Comparison of Feature Extraction Methods for Spike Detection with Artificial Neural Networks: A Focal Epilepsy Case Study

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Introduction

In focal epilepsy, EEG is used for non-invasively measuring epileptic activity as one of the standard diagnostic modalities for presurgical epilepsy diagnosis. In the diagnostic process, interictal epileptiform discharges (IED) are marked by experts in the EEG data. This manual marking is a time-consuming, subjective and tedious work, leading also to larger variability between different expert markers. Therefore, it would be beneficial to develop and train systems that can automatically detect IED in the EEG data. In our talk, we show how this can be achieved via training machine learning algorithms with EEG data.

Methods

We present a new automatic detection and Artificial Neural Networks (ANN) classification procedure together with detailed preprocessing steps. We survey the possibility of representing the data with new features without direct classification and show how advantageous it is to use these features. The complex, statistical and frequency features are represented in the multichannel EEG with epochs of smaller size and used for training the network.

Results

The multi-input ANN trained with multichannel EEG data achieved 71.81% accuracy and 70.18% precision. Training the ANN with the new features increased the success of classification and achieved 98.23% accuracy and 98.25% precision.

Conclusion

For IED detection, the proposed method increases the success and speed of classification. Furthermore, automatic detection embeds well in the expert inter-rater variability.

Keywords: EEG, Feature Extraction, Interictal Epileptiform Discharges (IED), IED Detection, Artificial Neural Network

Information about submission 707:

- Last change: 23 Mar 2023 11:29
- Theme: (1) BMT 2023 - Annual Conference of the German Society for Biomedical Engineering
- Topic: Track: Biosignal Analysis and Data Aggregation
- Submission type: Abstract Only

Submission decision

- Generic data:

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- Objective submission decision: Accepted (Accept, Only Abstract Submitted) as Abstract Only
- Submission status: Waiting for formal decision