

# Summary of reports

## I Unsupervised Learning

**Members:** Steven Zhu, Yiming Miao

**Topic Description:** The unsupervised learning is using unlabeled data to train models that can find general features of the training data which will be applied to other tasks like classification.

### New Things Learned:

Steven Zhu:

1. In image embedding task, using relative neighbor sampling over random sampling from noise distributions may lead to a better approximation.
2. Medical image classification suffers from a lack of accurately labeled training data. An unsupervised approach is proposed that we can use a pre-trained CNN to extract features from medical images. The CNN is equipped with a zero-biased auto-encoder atop of it, which can reduce the negative effect of the hidden bias generated in the training process.
3. In computer aid diagnose task, unsupervised learning algorithms like clustering can be used to learn categories of the training set automatically.
4. The unsupervised learning methods help to improve the performance of machine learning algorithms. Yet the accuracy of these machine learning models is still not satisfiable enough for practical application.
5. We can use cloud computing to accelerate the training process of machine learning models including unsupervised ones. A technique called map-reduce is essential for such acceleration.

Yiming Miao:

1. There are three mainstream unsupervised learning algorithms: auto-encoder, clustering and generative model.
2. The auto-encoder is invented based on the fact that human's visual system represent image with sparse coding. An auto-encoder is easy to train because it uses greedy layer-by-layer training strategy. Because of this, however, the auto-encoder cannot achieve global optimization and match the performance of supervised learning algorithms.
3. The Clustering is not a specific algorithm, but a general task to be solved. It usually uses iterative algorithms whose performance highly related to the data preprocessing method and parameter setting.
4. A generative model called GAN is excel at generate fake images after training on corresponding dataset. The basic idea of GAN is using a discriminator to test the quality of images the generative model produces and thus they can evolve together to obtain better performance. However, the training of GAN is difficult and tricky.

## II Object Detection

**Members:** Xiaoyu An, Tingyi Zhang, Vivian Pazmany

**Topic Description:** Object detection is a task to find both the category and the location of an object in the image.

**New Things Learned:**

Xiaoyu An:

1. R-CNN is consisting of four components: regional suggestion algorithm, feature extractor, linear classifier and bounding box correction regression model
2. There are various methods for region suggestion like selective search (R-CNN use this), Category-independent object proposals, Multi-scale combinatorial grouping, etc.
- 3.

Tingyi Zhang:

1. Faster-R-CNN combines two modules together. The one is a feature extractor and the other is a region proposal network.
2. There are improved version of YOLO named YOLOv2 and YOLOv3.
- 3.

Vivian Pazmany:

1. The expectation of the output of an unsupervised learning model is difficult to define.
- 2.