Deep learning project proposal
Sleep stages classification using EEG signals

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Motivation

Sleep-wake classification is important for measuring the sleep quality as it significantly affects the quality of daily life and it helps in finding out sleep disorders. A lot of studies have been made in this field but most of them used hand-crafted features extraction. However, we believe that this may lead to less accurate classification. s

Previous work

The existing solutions vary in the methods used in classification. We will not consider reviewing previous methods that depended on traditional machine learning based techniques and will only explore the deep learning based approaches. Starting with Sors. et.al[1], they developed a 14-layers CNN followed by one or two fully-connected layers and a softmax regression layer that outputs class probabilities. Similarly, Yildirim et.al[2] developed a 1-D convolutional neural network for the classification of sleep stages based on both EEG and EOG signals. In[3], authors used a network consisting of convolutional layers for local features extraction followed by an LSTM to capture temporal dependencies. Finally, in DeepSleepNet[4], a convolutional neural networks is used to extract time-invariant features then a bidirectional-long short-term memory is used to learn transition rules among sleep stages automatically from EEG epochs.

Proposed work

Our effort in this project will start by exploring and exploiting a public sleep EEG dataset, Physionet, which can be downloaded from Physionet website. The dataset contains 197 whole-night PolySomnoGraphic sleep recordings, containing EEG, EOG, chin EMG, and event markers, and besides them, the corresponding hypnograms (sleep patterns). These patterns consist of classes: W, R, 1, 2, 3, 4, M (Movement time) and ? (not scored). Next, we will start building new solutions to do classification. For the features extraction, we will use CNNs to extract features from data. For classification, We will start by building and comparing the performance of some basic models, such as LSTM structures and 1-D CNN and then gradually build on it to achieve better classification accuracy. We will consider adding an attention layer and building seq-to-seq model.

Suggested Milestones

Our suggestion for the progress of the project is as follows:

- Cleaning and preparing dataset,
- Features extraction,
- building and testing models,
- Analyzing results
- prepare slides and notebook report.

References

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