methods, eg if the experimental conditions are more difficult. We mostly focus on the case of outdoor environments reconstructed by using a 360 camera fixed on a vehicle or a helmet.

Short bibliography :

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- S.Peng, M.Niemeyer, L.Meschender, M.Pollefeys, A.Geiger, Convolutional occupancy networks, ECCV 2020.
- R.Sulzer, L.Landrieu, R.Marlet, B.Vallet, Scalable surface reconstruction with Delaunay-graph neural networks, CGF 40(5) 2021.