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An approach to emotion recognition in single-channel EEG signals: a mother child interaction.

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Summary

Summary

Introduction

This study seeks to determine when the emotional states of happiness, and sadness appears in a mother-child dyad with the analysis of some descriptive characteristics in time and frequency domain, after conducting an experiment to evoke emotions, using a single channel from a EEG signal.

Summary

Experimental Protocol

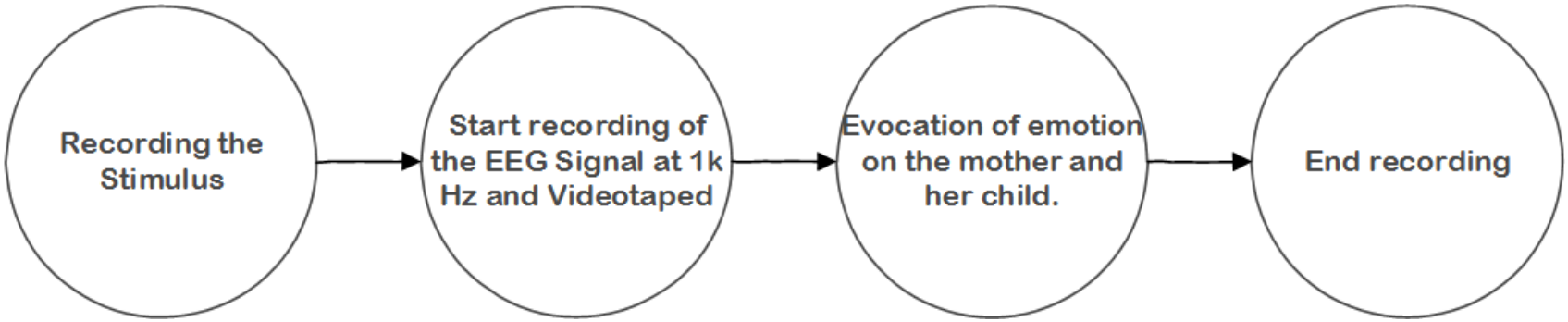

Figure: Experimental Protocol

Pre-processing: Filtering

The signal was filtered leaving the frequential components on the range of 0.5 Hz to 70 Hz, removing the power-line noise at 60 Hz.

Pre-processing: Filtering

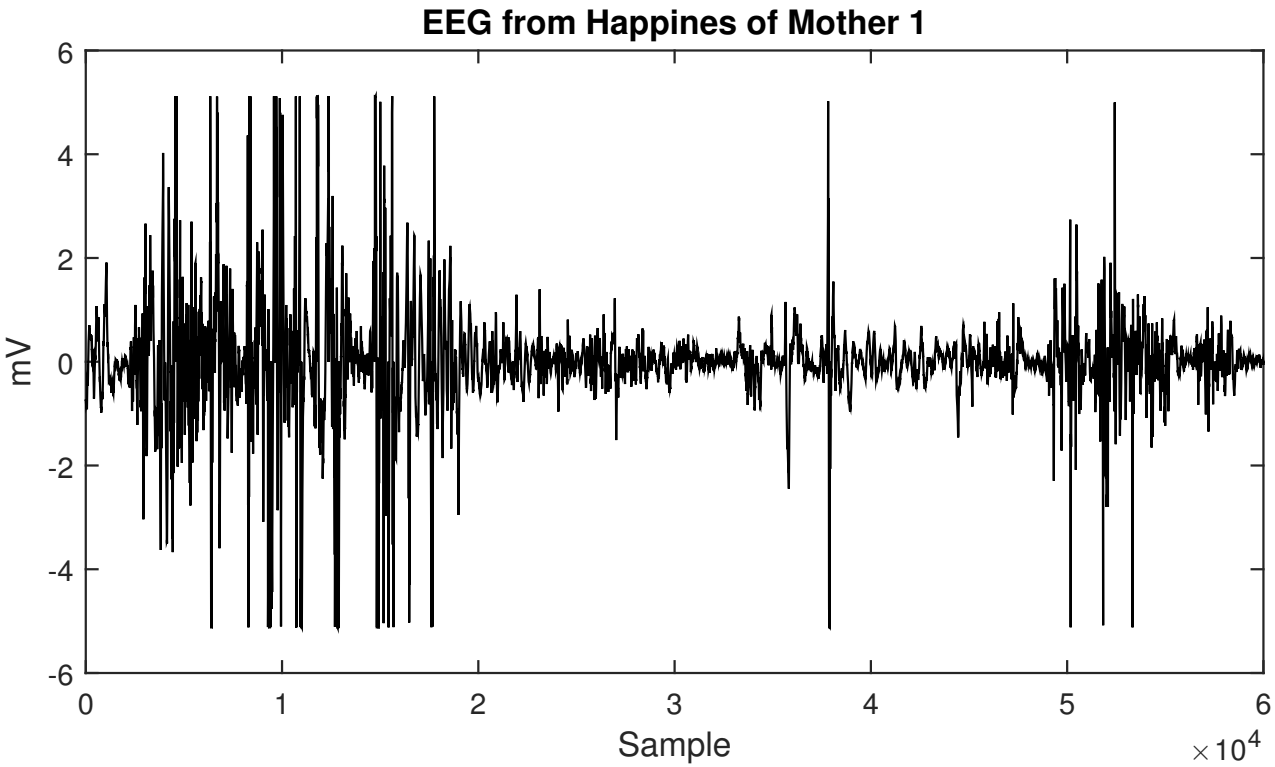

Figure: Raw EEG from Happiness of Mother 1

Pre-processing: Filtering

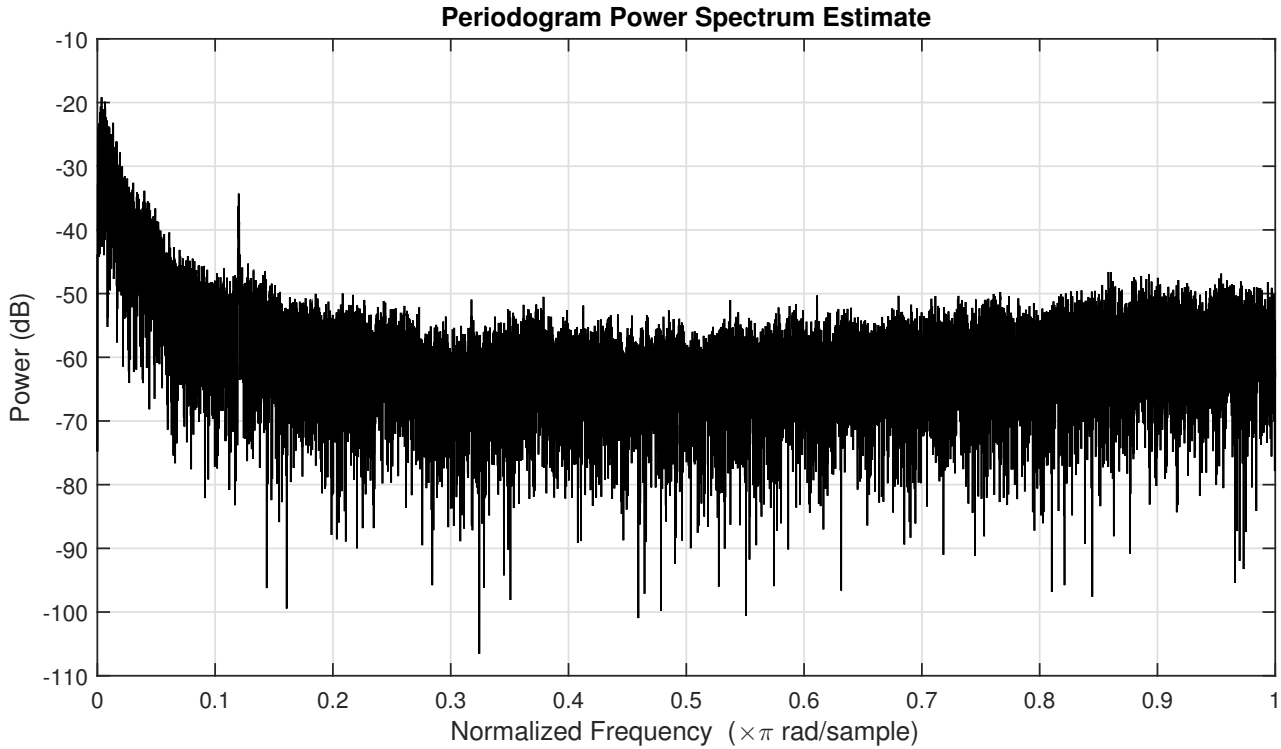

Figure: Periodogram of Raw EEG from Happiness of Mother 1

Pre-processing: Filtering

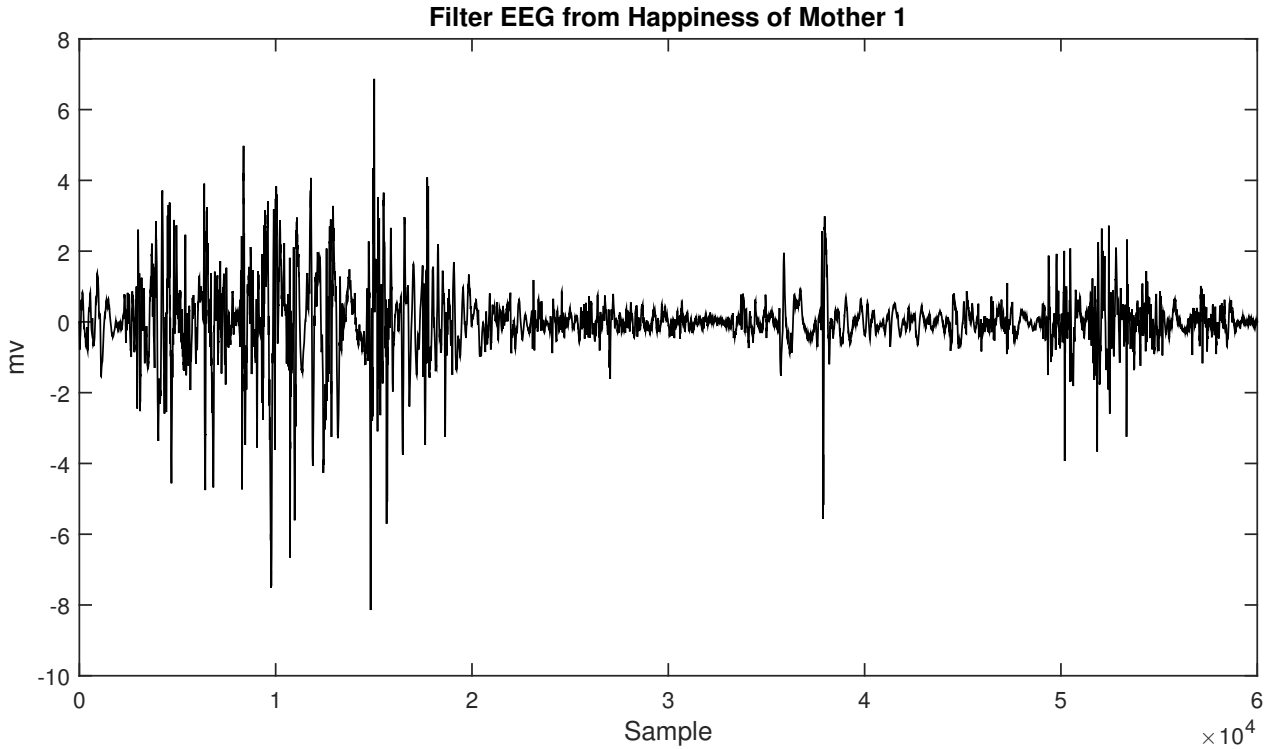

Figure: Filtered EEG from Happiness of Mother 1

Pre-processing: Filtering

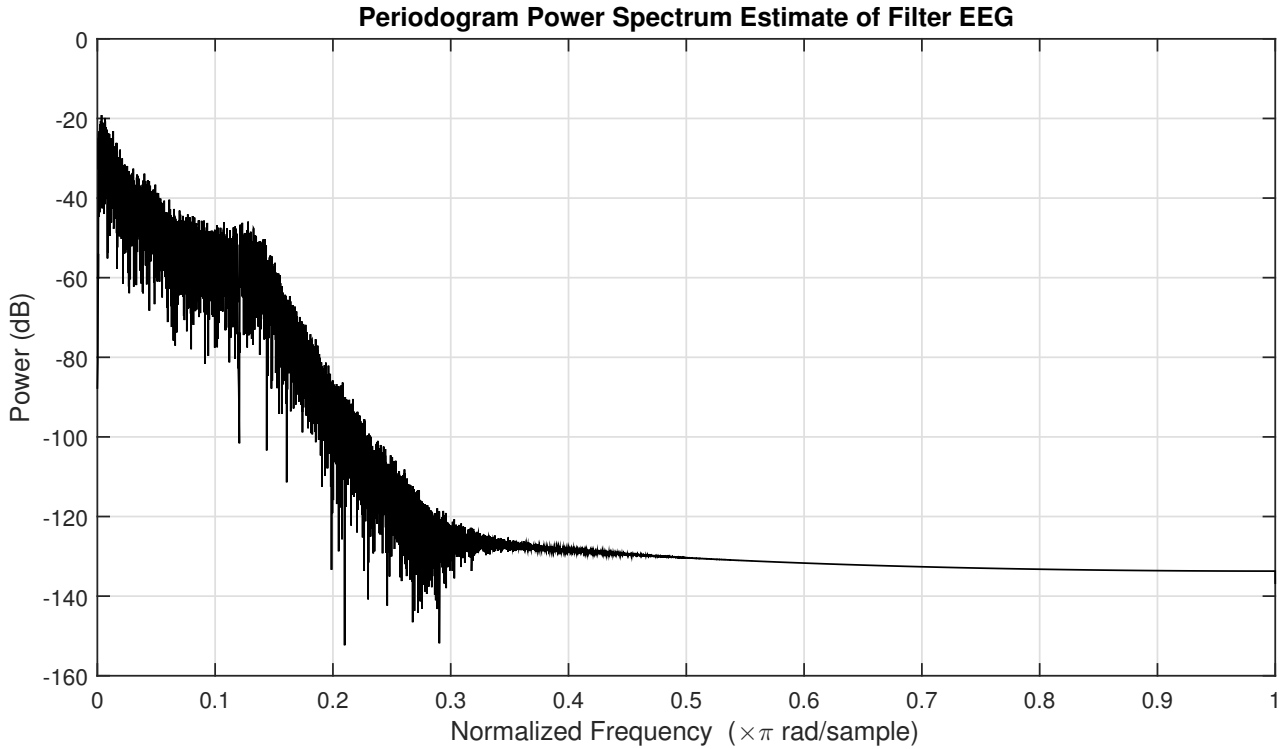

Figure: Periodrogram of Filtered EEG from Happiness of Mother 1

Pre-processing: Windowing

To perform the analysis of the signal, a windowing process is implemented with a Hamming window type.

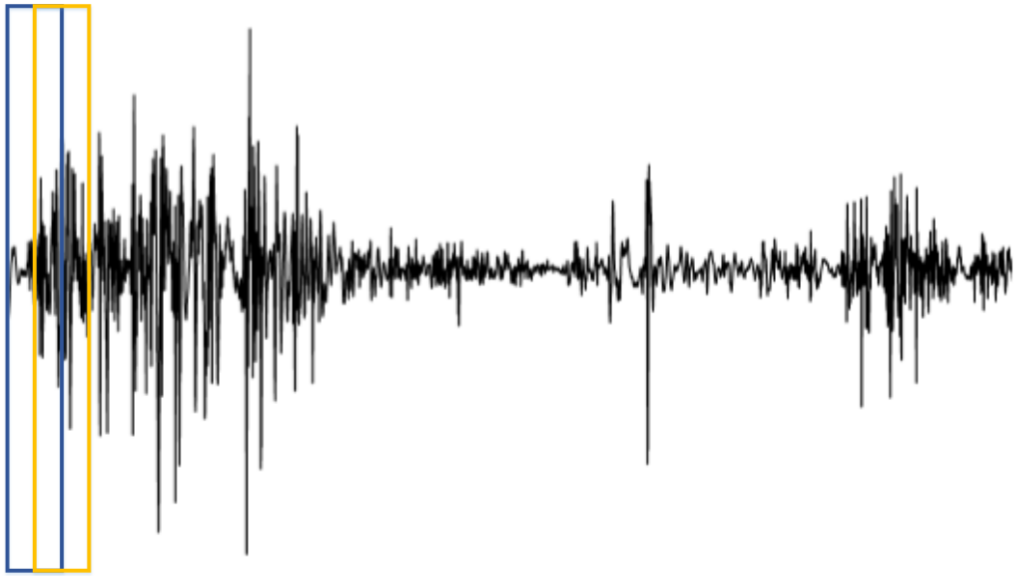

Figure: Windowing process

Descriptive Characteristics

For training a classifier system, it was decided to find some descriptive characteristics of the EEG signal in a temporal and frequency approach. Given the stochastic behavior of the signal [1], some type of statistical analysis must be performed[2].

Descriptive Characteristics

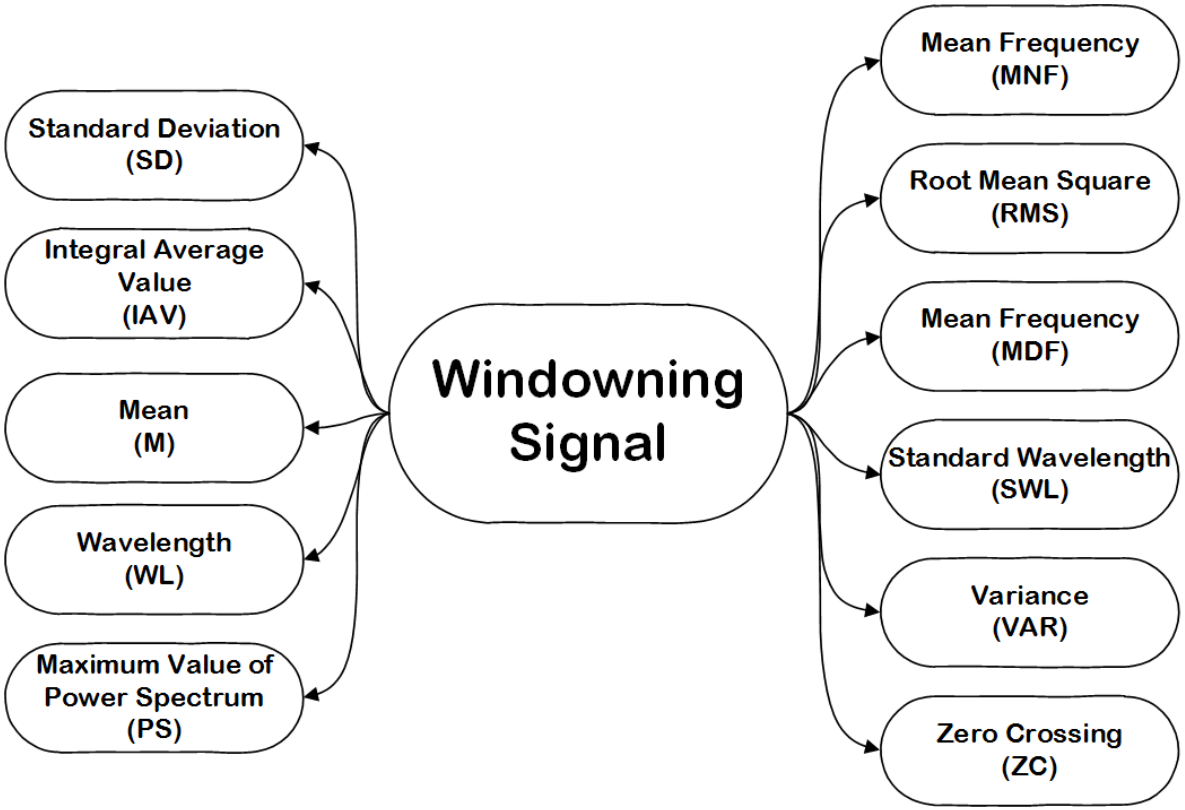

Figure: Descriptive Characteristics

Classifier

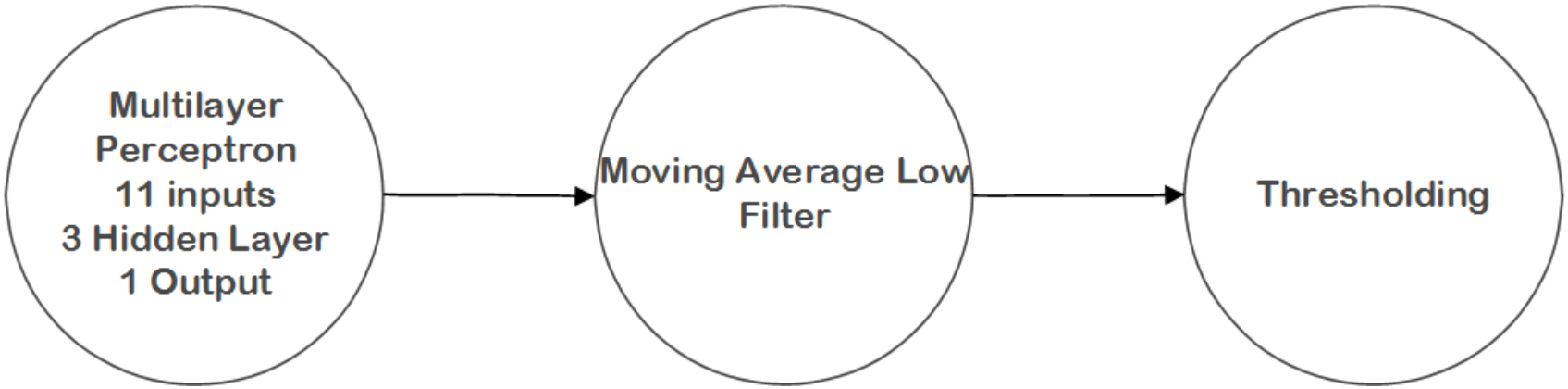

Figure: Classifier

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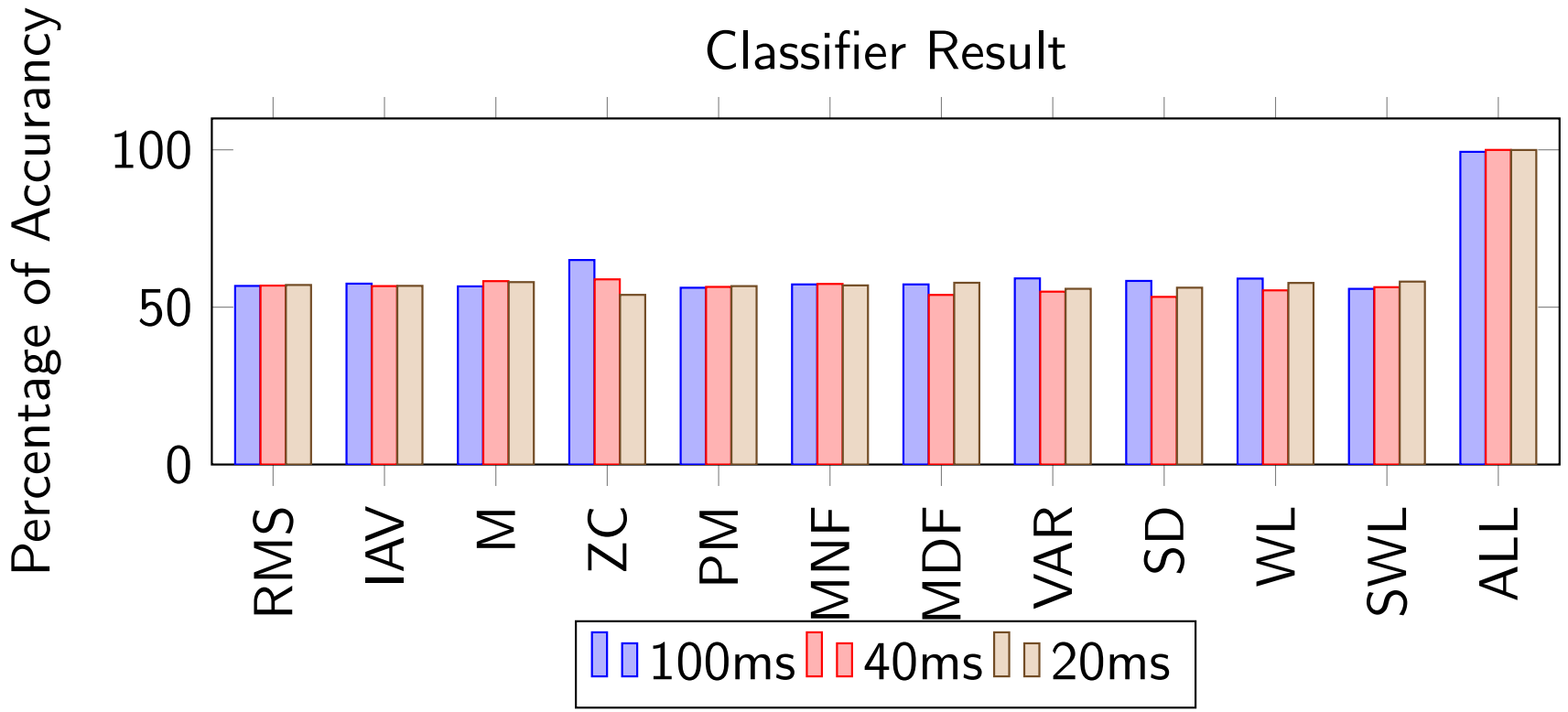
Results and Discussion



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Conclusions

The detection between the happiness and sadness emotional state, is possible through an analysis of a single channel of EEG. The analysis of the signal using temporal and spectral features, allows the classification of the emotional states with a high rate with a nonlinear classsifer as the MLP.

Conclusions

Moreover, the effect of window size on the results was also evaluated. Given the high classification rates, it can be concluded that the size of the analysis window is important but stable. Allowing the selection of larger window sizes to reduce computational costs, and trying to reduce the small effect of misclassification of the signal, assesing the segments before and after the emotional states obtained by the classifier.

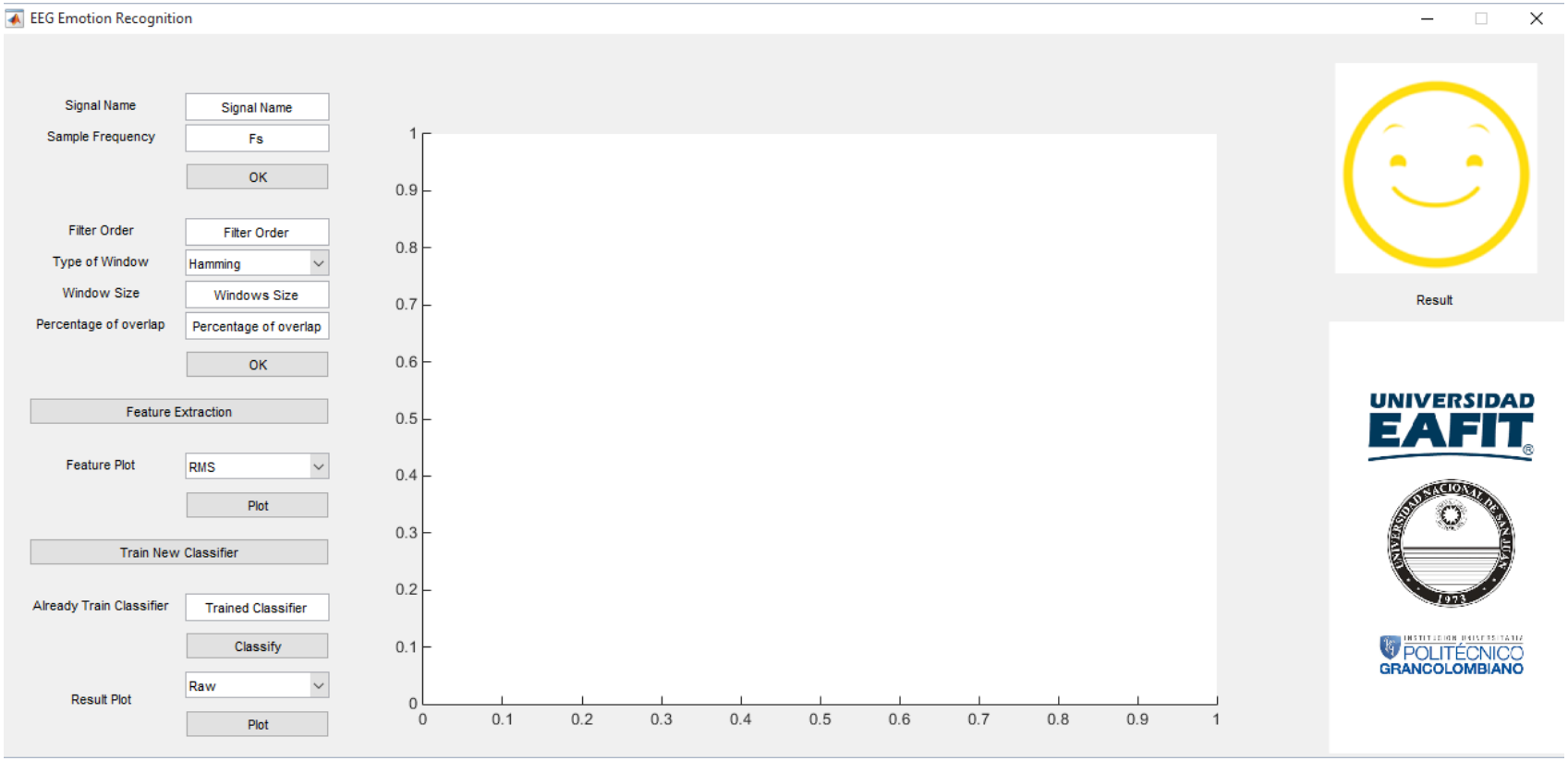
Summary

Future Work

This work sought an approach to detect emotions in EEG signals,allowing scale this analysis techniques to a higher number of channels for a detection of more emotional states.

Summary

User Interface



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References

1. Sanei, Saeid and Chambers, Jonathon, EEG Signal Processing, Chemistry & biodiversity, 2007
2. Manolakis, D.G. and Ingle, V.K., Applied Digital Signal Processing: Theory and Practice, Cambridge University Press, 2011.