Deep Neural Networks for stimulation artifact recognition and removal in epidural spinal cord recordings

Project Management and Software Development
for Medical Applications

General Info

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Project Abstract

This project aims to develop and evaluate deep neural network models for the recognition and removal of stimulation artifacts in epidural spinal cord recordings, improving the accuracy of neural activity interpretation and facilitating better treatment outcomes.

Background and Motivation

CereGate is a neurotechnology company developing novel communication interfaces with the nervous system. The key components of our interfaces are the software platforms that we develop. Our platform is hardware-agnostic and can be utilized to develop a multitude therapeutic solutions.

Spinal cord stimulation (SCS) has emerged as an effective treatment modality for chronic pain management. During SCS, electrical stimulation is applied to the spinal cord, and neural recordings are obtained for monitoring and evaluation of the efficacy of the stimulation delivery. However, these recordings are often contaminated by stimulation artifacts, which can impede the accurate interpretation of the underlying neural activity. Existing artifact removal methods have limitations, and there is a need for more advanced techniques to effectively remove these artifacts without compromising the neural signals. Deep learning approaches have shown promise in various neural recording applications, but their application in SCS remains relatively unexplored. The objective of this project is to develop deep neural network models for recognizing and removing stimulation artifacts in epidural spinal cord recordings, building upon the existing knowledge in the field and enabling more accurate analysis of the neural signals for improved treatment outcomes.

Student's Tasks Description

The student will be responsible for the following tasks during the project:

1. Conduct a literature review on existing artifact removal methods and deep learning approaches in the context of neural recordings.
2. Develop deep neural network models, such as convolutional neural networks (CNNs), recurrent neural networks (RNNs), or autoencoders, for recognizing and removing stimulation artifacts in epidural spinal cord recordings.
3. Implement the developed models using a suitable programming language and deep learning framework.
4. Evaluate the performance of the developed models on available datasets and compare the results with existing artifact removal methods.
5. Write a report documenting the developed methods, results, and future work.

Technical Prerequisites

- Proficiency in Python programming.
- Familiarity with deep learning frameworks such as PyTorch or TensorFlow.
- Basic understanding of signal processing and neural recordings.
- Prior experience with machine learning or deep learning techniques
- Experience with version control systems such as Git

References

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