Bachelor Project Proposal: Fine-grained 3D object recognition: an approach and experiments

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This research is aimed at 3D object recognition and classification. In this project, we will create an interactive object recognition system that can learn 3D object categories in an open-ended fashion. This experience and accumulation of 3D object recognition and classification makes it possible to adapt to new environments by improving knowledge from conceptualization of new object categories. Thus, we will take a look at how the system model performs in recognizing and categorizing 3D objects in open-ended learning. The main research questions this project seeks to answer is: *Which learning progress of hand-crafted and deep transfer learning is the best for recognizing and categorizing of the 3D object in an open-ended fashion?*. The performance of the system will be evaluated by the accuracy of the protocol, the accuracy of the global classification, the learning speed of the agent, and the number of instances classified in each category.

The requirements of the relevant Bachelor project include a literature review within the discipline, the implementation of relevant code, experimentation with benchmarks as well as writing a thesis. We mainly use C++ based ROS as the main programming language. Parts of the code can also be written in Python, and later integrated. Through this project, we will mainly focus on detailing 3D object category learning and recognition, assuming that the object has already been segmented in the point cloud of the scene.

To give a brief overview of the stages that make up the research, we begin by implementing an offline 3D object recognition system that takes an object view as input and generates category labels (e.g. apples, mugs, forks, etc.) as output. Then we will dedicate to testing our approach in an online fashion by integrating the code into a simulated teacher test. In the offline 3D object recognition system stage, instance-based learning (IBL) is used to form a new category and we use K-fold cross validation to evaluate the obtained object recognition performance. In the open-ended stage, it is determined that the evaluation method in the off-line is not suitable, and the teaching protocol designed for experimental evaluation in open-ended learning. In the off-line and open-ended stages, the Restaurant RGB-D Object Dataset and Washington RGB-D Object Dataset were used, respectively.

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