HW5 – Segmentation with Kmeans

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cv2.kmeans() has been used for applying K Means clustering for image segmentation.

| Input – Feature Matrix Dimension	86400 x 8
Features Used	(Pixel_X, Pixel_Y), (B,G,R), Std. Dev(B,G,R)
Weights for each feature	[1.5, 1.5, 2, 2, 2, 2, 2, 2]
Num of clusters testing range	[2,9]
Max iter	100
Epsilon	1.0
Num_reinit	10
Init Method	KMEANS_RANDOM_CENTERS

Methodology:

1. Load Image / Image Folder
2. For input image –
   a. Build the feature matrix
   b. Generate weight vector
   c. Scale the feature matrix with weight vector
   d. Apply Kmeans
   e. Scale the color-intensity values of B,G,R channel from [0, 255]
   f. Generate result image

Input Image –

Segmented Image (Very Good Segmentation, K=6) –
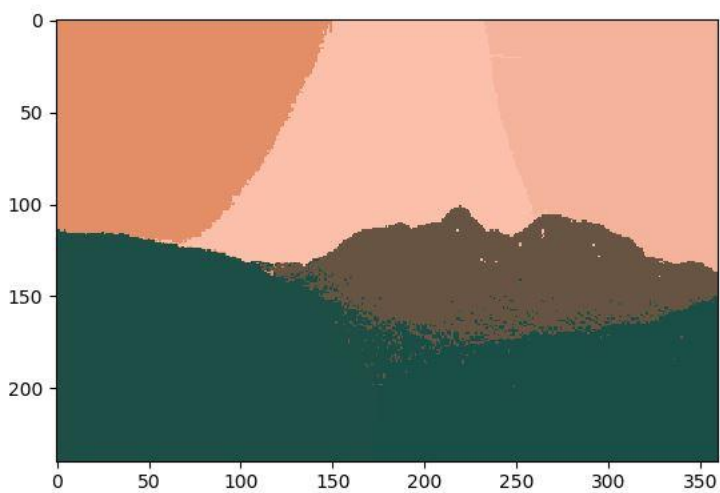
Discussion:

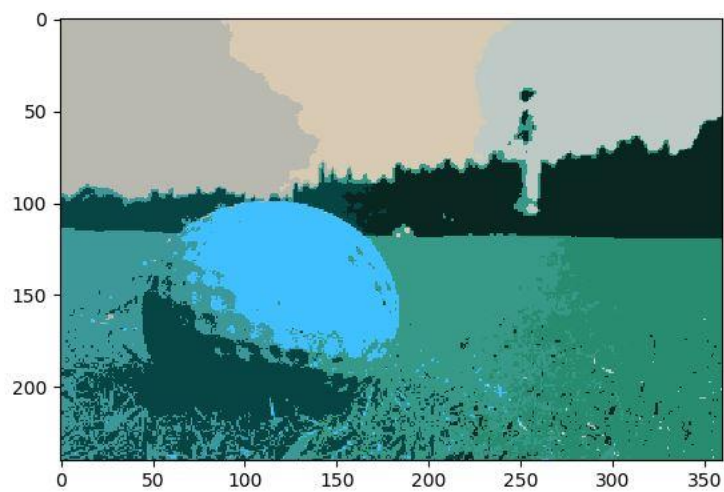This image has been nicely segmented by Kmeans. The original image had 3 broad regions

- Sky (3 regions - blue, white glair, blue)

- Mountain (green)

- Grass (green)

With K value set to 6, Kmeans has done a fairly good job of segmenting the Grass Layer from Sky and Mountain (even though mountain and grass had similar texture color)

Input Image –

Segmented Image ('Mostly' Bad Segmentation, K tried from 2..15) –

Discussion:

This image has not been nicely segmented by Kmeans. The original image had 5 broad regions

- Sky (2 regions – blue sky, white`ish' cloud)

- Forest (green)

- Ball (Yellow)

- Human (mostly grey and white)

- Grass (green)

The ball is not properly segmented in any image (for different K values), some portion of it even being considered as a part of the Grass Cluster.
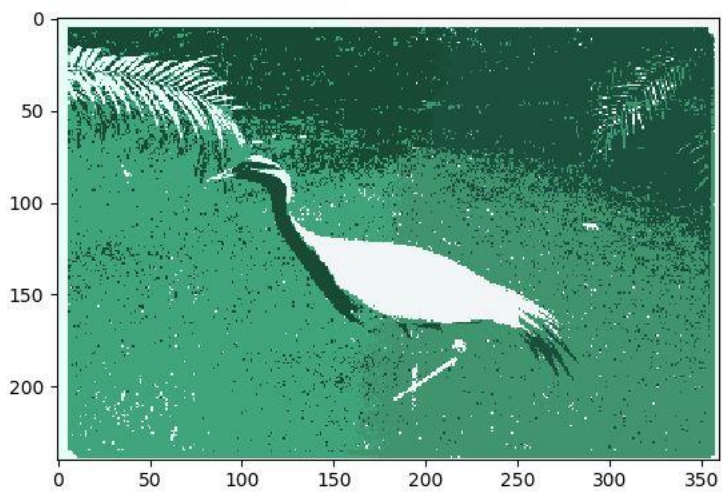
Input Image –

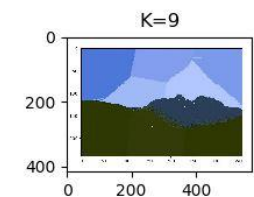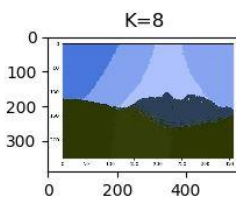Segmented Image (Fairly Good Segmentation, K = 9) –
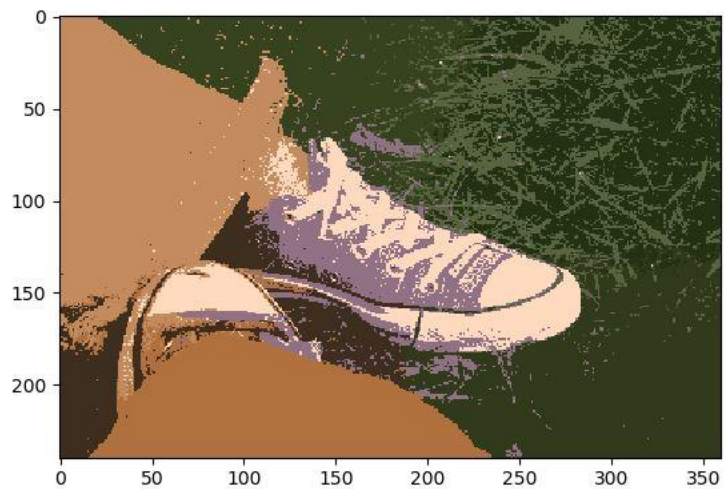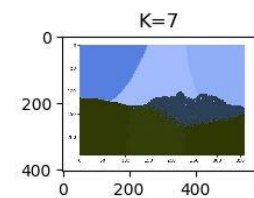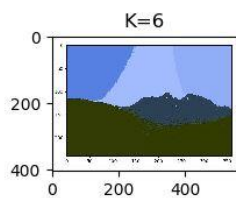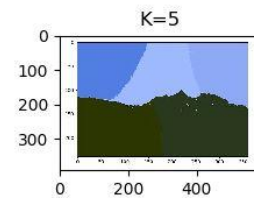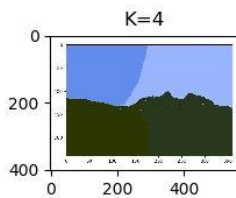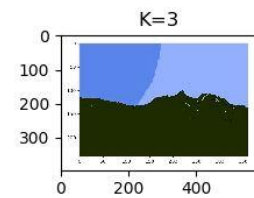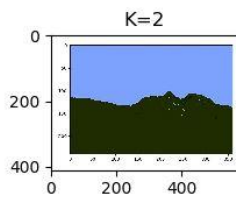
Input Image –

Segmented Image (Good Segmentation, K = 6) –

MORE TESTS:

Effect of varying K from [2,9]

From this effect, this can be inferred that if K is continuously increased, after a certain threshold, sometimes the misclassification rate will start to become higher, as number of clusters formed will be bigger than the number of original segments/clusters in the original image.

Also, sometimes, if number of K is increased after the optimal threshold, the one original cluster will start to break down into multiple clusters, so multiple clusters will have to merge to form the original cluster back [For this case, K = 7,8,9].

Optimal value of K can be selected using Elbow Method