Neural Engineering 2021/2022 – Practical exam 18/07/2022

Exercise 1 – Neural Signal Processing

Load the neural signal A (Sampling frequency: 10kHz). After having performed all the necessary (if necessary) steps for conditioning of the signal perform all the appropriate analyses to:

- Determine the number of firing neurons (10 points)
- **Bonus**: based on the previous results, proof that the threshold and the pre-processing adopted are optimal for the signal or optimize its value (4 points)

Exercise 2 – Muscle synergies

Load the multi-muscle EMG recording B (Sampling frequency: 1kHz). Perform all the steps needed to:

- Determine the number of muscle synergies underlying muscle activity and visualize the average activity of each motor module (10 points)
- Load the multi-muscle EMG recording C and test whether the coordination structures of the two subjects are equivalent (10 points)

*Exam rules: the duration of the test is **3 hours**. Everything is allowed (including the internet connection), except for communication between participants. The solution has to be provided in an .ipynb format, with both the codes and the interpretations of the results. All the different tested strategies should be provided in the solution. The final mark is just a starting point for the oral colloquium, some adjustments will be made during the discussion of the results. The bonus question allows the exam mark to be higher than 30/30, so it is not strictly required for reaching the maximum. **Important**: the questions will be evaluated in terms of both correctness of the results (1/3) and clarity of their interpretation (2/3).*

Note: The signals to be loaded will be provided from the website exercises at the start of the exam. While the exam questions are the same for all the participants, the signals to be solved are participant specific.