# **Software Requirements Specification**

# **1. Introduction**

## **1.1 Purpose**

As part of the Software Engineer unit we have to analyze existing machine learning methods to deal with time series. From this research we will be able to set up a neural system. In addition to this deliverable we will discuss the different methods of testing neural networks and write technical documentation of the code for github. Our main research resource is focused on the website www.nature.com which provides an article on the subject.

## **1.2 Project Scope and Product Features**

The project is based on the game "Guess the number".

We will implement a method to classify the data and make a simple user interface.

Also the code will be tested and documented on github.

We will use a specific DataBase to obtain a network of neurons capable of guessing the number :

The purpose was to provide to the scientific community a database large enough to be used for further research. The principle of the game is that the participant chooses a number between 1 and 9. Afterwards he looks at a series of numbers on a screen, the electrical impulses of the brain are recorded (EEG signal) and then thanks to these measurements, the program tries to deduce the number initially chosen by the participant. The final result is given by the participant himself at the end of the experiment.

## **1.3 References**

<https://www.nature.com/articles/sdata2016121>

Mouček, R. *et al.* Event-related potential data from a guess the number brain-computer interface experiment on school children. *Sci. Data* 4:160121 doi: 10.1038/sdata.2016.121 (2017).

# **2. Overall Description**

## **2.1 Product Perspective**

The main perspective of this product is to get acquainted with the requirements for detection of so-called evoked components in a EEG signal and propose a neural network(s) suitable to detect a number between 1 and 9 thought by a child’s brain during the “conscient phase” in the short-term memory using an electroencephalogram record in the input.

## **2.2 User Classes and Characteristics**

This product will principally be used by experimenters to better understand the child’s brain functioning and how they react to stimuli (time period, intensity, etc…). Some of them could also make statistics about it using the metadata that provides our records

## **2.3 Operating Environment**

In the beginning, the software will only be compatible with Windows architecture 10 and Python version (3.7).

The project will be compatible with x64 CPU architectures.

## **2.4 Design and Implementation Constraints**

This project will be coded in Python.

## **2.5 User Documentation**

The user documentation will consist of description of the goal of our project.

We will also make a step by step tutorial to use the software from scratch.

We also will present our testing protocol and the results.

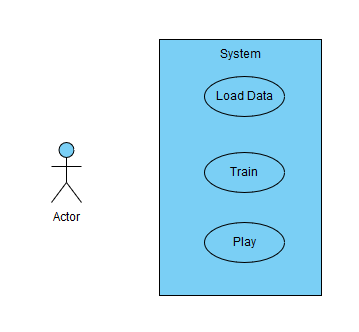
## **2.6 Assumptions and Dependencies**

Our project will work on Python 3.7 or higher and will use some usual Machine Learning libraries like Keras, Numpy, and MNE.

And the database from https://www.nature.com/articles/sdata2016121.

# **3. System Features**

The software will be able to read the data from the chosen database, classify the data into 10 sections from 0 to 9 and give an output of the result.



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| Primary Actor | Use Cases |
| Client | 1. Load the data 2. Train the neural network 3. Play the neural network |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Use Case ID: | 1 | | | |
| Use Case Name | Load Data | | | |
| Created By | Maryne Bouche | Last Updated By : | Maryne Bouche | |
| Date Created : | 12/1/2020 | Date Last Updated: | 12/1/2020 | |
| Actors | Client | | | |
| Description: | Load the database in the system and get ready to be used. | | | |
| Preconditions: | 1. Have a database rightformated | | | |
| Postconditions: | 1. Have loaded a database ready to be used by the system 2. Unlock the others functionalities | | | |
| Normal Flow: | 1. Activate the button “Load” 2. System display the list of the database 3. Client select in the new window the database 4. Client validates the choice 5. System confirms the acceptance | | | |
| Alternative Flow: | 1. Use the default Database included in the project | | | |

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| --- | --- | --- | --- | --- |
| Use Case ID: | 2 | | | |
| Use Case Name | Train | | | |
| Created By | Maryne Bouche | Last Updated By : | Maryne Bouche | |
| Date Created : | 12/1/2020 | Date Last Updated: | 12/1/2020 | |
| Actors | Client | | | |
| Description: | Train the neural network with a portion of the database. | | | |
| Preconditions: | 1. Include a database or use the default one | | | |
| Postconditions: | 1. Have a neural network trained and ready to be use | | | |
| Normal Flow: | 1. Activate the button “Train” 2. System confirms the neural network is trained | | | |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Use Case ID: | 3 | | | |
| Use Case Name | Play | | | |
| Created By | Maryne Bouche | Last Updated By : | Maryne Bouche | |
| Date Created : | 12/1/2020 | Date Last Updated: | 12/1/2020 | |
| Actors | Client | | | |
| Description: | Use the neural network to guess the number with the database included and a neural network trained | | | |
| Preconditions: | 1. Have a database included or use the default 2. Have trained the neural network | | | |
| Postconditions: | 1. See the result | | | |
| Normal Flow: | 1. Activate the “Play” Button 2. System dispay the result on the UI | | | |

## 

# **4. External Interface Requirements**

## **4.1 User Interfaces**

one independent script that the user will run in windows terminal with a -p (path) parameter.

The output guessed the number will also be displayed in this terminal instance.

## 

## **4.2 Hardware Interfaces**

**NONE**

## **4.3 Software Interfaces**

This software will require the interfaces below:

* Python 3.7 or higher
* MNE tool for Python 0.19
* Tensorflow 2.1.0
* Numpy 1.17.4
* Matplotlib 3.1.1
* ...

## **4.4 Communications Interfaces**

**NONE**

# **5. Other Nonfunctional Requirements**

## **5.1 Performance Requirements**

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## **5.2 Safety Requirements**

//

## **5.3 Security Requirements**

//

## **5.4 Software Quality Attributes**

The requirements for the Quality of the software are

* to comment the code
* to follow the python standard : snakecase