IMAGE SEGMENTATION USING KNN

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What is Image Segmentation?

Image segmentation is the process of partitioning a digital image into multiple image segments, also known as image regions or image objects (sets of pixels) in order to differentiate and focus on our region of interest (ROI). The goal of segmentation is to simplify and/or change the representation of an image into something that is more meaningful and easier to analyze. Image segmentation is typically used to locate objects and boundaries (lines, curves, etc.) in images. More precisely, image segmentation is the process of assigning a label to every pixel in an image such that pixels with the same label share certain characteristics. Several general-purpose algorithms and techniques have been developed for image segmentation.

What is K-Nearest Neighbour Algorithm?

K Nearest Neighbor algorithm falls under the Supervised Learning category and is used for classification (most commonly) and regression. It is a versatile algorithm also used for imputing missing values and re-sampling data-sets. As the name (K Nearest Neighbor) suggests it considers K Nearest Neighbors (Data points) to predict the class or continuous value for the new Datapoint. The algorithm's learning is:

Instance-based learning: Here we do not learn weights from training data to predict output (as in model-based algorithms) but use entire training instances to predict output for unseen data.

Lazy Learning: Model is not learned using training data prior and the learning process is postponed to a time when prediction is requested on the new instance.

Non -Parametric: In KNN, there is no predefined form of the mapping function.
Nearest neighbors are those data points that have minimum distance in feature space from our new data point. And K is the number of such data points we consider in our implementation of the algorithm. Therefore, distance metric and K value are two important considerations while using the KNN algorithm.

Our Proposed Work

In this poster, we proposed to implement a common and widely used image processing technique of Image Segementation using KNN Algorithm. As discussed above, here we initially define a K value which is the min no. of neighbours to be considered. The no. of K values must be odd to avoid ties. The K value for this poster is chosen to be 40, hence 40 neighbours will be considered before assigning the new pixel a cluster. A step by step walk around of the implemtation is:
The Number Program initially asks for the number of clusters to be selected in the K-NN algorithm. Obviously more the clusters more the number of segmented parts in the image.

So the steps Involved in K-NN algorithm:

- Choosing the number of Clusters
- Selecting at random K points for centroid, in our case 40 was passed as the number of neighbors.
- Assigning each Data point as we say each pixel value closest to the above centroid that further gives us clusters.
- Now we compute and place the new centroid for each cluster.
- On the last step we just do the reassignment of the new nearest centroid and if in any case any new reassignment took place we would reiterate the above process.

Results

This paper implements image segmentation for more comprehensive grouping and understanding of images and getting a more clearly distinct **ROI**. We applied image segmentation by the means of **KNN** on 2 images, one being a casual image and the other being an MRI scan. in both images we can see a significant form of clustering of regions of image which resume characteristics. For the normal image, the number of clusters is selected to be 10 and for the MRI scan the number of sclusters is

Outputs

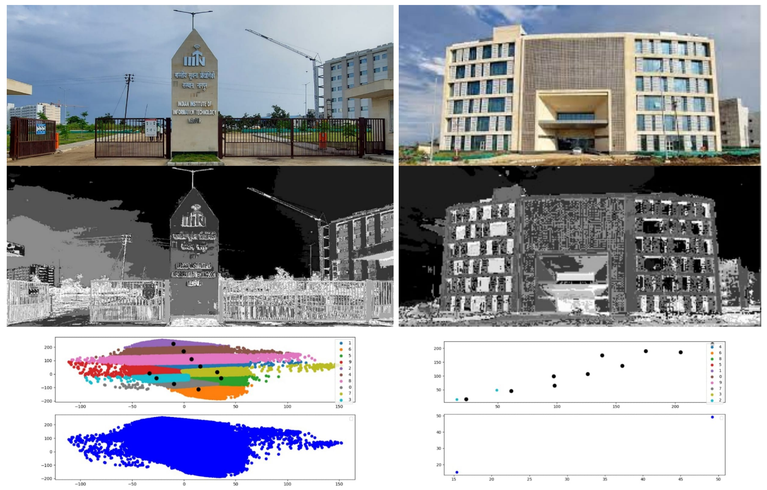

Figure 1. IIITN Academic Block

Figure 2. IIITN Entrance

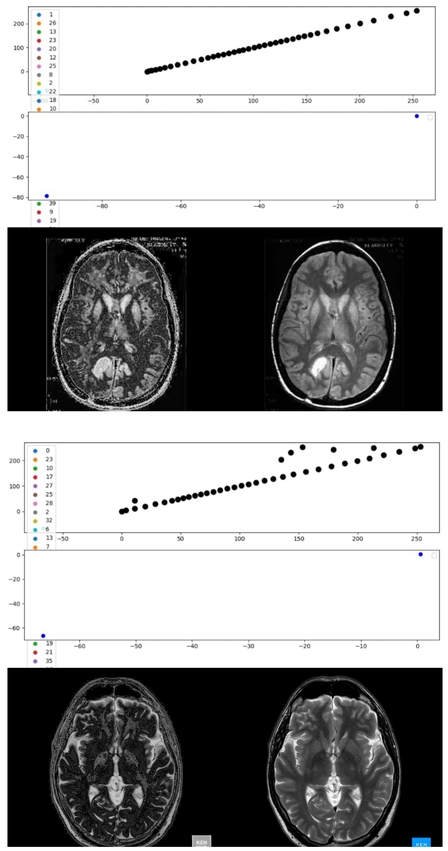

Figure 3. Brain Tumour

Pseudo Code

So the steps Involved in K-NN algorithm:

1. Import necessary libraries (eg. numpy, scikit, matplotlib)
2. Read and reshape the image
3. Choosing the number of Clusters
4. Selecting at random K points for centroid, in our case 40 was passed as the number of neighbors.
5. Assigning each Data point as we say each pixel value closest to the above centroid that further gives us clusters.
6. Now we compute and place the new centroid for each cluster.
7. On the last step we just do the reassignment of the new nearest centroid and if in any case any new reassignment took place we would reiterate the above process.

All this procedure is condensed under one function in Sci-kit and hence making it easy to use

Flow Chart

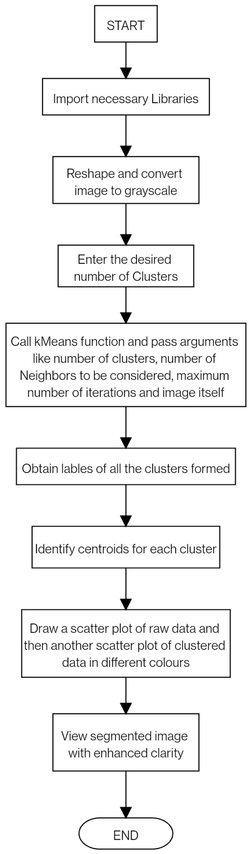

Figure 5. Flowchart

References

[1] IJERT. Image segmentation using nearest neighbor classifiers based on kernel formation for medical images. *International Journal of Engineering Research Technology*, 1(3):379–423, 2012.

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