Deep Clustering – Project Description

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Problem Description

Typical clustering algorithms are using unsupervised learning approach. Thus, they must make explicit assumptions on the metric of the data. The problem is that is many cases it is not clear how to write the metric explicitly. I suggest to try to learn how to cluster instances in a specific task by looking on cluster examples. Namely, to use supervised learning for the clustering task. For this purpose, I will tackle the task of semantic instance segmentation (clusters correspond to different instances in an image, where two instances of the same class yield different clusters).

Current Approaches

Current approaches for learning to cluster involves:

- Learning similarity of objects. That is, learn how likely it is to for different objects (pixels in the case of semantic instance segmentation) to belong to the same cluster.'
    - Semantic Instance Segmentation via Deep Metric Learning - Alireza Fathi, Zbigniew Wojna, Vivek Rathod, Peng Wang, Hyun Oh Song, Sergio Guadarrama, Kevin P. Murphy
- Embedding the original data to a new space in which the Euclidian distance can be used for clustering.
    - Semantic Instance Segmentation with a Discriminative Loss Function - Bert De Brabandere, Davy Neven, Luc Van Gool

My Approach

My idea is to train a network to perform embedding of the data to a space in which Euclidian distance can be used for clustering by taking into account both local and global features of each object (pixel). In addition, the current architectures that take this approach assume fixed size input. This assumption is reasonable for the task of semantic instance segmentation in which there is a convenient and natural way to scale the inputs. However, it does generalize to problems in which there is no natural notion of scaling (e.g. texts). In addition, I want to explore how the method react when noise objects (new objects that should not appear in the input data) affect the performance.

Evaluation Technique

I will work on the COCO dataset detection task. They provide images and labels that can be used to fragment the image into instances. Thus, this dataset can be used for the semantic instance segmentation task. The evaluation technique on this dataset is described in their website: http://cocodataset.org.