

Predicting cognitive state of human through fMRI image

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ABSTRACT

- The functional Magnetic Resonance Imaging (fMRI) has provided us with an approach of revealing the activity of brain. In this experiment fMRI image has been taken in three states
- 1. Showing a picture
- 2. Reading sentences
- 3. Ideal state (No Task)

Feature selection

- In our experiment each image contains around 5000 voxels. Each voxel has been treated as a feature, so feature vector length is around 5000 .

DIFFERENT FEATURE EXTRACTION METHODS USED-

1. K-MEANS-

We Cluster the voxels using Kmeans and take average of all the voxel intensities of the same cluster to normalize that cluster into a single voxel. We tried for different K values but a reasonably good accuracy could not be achieved, different K values were chosen as $k=25, 50, 100, 125, \dots, 225$

2.N Most Active voxels-

1. In this feature extraction method we have consider those voxels which are most active during the experiment. Intensity difference during various states (showing image or statement) defines activeness of a image.
2. Accuracy was better than K-means but good enough.

Disadvantages:

1. Data loss
2. Redundant data.(bcz several most active voxels are of same type).

3.(K-means) combined with (N most active voxels)- first we run K-means keeping high value of K then from each cluster we select N most active voxels and then we convert the voxels in a single cluster into a singe voxel by averaging their voxel intensities. The Result was some what better compared to earliers.

4.Spectral clustering –

1. This clustering technique is similar to K-means but in K-means we take distance as a measure and here we take co-variance of voxels as a measure of clustering .

2.voxels which are linearly dependent or similar in nature are clustered together. Finally we average voxel intensities of respective clusters to get a single voxel.

5.(Spectral clustering) combined with (N-most active voxels)-

first we run spectral clustering and then we choose N most active voxels, and convert them into a single voxel by averaging .

Accuracy comparison

CLASSIFIER/ FEATURE EXTRACTION	K-MEANS	N-Most active voxels with k- means	Spectral clustering	Spectral clustering with N-most active voxels
GNB	74.21%	79.07%	78.86%	81.65%
SVM (with RBF kernel)	83.02%	85.34% ,N=100	88.79%,	89.81%
KNN	67.17%	68.24%	65.36%	62.32%

FUTURE WORK

Our classifier is person specific classifier not a generic. We trained it for a specific person and then testing on that same person. It was not giving good results when we try to test it for some other person, it may be due to the different shapes of brain of different people. So taking that factor into consideration a generic classifier can be implemented.