Neuroengineering 2023-2024

April 4th 2025

Part II

How to submit your answers.

The answers can be typed in the provided text file, following the template. Do not modify or move the lines containing the headers.

Keep your answers tidy. Messy, hard-to-read answers may penalize your mark.

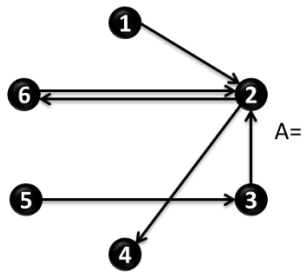
The maximum total score for part II is **8**.

Carefully read the following scenario and answer the questions listed below.

A patient needs to undergo **brain surgery** because she has frequent (daily) epileptic seizures that fail to respond to any antiepileptic medications (pharmacoresistant epilepsy). Before and after the intervention, when her skull must be open to perform the surgery, her **neuroelectrical data** are collected **for several hours.**

The aim is to build **directed brain functional networks**, to quantify the **role of specific regions** and to compare **the brain network properties before and after the surgery**.

The regions to be monitored are all subcortical. Their behavior at rest is known to occur in **Theta and Alpha bands**.



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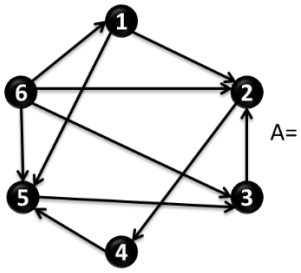

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0	0	0	0	0	-

Fig. 1: Graphs obtained for the patient before (Pre, first row) and after (Post, second row) the brain surgery

Questions:

Q1. Indicate which **level of invasiveness** and **EEG method** you would choose for the purposes of the study and **why**. *(2 points)*

Q2. Indicate which **connectivity estimator** (among those studied in the course) would be more appropriate to the purposes of the study. **Justify your choice.** Indicate **the pros and cons** of this estimator. *(3 points)*

Q3 – Assuming that the analysis returns the functional networks and the corresponding adjacency matrices reported in **Fig. 1:**

Q3.1: Compute the network **Global Efficiency** for each graph (Pre and Post conditions) *(2 points)*

Q3.2: Comment on which condition (pre or post) shows the more effective communication in the network. *(1 point)*

(End of the test)