Generation of Training Data for 3D Point Cloud Classification by CNN

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SUMMARY

3D point clouds are widely used as intermediate results for surface measurement with laser scanners and other optical sensors. With the currently available sensors, 3D point clouds of complex objects can be produced in a short measurement time and with a high geometric resolution and accuracy. The point clouds describe the geometry of the captured objects, but only with additional knowledge a differentiation of objects or object parts is possible. This differentiation is necessary for the creation of models or deformation analysis. Humans have learned this additional knowledge quite naturally and can segment individual objects in a point cloud easily and assign these segments to a sense class. For the evaluation of point clouds this manual classification is state of the art. The quality of the classification highly dependents on the evaluating person and is very time-consuming. In the case of automatic methods of point cloud evaluation, the knowledge about the semantics is usually not or only approximately known, so that a classification can only be carried out roughly or for special cases by individually developed algorithms.

The use of artificial intelligence for classification tasks with large data sets has become a major field of research in computer science in recent years. Especially through the success in the classification of images and objects within images, the method of deep learning is promising for the classification of 3D point clouds. For this purpose convolutional neural network (CNN) are used, which learn the knowledge for the segmentation and classification task by supervised learning. The supervised learning of a CNN is done with training data which have a ground truth classification. The training success of the CNN and thus the later classification performance of the CNN depends on the one hand on the network structure and on the other hand on the amount (and duration), the accuracy and the diversity of the training data. Therefore, special attention needs to be paid to the method of generating training data. To generate training data from colored and non-colored point clouds, various transformation and conversion tools were developed that produce images or image

sections from different types of point clouds. These images can be easily classified by using a browser-based tool so that tool can be converted into a crowd souring application. The concept of the tools for generating training data, the functions and first results will be presented and discussed in this paper.