Object Classification - Assignment 3

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Categories used:

1. **Brain**
2. **Face easy**
3. **Motorbikes**

EXPERIMENTATION

1. **Number of clusters**

The goal of K-means clustering is to find groups in the data, with the number of clusters (groups) represented by the value of K. The algorithm works iteratively to assign each data point to one of the K clusters based on the features that are provided. Feature vectors are clustered based on the similarity.

The train set contains 49 brain images, 218 face images and 399 motorbike images.

S.No	Number of Clusters (K)	Train Set Accuracy	Train Set Confusion Matrix	Test Set Accuracy	Test Set Confusion Matrix
1	80	0.8485714	[[37 5 7] [12 153 52] [5 33 361]]	0.8248648	[[33 9 7] [4 175 39] [6 25 368]]
2	100	0.8636090	[[33 7 9] [13 168 36] [3 36 360]]	0.8559870	[[39 3 7] [11 164 42] [5 33 361]]
3	120	0.8816541	[[38 4 7] [11 164 42] [3 25 371]]	0.8603769	[[38 5 6] [8 164 45] [4 25 370]]
4	150	0.9027067	[[39 3 7] [7 173 37] [3 21 375]]	0.8899870	[[37 7 5] [10 170 37] [5 21 373]]
5	200	0.9107518	[[39 3 7]	0.9022346	[[39 3 7]

			[6 180 31] [3 16 380]]		[9 177 31] [6 13 375]]
6	300	0.9287969	[[39 3 7] [6 186 25] [1 12 386]]	0.9154054	[[37 7 5] [3 192 23] [3 22 374]]

The number of visual words controls the trade-off between being distinctive and being robust. Therefore picking the best number of clusters is really problem specific. For this particular dataset, the values of train set accuracy and test set accuracy increase with the increase in the number of clusters.

Ideally, we should keep increasing the number of clusters till we reach a performance degradation. Then we should find the optimal number using some method similar to binary search. But owing to computational limitations I could not increase the number of clusters beyond 300.

2. **Train Set size**

Experiments have been carried out by fixing the number of clusters = 200
(As 300 clusters though gave a better accuracy took very long to execute)

S.No	Train-Test Split	Train images	Test images	Train Set Accuracy	Train Set Confusion Matrix	Test Set Accuracy	Test Set Confusion Matrix
1	50-50	666	665	0.9107518	[[39 3 7] [6 180 31] [3 16 380]]	0.9022346	[[39 3 7] [9 177 31] [6 13 375]]
2	70-30	930	401	0.9407732	[[43 3 4] [4 184 33] [4 9 388]]	0.8833102	[[39 3 7] [11 164 42] [5 33 361]]
3	30-70	401	903	0.7993455	[[27 12 10] [9 165 44] [9 32 358]]	0.7232189	[[23 16 10] [12 158 48] [9 40 350]]

We can see that with the increase in the train set size, accuracy of train set as well as test set increases.