Artificial Intelligence

Homework 5

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Solution to 1:

An experiment with K-means for color quantization, where we consider a picture for testing and try to represent an image with fewer colors than the original image.

Original image Quantized image for n_colors = 9

1. When we are increasing or decreasing the value of n_colors in a range between 2 and 64, the quantized image uses fewer colors to resemble the original image and in this k-means clustering on image, we can say that, smaller number of clusters give fast and efficient outcomes with minimal color usage.
   If the number of clusters or k value is less, then the predicting color indices on full image takes less time compared to larger k value. It means that the number of clusters or k

increases, the time taken to perform the clustering is more and also the amount of memory to store the output image. But, compared to original image, the quantized image takes less amount of memory for storage.

2. This color quantization with clustering methods provides a limited range of colors and are well suited for time constrained applications. And also for devices which have color limitation, which reduces the memory usage.

3. The resulting picture was funny because, when we decrease the n_colors value to 9, the image gets blurred (looks like an animated image in a comic book) resembling to original image. The quantized image lacks pixel wise quality. The color on the wall behind is faded, the yellow flower on the wall is not visible and also the color of the face and shirt is faded.

Solution to 2:

At first, when I tried the simple implementation of the MLP, I figured out that, we obtain better results when eta value is small and neutron value is higher. So, that the predicted data is accurate with the target dataset (red colored).

For 1000 samples, the best number of neurons is 38 and $\eta = 0.3$

If we are getting lesser number of neurons for the hidden layer, then it is an under fitting and if we are having too many neurons for the hidden layer then it is an over fit. So, the best value of neurons would be somewhere in between, but not a few or more neurons for a hidden layer.

Here, for my output the best number of neurons is 38 where, the predicted value (black line) is similar to the red + in the plot. I feel that, we can yield a better performance of the network when we have a smaller value of η and number of neurons obtained is optimal in this case.

For 10000 samples, the best number of neurons is 67 and $\eta = 0.1$

Here, while observing the graph the linear regression does a better performance the predicted data. The η value is optimal, but the number of neurons is not accurate for the data. The number of neurons should be increased for better performance of the network in this case.