

Problem Statement: Program should accept a 512x512 input image and return N images from the provided dataset similar to the input image where the dataset have around 5,000 images 512x512.

Models used: The problem statement given is solved using both Auto Encoder and K means Clustering.

Auto Encoder model: Auto encoder is an unsupervised artificial neural networks which have two sub networks namely encoder and decoder.

Encoder accepts the input data, learns to reduce the input dimensions and compress the input data into encoded representation.

Decoder is responsible to reconstruct the original input from the encoded representation which is the output from encoder.

In auto encoder model used in the code, encoder contains three 2D convolutional layers where each convolutional layer is followed by a max pooling layer with reLU activation function. In the decoder there are three upsampling layers used and each upsampling layer is followed by 2D convolutional layer with reLU activation function and sigmoid activation function for the output layer.

Training: To train the model 80% of the dataset is used i.e., 3790 images are used for training. The training dataset is made into batches with batch size of 64. Each batch of images are read using `cv2.imread()` and auto encoder model is run for training for 50 epochs with the training batch size of 16.

Testing: The trained model which is saved after training is loaded and only encoder part of the model is run to get the trained codes (output of the encoder layer) for the training dataset. For each image in the test set, test code (output of the encoder layer) is predicted and based on the distance between trained codes and the test code top N images will be displayed using matplotlib.

Same testing procedure is followed when user gives any input image.

K Means Clustering: K Means Clustering is an unsupervised learning algorithm which identifies k centroids to form k clusters and each data point is allocated to the nearest cluster.

The trained codes are used to run K means clustering. The trained codes for each image are flattened and are used for K means clustering where number of clusters is taken as 8.

In the testing phase of the K means clustering it accepts user input image and prints top N images of the cluster to which the input image belongs to.

Proposal for Enhancement: In the auto encoder model there are 3 convolutional layers used in both encoder and decoder sub networks, which can be fine tuned further.

In the K means clustering 8 clusters are considered which can be fine tuned.