

Point Cloud Classifier

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1 Introduction

I implemented two point-cloud generation procedures to train a PointNet classifier. The classifier has achieved over 90% accuracy rate in a held-out validation set within 400 gradient updates.

2 Point-Cloud Generator

A cube and a sphere point-cloud generator were implemented for training data. The generators finally produce a point-cloud with 1024 points, and each point is represented by its 3D coordinates. Each generator uniformly sampled 1024 points from the surface of the object. Two generators randomly sample points from the surfaces of a unit sphere and a unit cube. The sampling procedures follow uniform distribution of the objects surfaces. The sphere generator firstly produces three normal IID (independent identical) random variables and then normalize them to get a unit vector as the coordinate of the point. The cube generator simply selects a surface from a unit cube by a discrete uniform distribution, then samples a point from that surface. The point-clouds are further randomly transformed by random scaling, rotating, and translating. Samples of the point-clouds are Fig1.

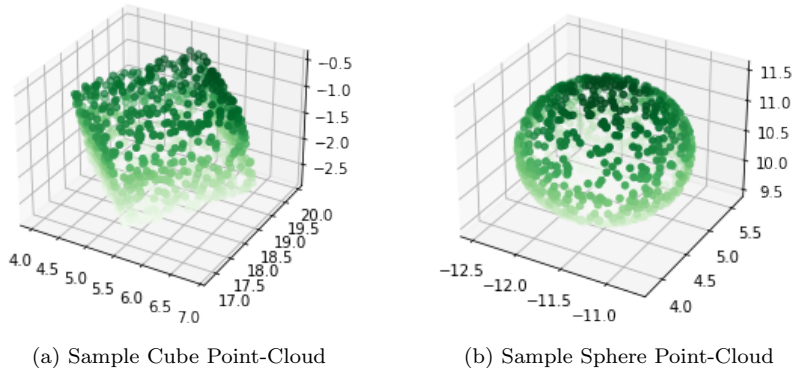


Figure 1: Sample Cube and Sphere Point-Clouds

3 PointNet Classifier

The classifier model is similar to a PointNet classifier [1]. In order to accelerating the convergence of loss and accuracy rate, the last two dense layers in the PointNet model, input transform and feature transform have been removed. To simplify the calculation of loss, regularization term is not included in loss function. Comparison of two models are Fig2.

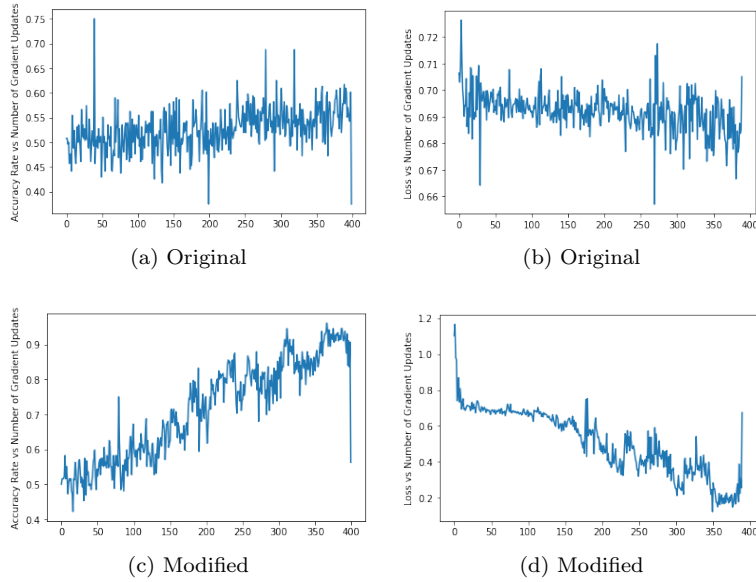


Figure 2: Loss and accuracy convergence of original and modified model

4 Experiment

I used Colab platform for data generation, model training and testing. The total time consumption for generating 100,000 different point-clouds, updating gradients 400 times with batch size of 256 and testing with size 1024 was about two hours for each of the model. An accuracy rate of 90% has been achieved.

References

- [1] Charles R. Qi, Hao Su, Kaichun Mo, and Leonidas J. Guibas. *PointNet: Deep Learning on Point Sets for 3D Classification and Segmentation*. 2017.