**Comparative Analysis**

This report aims at building an initial survey for the upcoming BCI project. This includes comparing various Feature Extraction, Feature Selection and Classification techniques used by other authors in their papers between 2011 and 2017.

This is report is divided into 3 sections. The first section tabulates various feature extraction techniques followed by the recorded accuracy of the proposed methods. The second section and third sections compare various Feature Selection and Classification techniques respectively.

**Feature Extraction**

Feature Extraction is one of the most crucial methods in Brain Computer Interfaces. It involves incorporating various signal processing methodologies to extract useful information from raw EEG data.The below table lists some of the most useful feature extraction strategies that can be implemented before advancing.

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| --- | --- | --- | --- |
| Paper Name | Authors | Algorithm Used | Accuracy |
| A Wearable EEG Based Drowsiness Detection System with Blink Duration and Alpha Waves Analysis | V. Kartsch , S. Benatti, D. Rossi, L.Benini | Power Spectral Density  Fast Fourier Transform | 85% |
| A Motor Imagery using Wavelet Analysis and Spatial Pattern features extraction | Obed Carrera-León, Juan Manuel Ramirez, Vicente Alarcon-Aquino, Mary Baker,  David D´Croz-Baron1, Pilar Gomez-Gil | Using Spatial Patterns obtained from Hilbert transform  Wavelet Analysis using Discrete Wavelet Transform | 87.86% |
| A P300-based BCI Classification Algorithm using Median Filtering and Bayesian Feature Extraction | Xiao-ou Li , Feng Wang , Xun Chen, Rabab K. Ward | Median filtering | 90% |
| A Novel Effective Feature Selection Algorithm based on S-PCA and Wavelet Transform Features in EEG Signal Classification | Saadat Nasehi, Hossein Pourghassem | Discrete Wave transform | 91% |
| Developing a Logistic Regression Model with Cross Correlation for Motor Imagery Signal Recognition | Siuly and Yan Li, Jinglong Wu and Jingjing Yang | Cross correlation between signals | 90.29% |
| P300 Event Detection using Feature Extraction Technique in FPGA | Kalyana Sundaram, Marichamy, Pradeepa | FIR/Hanning filter, Self-organised Fuzzy Neural Network | 90% |
| Feature Extraction Technique of EEG based on EMD-BP for motor imagery classification | Dalila Trad, Tarik Al-ani, Mohamed Jemni | Empirical Mode Decomposition to decompose the signals into stationary signals followed by using band power of those signals to characterize sensorimotor rhythm |  |
| Time-Frequency Analysis of EEG Asymmetry Using Bivariate Empirical Mode Decomposition | Cheolsoo Park, David Looney, Preben Kidmose, Michael Ungstrup, and Danilo P. Mandic | Bivariate Empirical Mode Decomposition | 70% and more |
| Experiments on Using Combined Short Window Bivariate Autoregression for EEG Classification | Tuan Hoang, Dat Tran, Phuoc Nguyen, Xu Huang and Dhamendra Sharma | Auto regression | 70-80% |
| EEG Filtering based on BSS Algorithm and Its Modification for BCI | Manoj Kumar Mukul, Fumitoshi Matsuno | Blind source separation | ~100% |

**Feature Selection**

Feature selection is the next method in Brain Computer Interfaces after Feature extraction. It involves selecting a subset of relevant features from various extracted features for use in model construction. It makes training and applying a classifier more efficient by decreasing the size of the effective vocabulary and often increases classification accuracy by eliminating noise features. The below table lists some of the most useful feature selection strategies that can be implemented after advancing.

|  |  |  |
| --- | --- | --- |
| Paper name | Authors | Algorithm used |
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**Classification**

Classification is one of the last but most crucial method in Brain Computer Interfaces. It involves the problem of identifying to which of a set of [categories](https://en.wikipedia.org/wiki/Categorical_data) a new [observation](https://en.wikipedia.org/wiki/Observation) belongs, on the basis of a [training set](https://en.wikipedia.org/wiki/Training_set) of data containing predefined categoric observations. Classification allows a device to classify the cognitive brain activity based on some selected features into an appropriate category. The below table lists some commonly used classification methods.

|  |  |  |  |
| --- | --- | --- | --- |
| Paper name | Authors | Algorithm used | Accuracy |
|  |  |  |  |
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