

## **Identification of alcoholic persons using EEG signals and unsupervised classification methods**

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### **Abstract**

This paper aims to distinguish alcoholic persons from non-alcoholic persons using Electroencephalography (EEG) signals. The effect of alcohol on a person is different from one to another. Nowadays, there are number of sophisticated equipment used to identify how much amount of alcohol a person consumes. However, they are vulnerable to sensor errors and need regular calibration after each test. Electroencephalography (EEG) are commonly used for identifying the effect of alcohol taken by the person through brain signals. Therefore, we aimed to distinguish ten alcoholic persons from ten non-alcoholic persons using the EEG sensor kit worn on the skull surface. Our analysis is based on frequency collected from 5 electrodes on the brain of ten alcoholic and non-alcoholic persons. We have applied time varied entropy techniques (Sample entropy and Approximate entropy) and fast Fourier transform over the electrodes measurements. Mean values of sample entropy and approximate entropy relevant to electrodes are calculated. The fourth dominant frequency was calculated for each record conducting fast Fourier transform over sensor measurements. The calculated Sample Entropy, Approximate Entropy and amplitude of fourth dominant frequency ranged from (-2.7 to -3.4), (1 to 0) and (0.25 to 2.7) respectively. The three features (Sample Entropy, Approximate Entropy and amplitude of frequency bands) were plotted in a three-dimensional sphere. The alcoholic and non-alcoholic persons could be grouped, handily in to two clusters with 100% accuracy.

**Keywords:** Alcoholic, Approximate entropy, Electroencephalography signal, Fast Fourier transform, Sample entropy

### **Introduction**

Alcoholism is a qualitative psychiatric phenotype with EEG based analysis conducted by a number of studies to obtain the correlated quantitative biological markers (Fattah & Fatima, 2015). Increased usage and addiction to alcohol among the general populace including the younger generation has been noted. Consuming alcohol is identified as an abuse disorder (Yazdani & Setarehdan, 2007). Studies of World Health Organization have revealed that approximately 2 billion people across the world consume alcoholic beverages and out of them, 76.3 million are seriously addicted to alcohol (Acharya & Sree, 2012).

Electroencephalogram (EEG) is the general reflection of human brain's electrophysiological activity that appears in the cerebral cortex or the skull surface. Nowadays, the study on human brain based on EEG signal is being subjected to growing concern, because it is a non-invasive and higher temporal resolution (Wu Di, 2010). The study of brain electrical activity, through the electroencephalographic records, is one of the most important tools for the diagnosis of neurological disease (Wu Di, 2010).