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Homework Assignment 2 - Image Segmentation

Problem 1: k-means Segmentation.

In order to apply the k-means segmentation on the white-tower image, I first randomly initialized 10 cluster centers and got their respective RGB triplet. Then given each cluster center, I determined the points in each cluster by finding the distance between each pixel and the cluster centers using the RGB (red/green/blue) values. I found the differences between the colors, squared them and then compared the minimum of the distance^2. Each point was put into the cluster of its closest cluster center. Then, after having all the points in each cluster, I find the centroid of these points to find the new cluster center. To find the average value, I added all the RGB and then divided by the number of pixels in the cluster. The new cluster centers colors were calculated using the average of the RGB of the pixels in the cluster. If the new cluster's center is different from the original cluster center, then I repeat the process from redetermining the points in the new cluster center. However, if the cluster center is the same as before, then I stop. Finally, I simply set the color of each cluster to the average RGB of the entire cluster and create an image similar to the one in slide 18 of Week 6.

Result of k = 10:

Problem 2: SLIC

In order to apply the homework's variant of the SLIC algorithm, I first initialized the center of each block with x and y coordinates to be the multiple of the block size / 2 (50/2) and non-zero. Then, for all the centroids, I calculated the magnitude of the gradient from the pixels in each of the RBG channels and found the square root of all three magnitudes (mag2 + mag2 + mag3) summed up as the combined gradient magnitude. Then I moved the centroid to the position with the smallest gradient magnitude using 3x3 windows centered around the initial centroids. Then, I applied the k-means using a similar strategy as problem1, but this time in the 5D space of x, y, R, G, B. I assigned pixels to the clusters based on their euclidean distance (but also divided x and y by 2) between the pixel and the centers. If the new centers are different from the initial one, I looped again to find new centers and otherwise ended the loop when the centers were the same. Then, I set the color of each cluster to the average RGB of the entire cluster and returned it into my main function. Finally, I colored pixels next to two different clusters black and kept the rest of the pixels the same (average value of the RGB of their cluster) and created an image similar to the one in slide 41 of Week 6.

Result of SLIC: