תאריך: ‏31/10/2021

מסמך אפיון פרויקט

|  |  |  |
| --- | --- | --- |
| **הפרויקט** | | |
| שם הפרויקט: | **Neural ODE for Sleeping Stage Identification** | |
| מס' ב-LabAdmin: | 6440 | |
| סמסטר: | Winter 2021/2022 | |
| חד/דו סמסטריאלי: | חד סמסטריאלי | |
| **הצוות** | | |
| שם המנחה: | Ya-Wei Eileen Lin | |
| שם סטודנט 1: | Orel Tsioni | מקצוע רישום: פרויקט ב' |
| שם סטודנט 2: | Itamar Meyer | מקצוע רישום: פרויקט ב' |
| **חברה מלווה** | | |
| שם החברה: |  | |
| שם איש קשר: |  | |

**1. מטרת הפרויקט**

Project purpose is to use Neural ODE for sleeping stage identification and prediction of the incoming measurement. Neural ODEs are neural network models which generalize standard layer to layer propagation to continuous depth models. In our project, the data is a time series of EEG measurements during people sleeping time. We want to feed this data to the model and see the performance of our model in classifying and predicting sleeping stages.

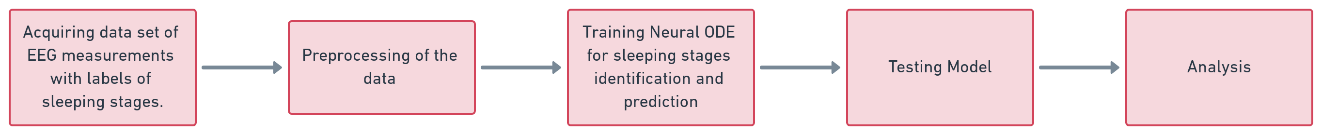
**2. פירוט הנחות ודרישות**

In this project we will use a data set of EEG readings. This data should be a 2D tensor where one dimension is 'time' and the other is the set of different sensors measurements. It models the sleeping dynamic.

**3. פתרונות אפשריים וסיכום קצר של סקר הספרות**

**A relevant paper:**Chen, Ricky TQ, et al. "[Neural Ordinary Differential Equations.](https://arxiv.org/pdf/1806.07366.pdf)" arXiv preprint arXiv:1806.07366 (2018).

**4. תרשים מלבנים (block diagram) של הפתרון הנבחר או הנבדק**

**Project main goals chronologically.**

**Top view project block diagram.**

A screenshot of a computer

Description automatically generated with low confidence

**5. מודולים שנידרש לפתח**

Implementing and adapting the Neural ODE model from the paper discussed for sleeping stages time series data.

**6. מודולים מוכנים שניתן להיעזר בהם**

The paper comes with a GitHub repository that contains a PyTorch implementation of the model. It is stated that this code can run over a GPU.

GitHub: <https://github.com/rtqichen/torchdiffeq>

**7. סביבת עבודה וכלי פיתוח שיהיו בשימוש**

* Programming language: Python.
* IDE: Google Colab or PyCharm.
* We may use GPU to train and test our model which is provided by SIPL lab.
* We will use Overleaf for project report and results analysis.
* Libraries – PyTorch, Pandas and probably signal processing packages.

**8. שיטת הבדיקה שתידרש בסיום הפרויקט**

We will analyze the results and determine if the “Neural ODE network” we implemented is working well with the sort of data we will use. First objective is checking the correctness of the built model. Seeing if the result is logical and coherent. Then, examining the outcome of the network and its ability to analyze the data correctly to identify and predict the sleeping stages.

**9. רשימת משימות:**

|  |  |  |  |
| --- | --- | --- | --- |
| מס' | שם המשימה | תיאור המשימה | משך ביצוע משוער |
| 1 | Reading the paper | Reading the paper and acquiring better understanding of the model | 3 weeks |
| 2 | Understanding the code in the GitHub and reproduce the paper results | Reading the code and finding a way to implement it so it would fit our cause | 2-3 weeks |
| 3 | Pre-processing the data set | Make adjustment to the data so we can insert into the model | 1.5 weeks |
| 4 | Using sleeping stages data as a time series input to the Model. | We will examine the results that are generated with different parameters of the network. We will see if there are adjustments that can improve the model. | 3 weeks |
| 5 | Midterm Presentation | Preparing a slide and a preliminary result. | 1 week |
| 6 | Analyzing the results | We will try to understand whether the neural ODE came with a good result in comparison to different approaches to solve this sleeping stage prediction. We will compare in terms of memory used, time of training, accuracy of prediction, etc. | 3 weeks |
| 7 | Final Presentation/Final Report/Final Poster | Preparing a slide to present all the results and project achievements. Submit a final Report which includes all the details and methods that were taken. Submit a final Poster as a simple summary of the work. | 2 weeks |
| 8 |  |  |  |
| 9 |  |  |  |
| 10 |  |  |  |

**10. תרשים גאנט (התקדמות הפרויקט):**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| מספר חודשים מתחילת הסמסטר | | | | | | | | | שם משימה |
| 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |  |
|  |  |  |  |  | תקופת מבחנים |  |  | X | Reading the paper |
|  |  |  |  |  |  | X |  | Understanding the code in the GitHub and reproduce the paper results |
|  |  |  |  |  |  | X |  | Pre-processing the data set |
|  |  |  |  |  | X |  |  | Using sleeping stages data as a time series input to the Model. |
|  |  |  |  |  | X |  |  | Midterm Presentation |
|  |  |  |  | X |  |  |  | Analyzing the results |
|  |  |  |  | X |  |  |  | Final Presentation/Final Report/Final Poster |
|  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |