**MIST implementation**

# **MIST introduction**

MIST or the Montreal Imaging Stress Task is a psychometric task. The purpose of this task is to induce stress through mental arithmetic operations.

The stress assessment is performed in 3 parts. The easy session consists of only one-digit numbers and the operations include only the addition and subtraction operators. The session in the middle consists of both one-digit and two-digit numbers, but the allowed operations are also restricted to addition and subtraction. The final and hardest session consists of multiple two-digit numbers and the set of separating operations are now inclusive of multiplication and division. Each of these sessions span across a period of 5 mins.

The factor responsible for induction of stress in the subject is the limited time available to solve each question and the rapid toggling of questions on the screen. According to the standard protocol, the answer to each of the problems lie in the range of 0-9. Thus, the subject is responsible for selecting the correct answer on the screen.

To maintain homogeneity of the process, the test takes into account the consecutive correct responses and wrong responses of the subject. A number of correct responses in a row is indicative of habituation by the subject. So, the time for each question is reduced by 10%. Similarly, a certain number of consecutive wrong responses leads the time allotted for each question be magnified by 10%.

Usually, alongside this experiment, some physiological signals of the patient are recorded. The common ones are EEG signals and PPG signals. The results from various physiological observations mapped with the corresponding tests in MIST, paves way for further analysis involving the identification of biomarker for stress.

# **Tools used**

* **Tkinter:** for the implementation of the GUI or the Graphical User Interface
* **Openpyxl:** To read questions specified in the external Excel sheet
* **Random:** To jumble up the ordering of questions from the question bank
* **Serial:** To regulate the serial port that allows us to log the corresponding EEG and PPG data.
* **Threading:** To carry out simultaneous operations that include question toggling and logging of physiological data.

# **Variable Description**

**correct\_response:** Keeps a count of the number of correct responses achieved by the subject

**wrong\_response:** Keeps a count of the number of incorrect responses committed by the subject

**consec\_correct:** Keeps a count of the consecutive correct answers by the subject

**consec\_wrong:** Keeps a count of the consecutive wrong answers by the subject

**current\_question:** Stores the index of the current question from the Excel sheet that is displayed on the screen

**p:** stores the tentative value of the answer based on the activation of the radiobuttons

**logger:** array where the data is logged from the serial port

**timer:** keeps count of the starting and ending points of the experiment (variable determining the experiment duration)

**time:** allotted time to the subjects to solve each question

**cond:** condition variable which remains true till the experiment is going on

# **Function Definitions**

**log\_data:** The function which reads the data from the serial port line-by-line. After obtaining the data, it decodes it and removes the unnecessary characters in the line. Then the data is logged in an array for later analysis.

**nexta:** The function has three main utilities. It determines the **time** variable based on the values of **consec\_correct** and **consec\_wrong.** Here the count of questions in either to change the value of time allotted for each question is kept as three. It means the 3 consecutive right responses decreases the allotted time by 10% and vice-versa. It also maintains the **timer** variable and periodically reduces it to demarcate the end of the experiment. Furthermore, the function is responsible for evoking questions one after the other for the predefined question bank of the excel sheet.

**clicked:** It is the function that is evoked, every time the user activates a radiobutton. The function assigns the value passed from the radiobutton and assigns it to **p** (a global variable). The function is also responsible for verifying the correctness of the answer and modify the value of the global variables **correct\_response, consec\_correct, wrong\_response** and **consec\_wrong** accordingly.

# **Program Overview**

The main purpose of this program is to deploy an end-to-end MIST test for the subjects. The program involves uses an external excel based question bank to fetch the questions to the GUI. The responses of the subjects are validated and stored. The time for each of the tests is defined as 5 minutes and the initial value of the time allotted to each patient is given by 1 sec initially. The GUI shows 10 radiobuttons with values ranging from 0 to 9. The subject chooses the answer from the 10 options while taking the test. Since the program requires the continuous data logging and the toggling of questions to be done simultaneously, the concept of threading has been used. Two threads are defined, one for each of the tasks.