3D space points classifier

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While viewing the world in terms of 2D images and applying data analytics techniques on it for analysis has been fruitful and widely used for many applications , applying the same techniques on 3D geometries is, so far, relatively unexplored. Various applications could benefit from leveraging data analytics algorithms and applying it on 3D geometries such as robots navigation, content creation for computer graphics, computer vision, and augment reality applications. In this project, we pick the simplest type of geometry to study i.e., points. While classifying space points can be done by extracting and aggregation of hand-crafted features and fed it into off-the-shelf classifier such as SVMs [1], we choose to follow the same route of deep learning on images where the features and classifiers are jointly learned from the data.

One of the challenges of designing a model of space points processing is that the model should not be sensitive to point permutation or rotation [2]. Another challenge is concerned with the architecture and data representation that would yield good performance while keeping the computation tractable as volumetric representations could be expensive [1].

In this project, we plan to create a model that feed into 3D space points directly for classification by tackling the above challenges. For training and testing, we are going to use available datasets in [3], [4] and others.

[1] *Maturana, Daniel, and Sebastian Scherer. "Voxnet: A 3d convolutional neural network for real-time object recognition." In Intelligent Robots and Systems (IROS), 2015 IEEE/RSJ International Conference on, pp. 922-928. IEEE, 2015.*

[2] *Qi, Charles R., Hao Su, Kaichun Mo, and Leonidas J. Guibas. "Pointnet: Deep learning on point sets for 3d classification and segmentation." Proc. Computer Vision and Pattern Recognition (CVPR), IEEE 1, no. 2 (2017): 4.*

[3] *Sungjoon Choi and Qian-Yi Zhou and Stephen Miller and Vladlen Koltun. "A Large Dataset of Object Scans". arXiv:1602.02481, 2016.*

[4] *Yu Xiang, Wonhui Kim, Wei Chen, Jingwei Ji, Christopher Choy, Hao Su, Roozbeh Mottaghi, Leonidas Guibas and Silvio Savarese. "ObjectNet3D: A Large Scala Database for 3D Object Recognition". In European Conference on Computer Vision (ECCV), 2016.*