
Using fMRI to Diagnose Schizophrenia

Department of Computing Science
University of Alberta

Department of Computing Science
University of Alberta

Department of Computing Science
University of Alberta

Abstract

Diagnosis of schizophrenia is a challenging task that yet to be addressed[4]. Although, in recent years methods which use Functional Magnetic Resonance Imaging (fMRI) for mental disorder diagnosis has become more popular, but in case of schizophrenia it still needs to become more robust and reliable. In similar studies[6][7] have been shown that fMRI can be used in conjunction with Sparse Gaussian Markov Random Field (SGMRF) to produce high accuracy in diagnosis of illness. However having a dataset with homogeneous distribution of illness makes this result less reliable and creates the need for more evidence using heterogeneous dataset in terms of illness. In this work we pursue two path to tackle this problem. First, we evaluate performance of Sparse Gaussian Markov Random Field (SGMRF) on fMRI data obtained through whole brain, and second we work on Regions of Interest (ROI) according to Power et al.[5]. We have used 5 fold cross validation for hyper parameter tuning and 20% holdout set for test. Accuracies that we have obtained through mentioned method are: — for whole brain features and — for ROI features. While this result are slightly less than the results obtained by Rish *et al.* it is on par with Rosa *et al.* results.

1 Introduction

Functional Magnetic Resonance Imaging (fMRI) is a tool for recording functional changes caused by neuron activity. When a person is doing a task neuron activity fluctuate and human body in order to provide the energy needed for this activity increases the blood flow to feed the neurons with the needed glucose which is not stored in the brain. More blood flow also brings more oxygen through blood vessels. This change in the level of oxygenated blood known as oxyhemoglobin and deoxyhemoglobin (oxygenated or deoxygenated blood) changes the magnetic susceptibility of blood (BOLD signal) which is the base for detection in MRI machine.

Schizophrenia is a mental disorder that has been shown to affect blood flow in patient's brain[3],and this makes fMRI a perfect match for detecting changes caused by Schizophrenia in the brain. The only down side is the low resolution of fMRI compare to the scale of those changes. However fMRI is still one of the most used and efficient tools in study of psychiatric disorders such as Schizophrenia.

Another advantage of fMRI is that this method is non invasive. This means that unlike some other imaging methods that needs using some types of instruments in patient body this methods operates without the need of that.

One of the approaches that has been used for studying schizophrenia is Sparse Gaussian Markov Random Field(SGMRF) [6][7]. One of the main advantages of this method is that functional network of the brain can be captured using the precision matrix. [6] Using the resulted network one can differentiate between healthy subjects and schizophrenic ones. This method is depends on the functional connectivity in the brain.

2 Background

2.1 Schizophrenia

Schizophrenia is a psychiatric disorder [6] where those who are affected can experience hallucinations, delusions and diminished mental capacities to varying extents [2]. While several features of schizophrenia have proven useful for its diagnosis there are current no set of features that have sufficient sensitivity or specificity to be used in diagnostic tests [2]. This effectively means that subjectivity plays a role when a physician is looking to diagnose a patient. Currently automated approaches to schizophrenia diagnosis have been able to yeild accuracies of 93% for data that originates from a single location [6] and up to approximately 80% for data that originates from multiple locations [1].

2.2 Fourier Transform

What is a FFT and how does it work

2.3 Principal Component Analysis

2.4 Support Vector Machines

What is an SVM and how does it work

2.5 SGMRF

What is a SGMRF and how does it work

3 Methodology

3.1 Data Set

Turn our slide into this section How do we have? Balance? How we create the holdout set?

3.2 Your Approach? Mario

Describe your experiments

3.3 Your Approach? Neil

Describe your experiments

3.4 Your Approach? Farhad

Describe your experiments

4 Results

4.1 Your Approach? Mario

Report your results

4.2 Your Approach? Neil

Report your results

4.3 Your Approach? Farhad

Report your results

5 Conclusions

References

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