
Bachelor Project Proposal: Learning to Grasp 3D objects using Deep Convolutional Neural Network

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This research is aimed at grasping 3D objects using deep convolutional neural networks (DCNN). In this project we see to teach a DCNN how to grasp a 3D object in a simulated environment, and potentially in the real world. The reliable performance of object grasping in dynamic human environments is a challenge that the fields of computer vision face today. The importance of the project lies in its contribution towards identifying the effectiveness of DCNN as a prospective solution. The main research question that this work will try to answer is the following: *(i) How effective can Deep Convolutional Neural Networks be for identifying the grasp affordances of 3D Objects in a cluster?*

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. For the deep learning parts, we will use Keras with tensorflow backend. Through this project, we assume objects are captured under various density conditions and each scene contains one or multiple 3D objects.

To give a brief overview of the stages that make up the research, we begin by segmenting the research into four sections: Object Recognition, Object Segmentation, Grasp Affordance Detection and Object Grasping. By following a methodology similar to that proposed by Point-Grid (1), a hybrid approach where both points and grids are used to reduce computational complexity while maintaining local geometry shapes, the object will be recognized and segmented. Grasp Affordance detection will be topic that this project particularly will attempt to expand as the focus point will be directed towards modifying the source code for the DCNN to handle cluster scenarios. Object grasping will initially occur in a simulated environment, and if possible will be extended to a real world experiment.

References

- [1] T. Le and Y. Duan, "PointGrid: A Deep Network for 3D Shape Understanding," 2018 IEEE/CVF Conference on Computer Vision and Pattern Recognition, Salt Lake City, UT, 2018, pp. 9204-9214.

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