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ASSIGNMENT-3

Note: The train/ and test/ folders contain the train set and the test set for the experiments respectively.

Categories used:

1. Airplanes
2. Faces
3. Sunflower

The value of **Number of Clusters** for K-Means clustering and **Size of the train set** have been varied and experimented with.

Sl.No	Train Set Size	NUM_CLUSTERS	Train Set Accuracy	Train Set Confusion Matrix	Test Set Accuracy	Test Set Confusion Matrix
1	702 (airplanes=400, faces=252,sunflower=50)	80	0.843345	array([[100, 62, 21], [1, 395, 3], [1, 13, 21]])	0.8155339	array([[93, 68, 22], [6, 390, 4], [3, 11, 21]])
2	702 (airplanes=400, faces=252,sunflower=50)	100	0.882342	array([[125, 40, 18], [3, 393, 4], [4, 10, 21]]	0.8511326	array([[110, 52, 21], [3, 393, 4], [4, 8, 23]]
3	702 (airplanes=400, faces=252,sunflower=50)	110	0.890112	array([[125, 46, 21], [1, 399, 1], [3, 13, 18]])	0.8543689	array([[116, 46, 21], [4, 390, 6], [3, 10, 22]])
4	702 (airplanes=400, faces=252,sunflower=50)	120	0.863221	array([[112, 52, 19], [4, 392, 4], [1, 13, 21]])	0.8414239	array([[108, 55, 20], [5, 390, 5], [3, 10, 22]])
5	925 (airplanes = 560, faces = 305,sunflower = 60,)	110	0.829211	array([[80, 40, 10], [5, 233, 2], [1, 5, 19]])	0.8101265	array([[73, 45, 12], [6, 230, 4], [2, 6, 17]])
6	925	150	0.851124	array([[82, 38, 10],	0.8430379	array([[79, 40, 11],

	(airplanes = 560, faces = 305,sunflower = 60,)			[2, 234, 4], [2, 1, 22]])		[4, 233, 3], [3, 1, 21]])

STEPS FOLLOWED:

SIFT feature descriptor has been used to detect and compute features from each of the images. Similar features in the images give an approximate to what the image is. Therefore when the machine is trained over several images, similar features that are able to describe similar portions of the image are grouped together to develop a vast vocabulary base. Each of these group collectively represent the a word and all groups in totality yields us the complete vocabulary generated from the training data. Bag of visual words creates a vocabulary that can best describe the image with extrapolary features.

KMeans is used as the clustering algorithm to group these features based on similarity metric. The final histograms for some of the experiments have been saved in the /outputs folder. They give a visualisation of the frequencies of the visual words collectively from all the train images.
The number of clusters used for K-Means clustering has been mainly experimented with.

EXPERIMENTS

Determining the NUM_CLUSTERS is very problem-specific. NUM_CLUSTERS, which is the number of visual words controls the trade-off between being distinctive and being robust. It also affects the efficiency of the algorithm which use bag of features. So the best number is really problem specific. I began experimenting with 100 as the starting value.

With 100, a test set accuracy of 85.11 was achieved. On decreasing, the test set accuracy showed a decrease to 81.55 . Hence, I increased it to 110 and obtained a slight improvement to 85.43.
However, on increasing it to 120, it again decreased to 81.01. Thus, 110 is the optimal number of visual words for the given dataset.

The trainset size, on increasing it to 925 from 702 showed a decrease of test set accuracy to 81.11 with 110 as the NUM_CLUSTERS value. On increasing to 150, the accuracy increased to 0.8430, which shows that the larger train set gives rise to a greater number of visual words.

Thus. the NUM_CLUSTERS value needs to changed according to the SIZE OF TRAIN SET and optimal values of both need to chosen.