Invariant Information Clustering for Unsupervised Image Classification and Segmentation

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Introduction

Clustering

is a process of grouping similar objects together in a way that objects in the same group are more similar to each other than to those in other groups.

Classification

is a machine learning technique that involves assigning a label or category to input data based on its features. A model is trained on a set of labeled examples to learn the relationship between the input features and the corresponding labels.

Image segmentation

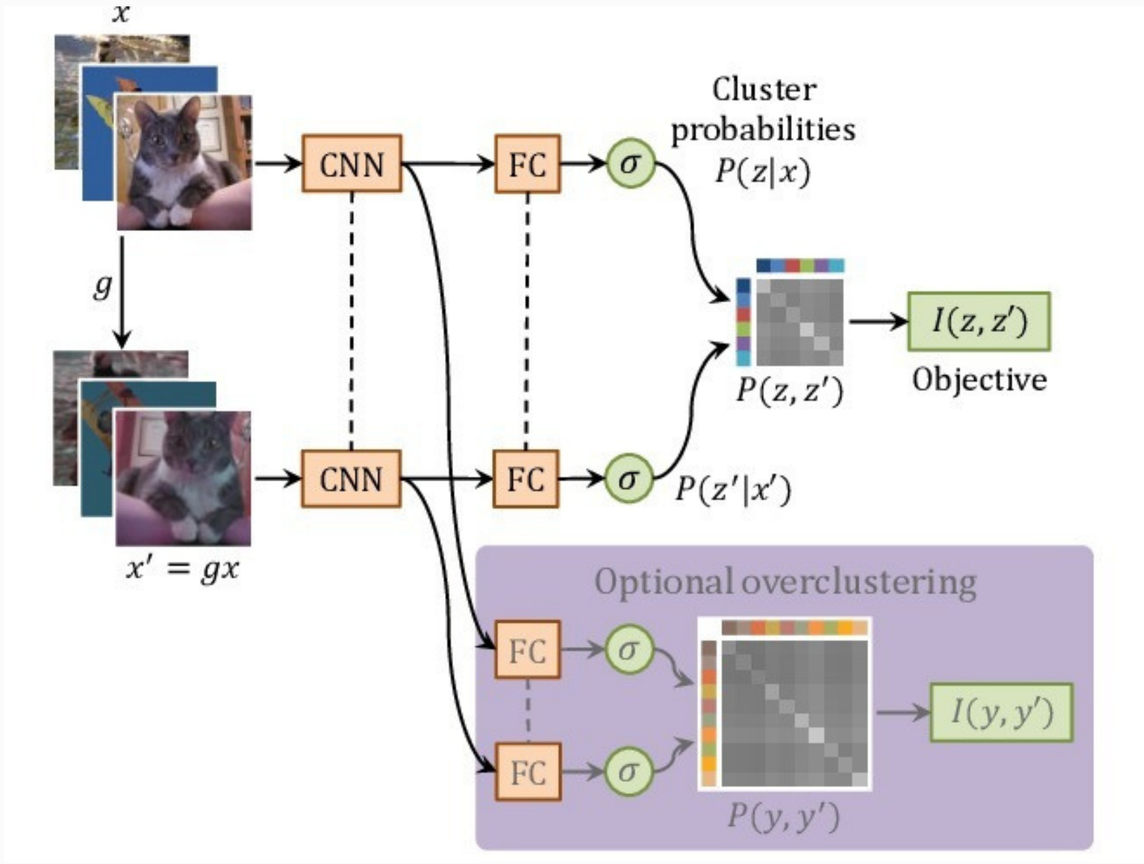
is the process of dividing an image into multiple segments or regions based on the characteristics of the pixels in the image.

Invariant Information Clustering

The IIC model is based on the idea of clustering image features in a way that maximizes the mutual information between the cluster assignments and the input images. It consists of two parts: a feature extractor network and a clustering network.

The feature extractor network is typically a convolutional neural network (CNN) that takes an image as input and produces a feature vector for each pixel. The clustering network is a multi-layer perceptron (MLP) that takes the feature vectors as input and outputs the cluster assignments.

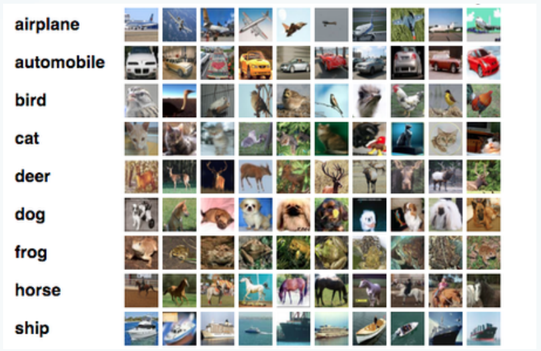
Architecture



Datasets Used

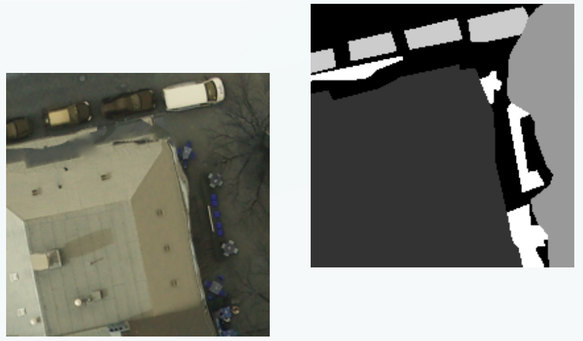
MNIST

CIFAR-10



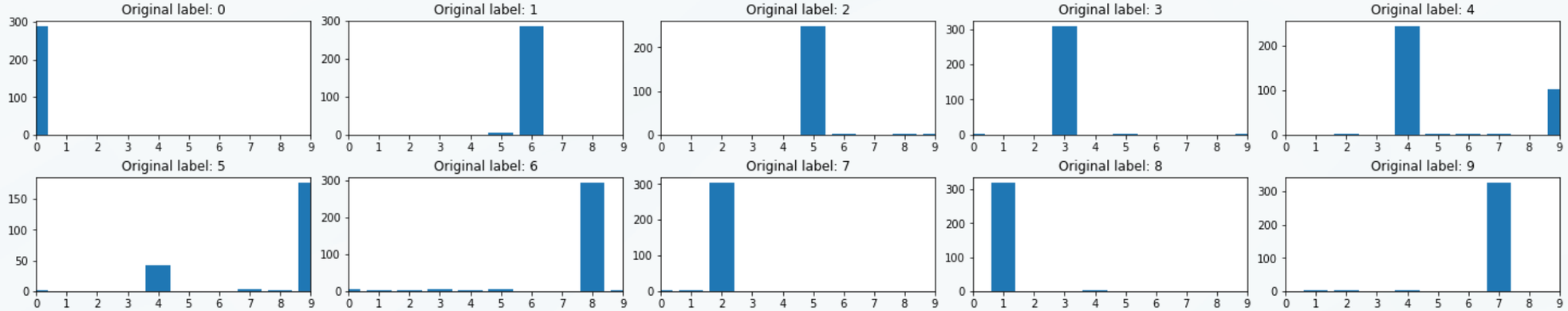
Chess Dataset

Potsdam Dataset



Results

MNIST

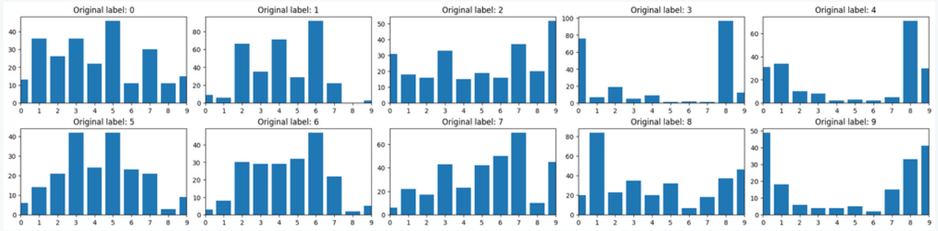


- Adjusted rand score: 0.885
- Homogeneity score: 0.885
- Completeness score: 0.907
- Silhouette Score: 0.789

Results

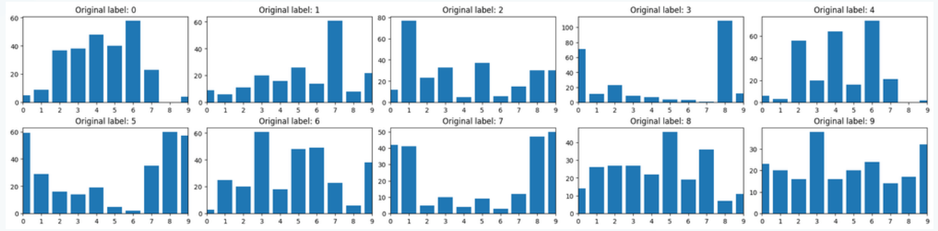
CIFAR-10

Resnet



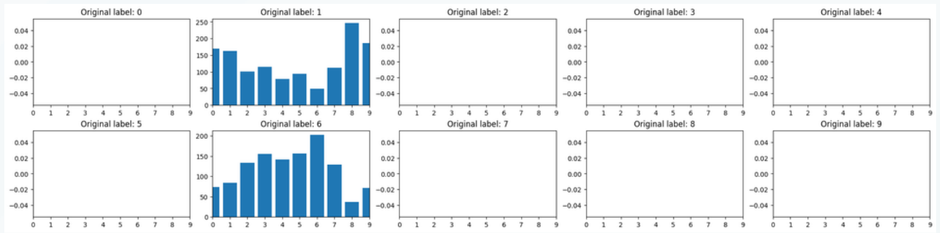
- Adjusted rand score: 0.068
- Homogeneity score: 0.068
- Completeness score: 0.135

VGG



- Adjusted rand score: 0.070
- Homogeneity score: 0.070
- Completeness score: 0.136

SqueezeNet

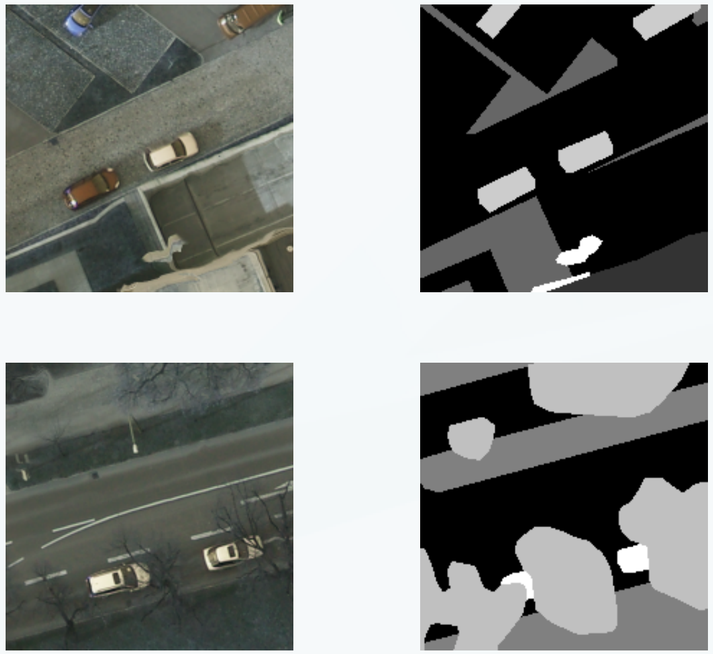


- Adjusted rand score: 0.033
- Homogeneity score: 0.033
- Completeness score: 0.037

Results

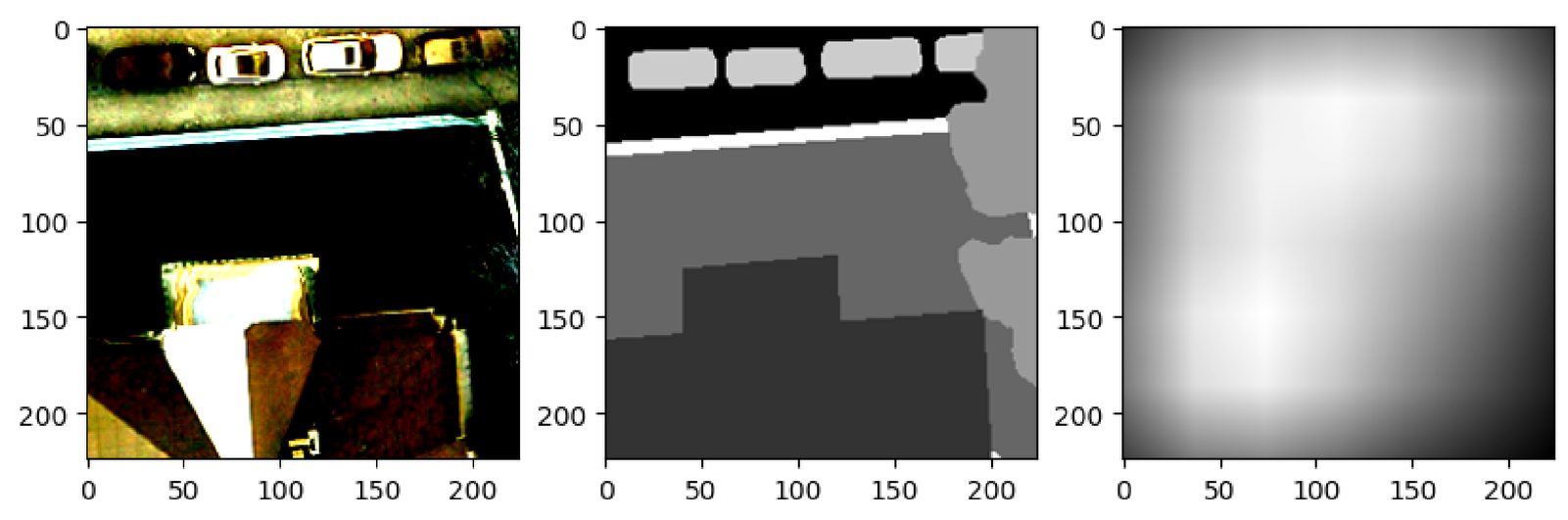
Potsdam Dataset

Segmentation Model »»



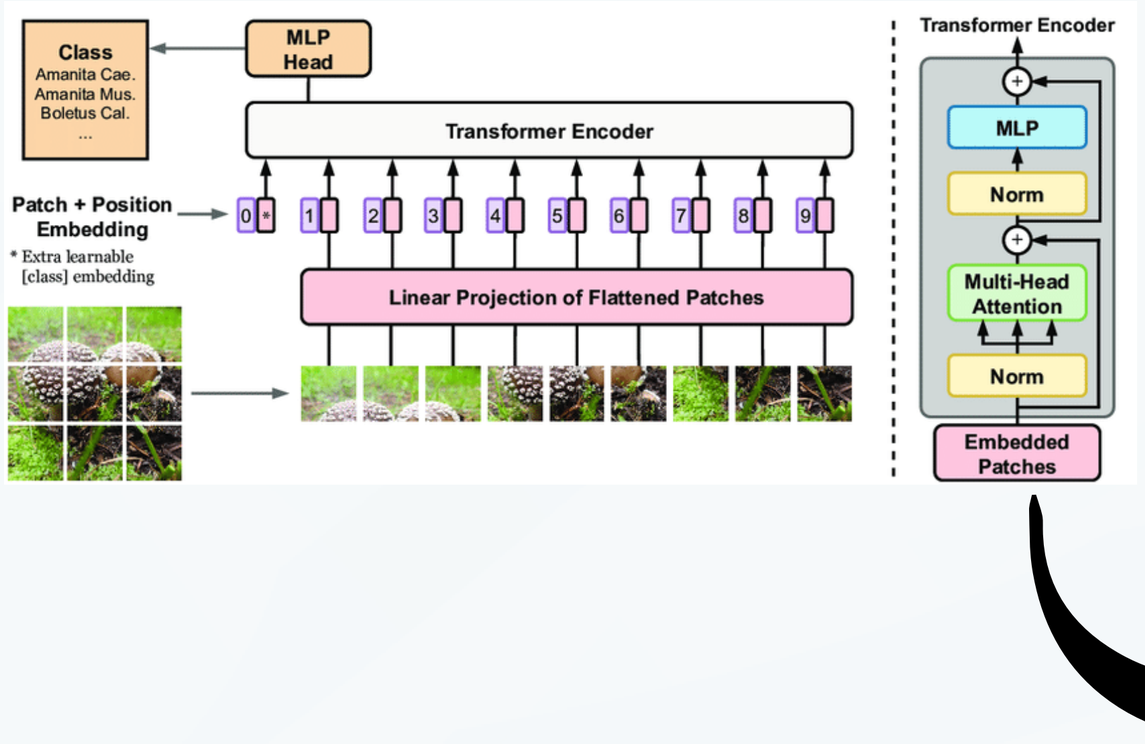
Results

Segmentation Model

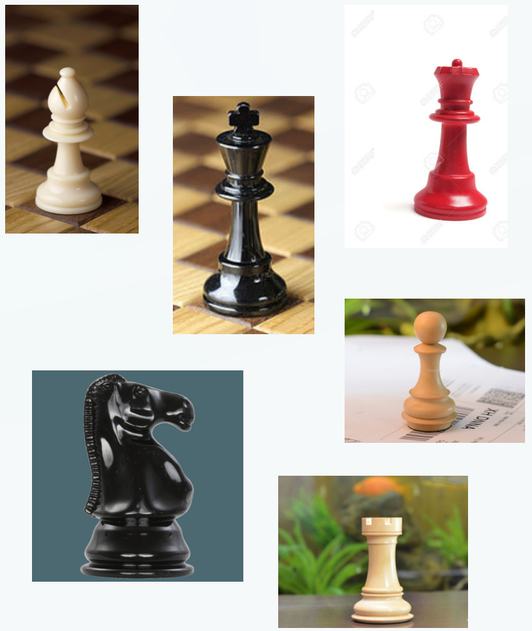


Proposed Model

Vision Transformer

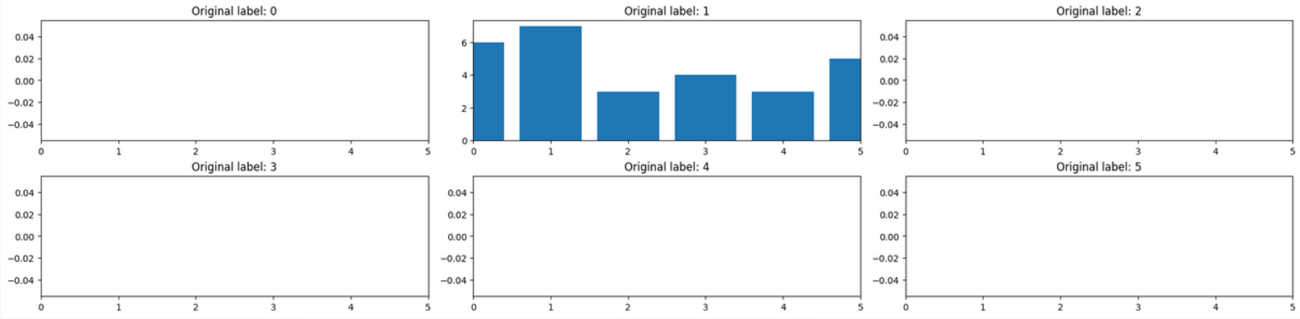


Chess Dataset



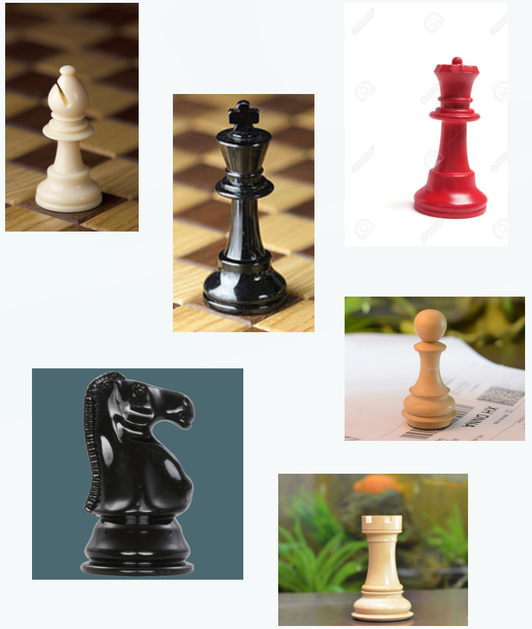
Results

Vision Transformer



- Adjusted rand score: 0.041
- Homogeneity score: 0.041
- Completeness score: 0.044

Chess Dataset



Thank You