Neural Engineering 2021/2022 – Practical exam 27/06/2022

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)
- Calculate the firing rate for each of the identified neurons and the quality of its estimation (5 points)
- Based on the shape of the identified neurons, determine the minimum number of features that gives correct results (8 points)
- **Bonus**: use a purely data driven approach to solve the problem of determine the minimal set of features (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 (7 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.