Image Segmentation using K-Means clustering

And

Mask RCNN

Internship Report

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Introduction

Image segmentation is the process of partitioning an image into multiple distinct regions on the basis of some similar properties.

An image is a given set of pixels. In the image segmentation pixels which have similar properties are grouped together. This way the image can be segmented into different regions.

Objective of image segmentation:

To represent the image in such a way that is more meaningful and easier to analyze.

Uses of image segmentation:

- **Retail image recognition :**

This technique is very useful as it provides help to the retailers to understand the layout of goods on the shelf. And this recognition process the algorithms process data in real time for the detection of goods whether they are absent or present on the shelf. If we find that it product is missing then it alerts the retailer about the specific product missing so that he can take necessary action.

- **Self driving cars:**

As we are accelerating with time ,we have made such a great landmark in the field of technology that we have self driving cars now. In self driving cars the car must be able to

recognise the safe route to drive. Image segmentation plays a vital role here as the car would recognise areas in the image to decide whether it is safe to drive or not.

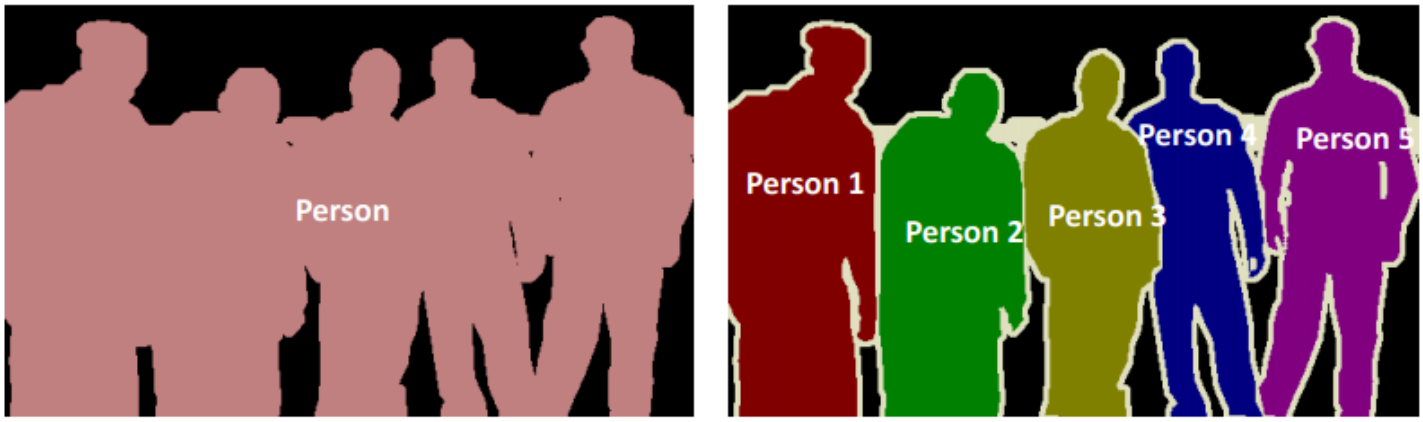
- **Biometric protection:**

In today's world, people are taking privacy very importantly. In order to keep all the data and information safe, there is is need of advanced privacy protection. Biometric protection is a very advanced and secured way of protection where a user is allowed access to his data only upon successful recognition office of his biometrics by the system. In this way no intruder can get access to anyone's data. Image segmentation can be used here to recognise the complex patterns of an iris. Automatic pattern recognition can be used to analyse the patterns in in a person's eye.

Types of segmentation:

There are basically two types of image segmentation techniques.

1) Semantic segmentation:
   Semantic segmentation links each pixel in an image to a class label.Here,multiple object of same class is treated as a single entity.
2) Instance segmentation:
   Instance segmentation is the process of identification of each instance of each object within the image at pixel level. Here, multiple objects of same class are treated as distinct individual objects or entities.



Semantic Segmentation **Instance Segmentation**

Here we have tried to implement image segmentation using :

1)K- means clustering

And

2)Mask RCNN

K-means clustering:

K-Means clustering is unsupervised machine learning algorithm that aims to partition N observations into K clusters in which each observation belongs to the cluster with the nearest mean. A cluster refers to a collection of data points aggregated together because of certain similarities. For image segmentation, clusters here are different image colors.

The actual mathematics behind this concept of clustering uses two methods, they are-

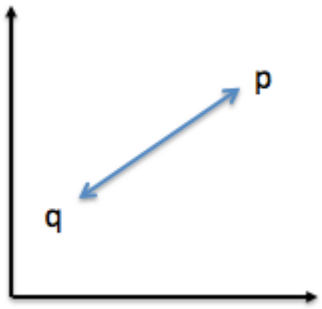
EUCLEDIAN DISTANCE:

This method is used to find the distance of each pixel from the centroid , which are taken randomly.

It is just a distance measure between a pair of samples *p* and *q* in an *n*-dimensional feature space:

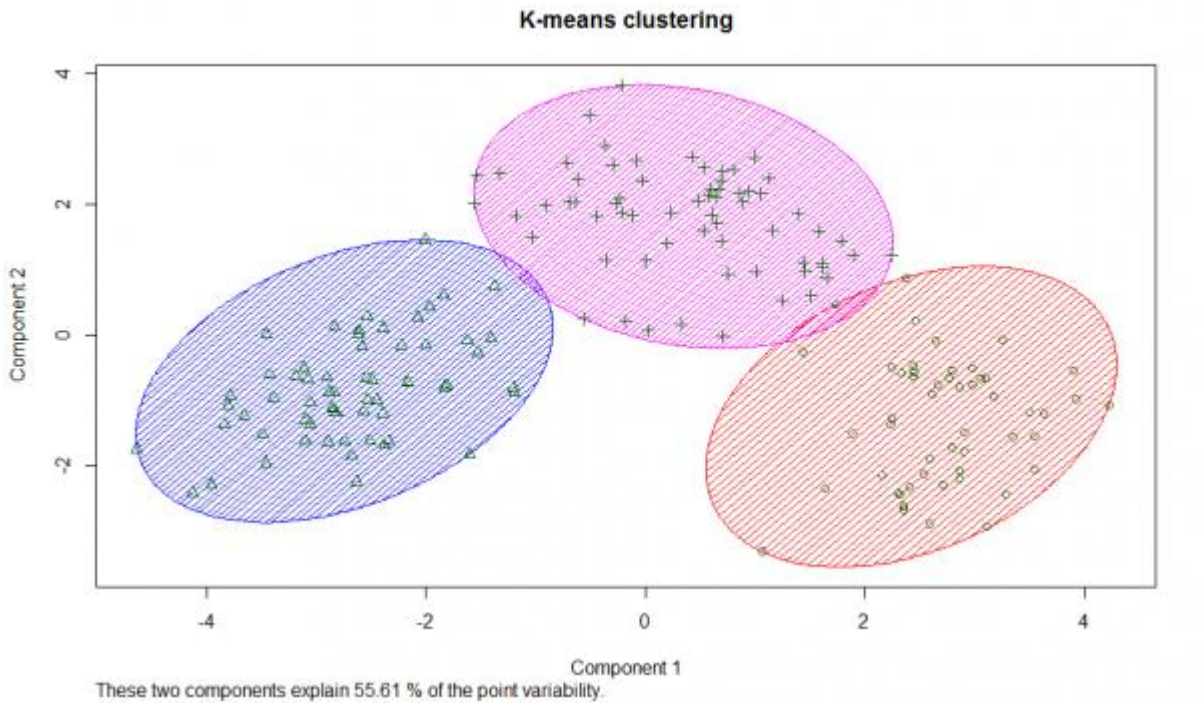
$$\sqrt{\sum_{i=1}^{n}(q_i - p_i)^2}.$$

For example, picture it as a “straight, connecting” line in a 2D feature space:



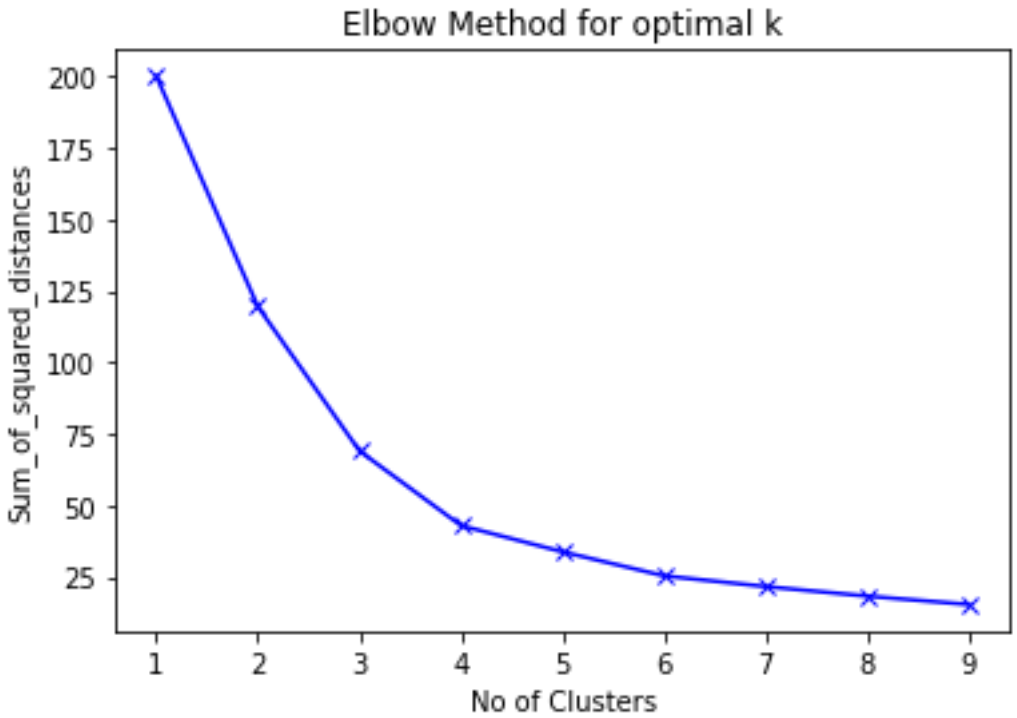
The Euclidean is often the “default” distance used in e.g., K-nearest neighbors (classification) or K-means (clustering) to find the “k closest points” of a particular sample point. Another prominent example is hierarchical clustering, agglomerative clustering (complete and single linkage) where you want to find the distance between clusters.

With each iteration k number of centroids are shifted by the average distance between them and then we divide the clusters on the basis of distance of the pixels from those centroids. More the number of iteration more will be the accuracy of clustering.



ELBOW METHOD:

Elbow method is used to find the number of k required to do the efficient clustering.



How k-means clustering works ?

- Select k initial clusters randomly.
- Then randomly assign data points to the clusters.

- Calculate the centers of these clusters
- Then calculate the distance of the points from the centre of the clusters.
- Based on the distance, reassign the points to the nearest cluster.
- Then again repeat the steps from calculating the centre of the clusters until the centre of the clusters do not change.

The Code:

Mask RCNN

In Mask RCNN a pixel-wise mask is created for each object in an image. It is a deep neural network which solve instance segmentation problem.