Reaction Report: Dynamic Graph CNN for Learning on Point Clouds
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What I like about this paper: With the advent of newer technologies, it is extremely important to process the data as point clouds rather than the expensive conversion to meshes and then process them. In this paper, authors present a new neural network module called Edge-Conv to perform CNN-based tasks on point clouds like classification, part segmentation and indoor scene segmentation. In the previous approaches like pointnet, each point was treated independently to maintain the permutation invariance. In Edge-Conv, the authors have proposed a new operator to capture the local descriptors using the k nearest neighbors. Thus, Edge-Conv is able to capture geometric features while maintaining permutation invariance. Edge-Conv constructs the local graph and learns the embedding for the edges the model is capable of grouping the points in both the Euclidean space and semantic space. Authors have shown that even if the points are from different sources, they will have similar predicted identity, if they correspond to semantically similar class parts. Another thing that I like is the ability of the Edge-Conv to integrate efficiently with existing pipelines. Also, in terms of performance Edge-Conv achieves the best tradeoff between the model complexity, computational complexity, and the classification accuracy.

What I don't like about this paper: The authors have used a k nearest neighbors for local descriptors and they have used ModelNet 40 meshes to sample points. There can be a case where the triangles in the meshes are not uniform i.e., they are either large or elongated. This might lead to a smaller number of points being allocated to flat surfaces and more to the edges and curves. Thus, while taking the k nearest neighbors it is possible that a point which is very far away will get captured as a neighboring point and will not be a good representation of local neighborhood. The authors have evaluated their model with only one data set i.e., ModelNet40 for classification. Robustness of Edge-Conv would have been better evident from multiple model evaluation and comparison with existing methods.

Future directions: Instead of k nearest neighbors it would be interesting to use a Euclidean distance sphere to get the local neighborhood points. Instead of pairs, triplets or more can be considered while exploring the relationship between the neighborhood points. One can also consider global neighborhood descriptors like with k=200 and local descriptors like with k=10 and merge them to predict the class. It would be interesting to apply sampling at every layer since we can eliminate the points which are very close (less than some threshold) to each other in higher dimensions i.e., intelligent selection of nearest neighbors. This method can also be extended for object classification and segmentation on image dataset. Moreover, as this method considers the local geometry it can also be extended for application on volumetric datasets like PartNet.