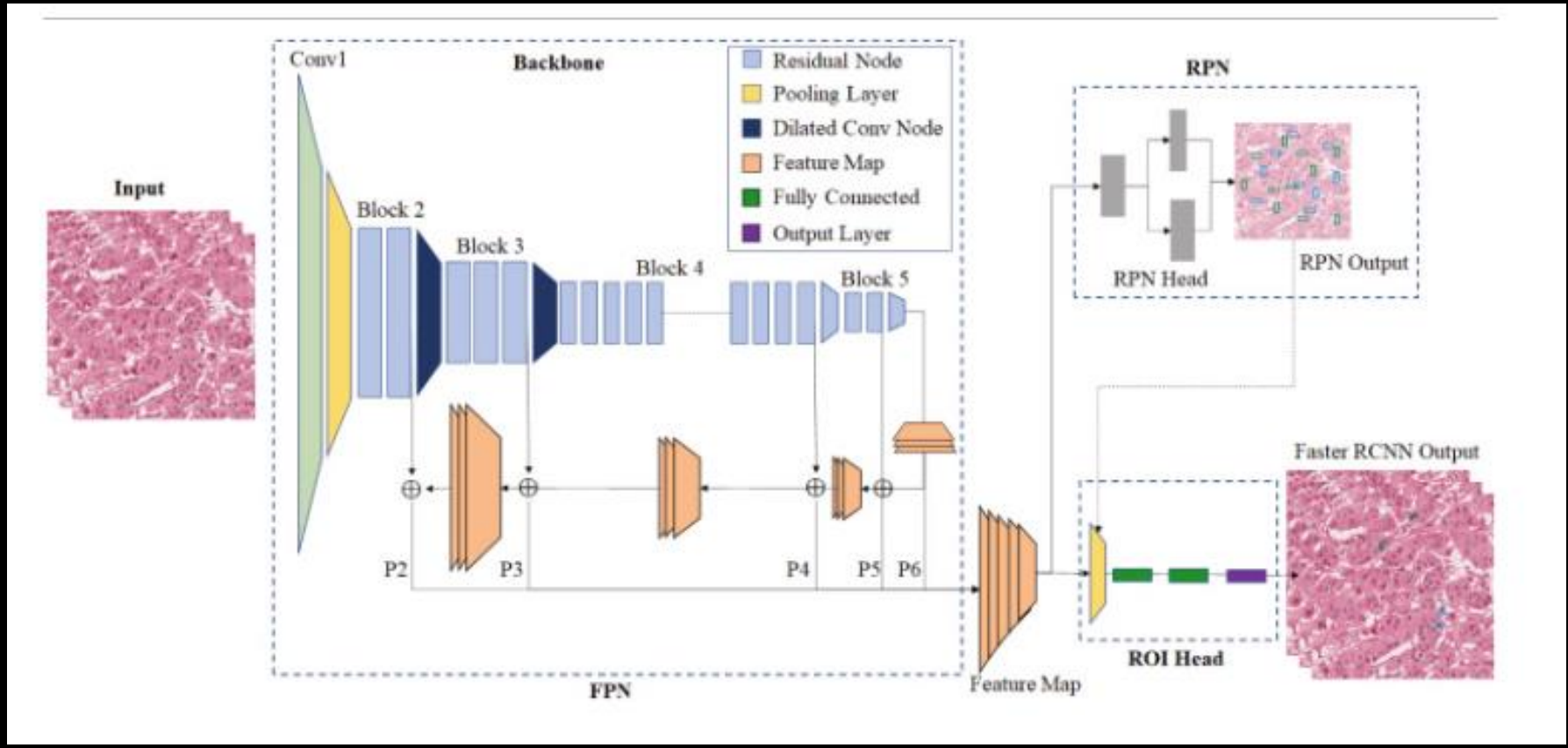
# AIL 862

Lecture 8

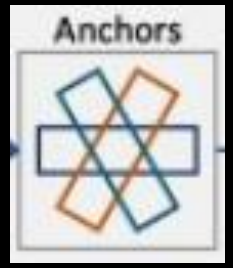
# Mitotic detector in histopathology images




SMDetector: Small mitotic detector in histopathology images using faster R-CNN with dilated convolutions in backbone model

# Oriented object

- RPN-oriented and ROI pooling-oriented




Rotation-aware and multi-scale convolutional neural network for object detection in remote sensing images

# Oriented object

- Some works use feature extractors that are rotation invariant.

ReDet: A Rotation-equivariant Detector for Aerial Object Detection

# Supervised to Unsupervised

# What are we looking for

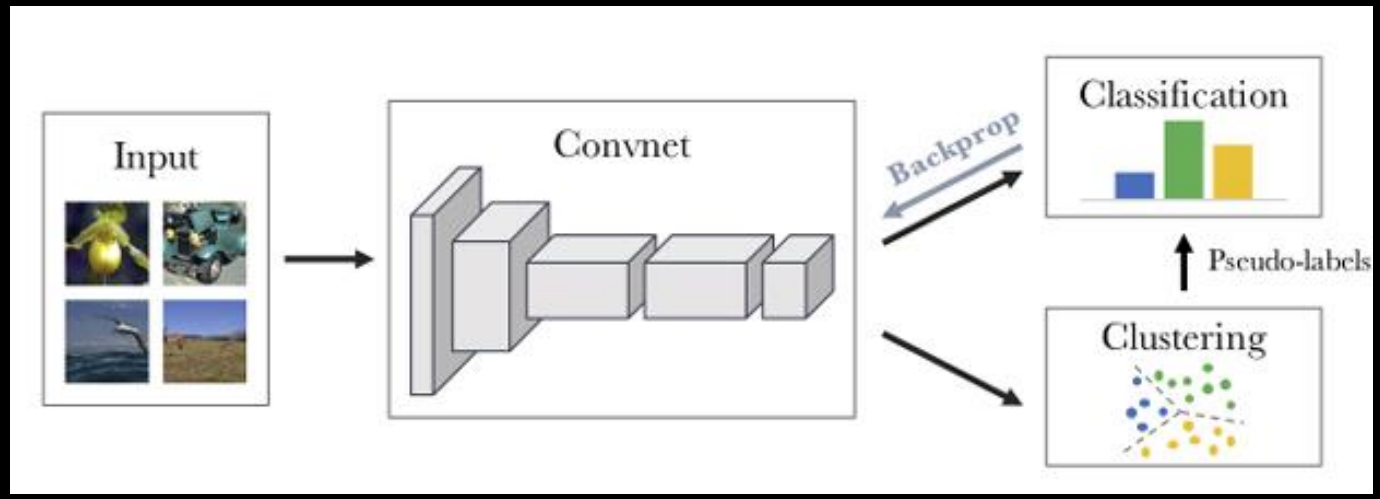
Some numbers

On ImageNet

0.1 > 12 > ?

# Clustering

# Deep Clustering




Deep Clustering for Unsupervised Learning of Visual Features, 2018

# Deep Clustering

- Feature Extraction: Use a CNN to extract features from input images.

# Deep Clustering

- Clustering: Apply k-means clustering to group similar features. (Features are PCA-reduced before clustering).

# Deep Clustering

- Pseudo-Label Assignment: Assign cluster labels as pseudo-labels to the images.

# Deep Clustering

- CNN Training: Retrain the CNN using the pseudo-labels.

# Deep Clustering

- Iteration: Repeat the process to progressively refine features and clusters.

# Working

DeepCluster alternates between clustering the features to produce pseudo-labels and updating the parameters of the convnet by predicting these pseudo-labels

# Over-clustering

- Over-clustering is helpful, e.g., consider few thousand clusters if you have 1000 classes.

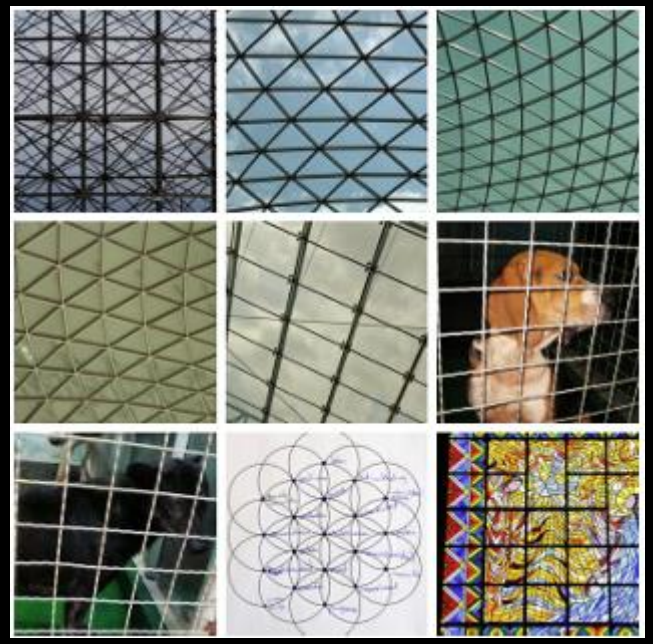
# STL-10

- Developed specifically for unsupervised feature learning
- 10 classes, 500 training images, 800 test images per class.
- 100000 unlabeled images for unsupervised learning. These examples are extracted from a similar but broader distribution of images. For instance, it contains other types of animals (bears, rabbits, etc.) and vehicles (trains, buses, etc.) in addition to the ones in the labeled set.

# First Layer Filters

- Visualization

# Deeper Layers



Understanding Neural Networks Through Deep Visualization

# Linear classification

- Linear classification on top of frozen model

# Empty Clusters

- During the clustering process, especially with large datasets and high-dimensional features, some clusters may end up without significant assigned data points.

- Reassigning such clusters to new positions in the feature space based on certain criteria, such as splitting existing.

# Stopping Criterion

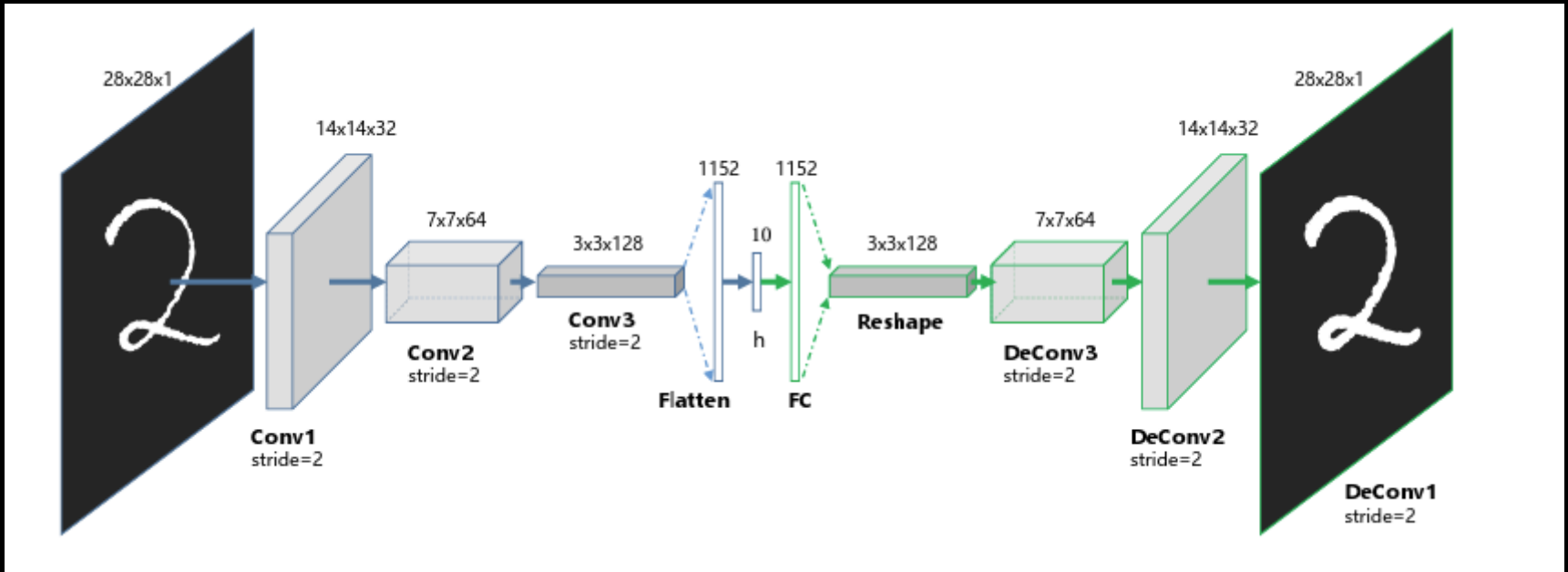
- Often not very clear

- Can have a downstream task (different from your actual task) on which clustering performance is monitored continuously

# Semisupervised Learning?

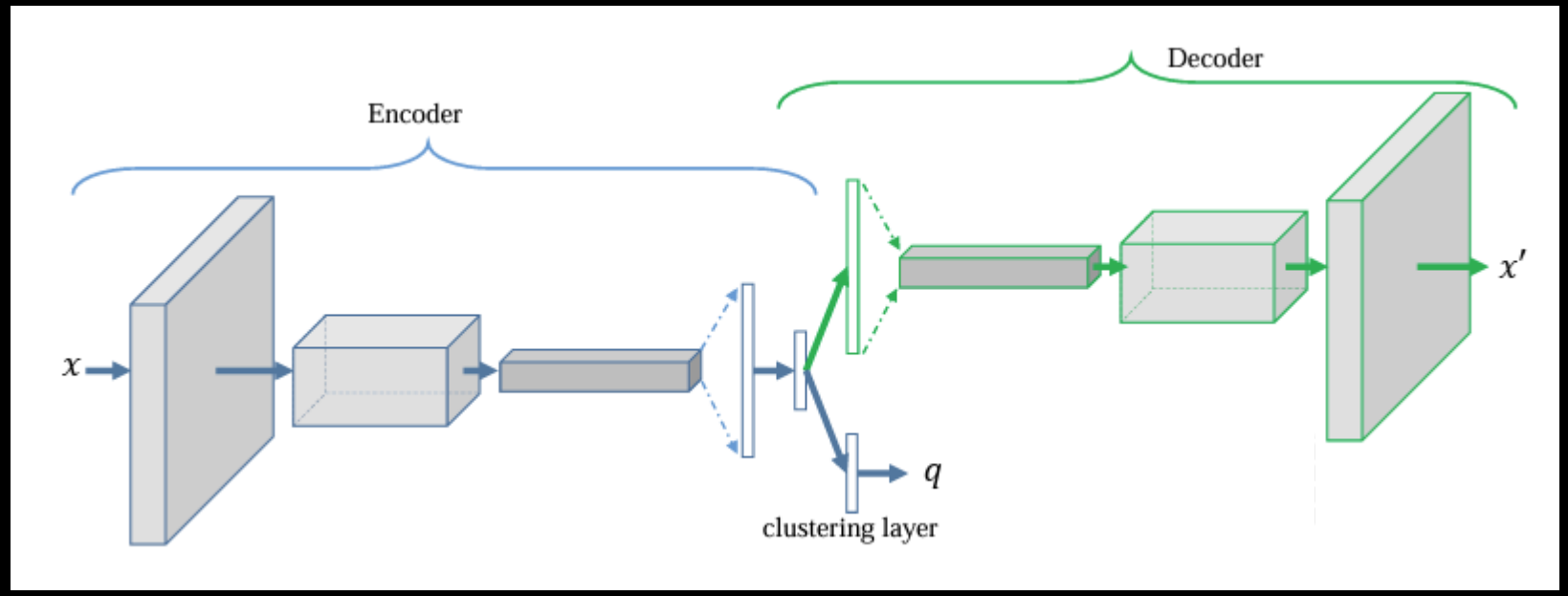
- How?

# Deep Clustering With Autoencoder



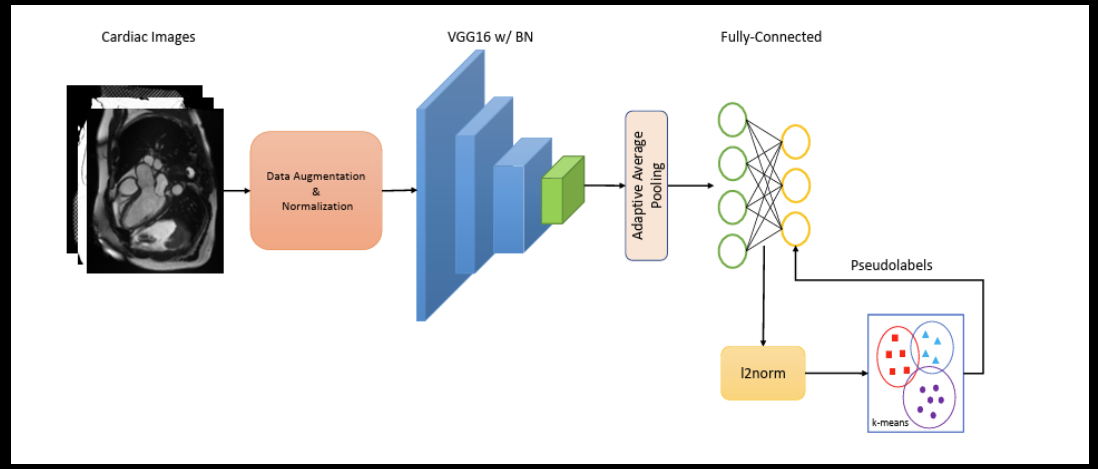

Deep Clustering with Convolutional Autoencoders

# Deep Clustering with Autoencoder



# In Medical Image Analysis

Develop an unsupervised method to automatically cluster and categorize large-scale medical image datasets, focusing on cardiac MRI images, without using any labels.




DeepMCAT: Large-Scale Deep Clustering for Medical Image Categorization

# Mutual Information