

44\_Concorso Pubblico, per titoli ed esami, per la copertura a tempo determinato, della durata di cinque anni per n. 1 posto di RICERCATORE SANITARIO da assegnare alla SC NEUROLOGIA, SALUTE PUBBLICA E DISABILITÀ

### PROVA 1

1. Hai un paziente con cerebrolesione e raccolte multimodali: dati di risonanza magnetica, EEG, dati clinici (scale, deficit focali, farmaci), e dati longitudinali (baseline + follow-up). Descrivi una pipeline end-to-end per integrare questi dati in un unico framework di analisi
2. Cos'è un software Open Source e in cosa si distingue dagli altri?
3. Leggere e tradurre il seguente testo

## EEG Power spectra and subcortical pathology in chronic disorders of consciousness

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### Abstract

**Background.** Despite a growing understanding of disorders of consciousness following severe brain injury, the association between long-term impairment of consciousness, spontaneous brain oscillations, and underlying subcortical damage, and the ability of such information to aid patient diagnosis, remains incomplete.

**Methods.** Cross-sectional observational sample of 116 patients with a disorder of consciousness secondary to brain injury, collected prospectively at a tertiary center between 2011 and 2013. Multimodal analyses relating clinical measures of impairment, electroencephalographic measures of spontaneous brain activity, and magnetic resonance imaging data of subcortical atrophy were conducted in 2018.

**Results.** In the final analyzed sample of 61 patients, systematic associations were found between electroencephalographic power spectra and subcortical damage. Specifically, the ratio of beta-to-delta relative power was negatively associated with greater atrophy in regions of the bilateral thalamus and globus pallidus (both left > right) previously shown to be preferentially atrophied in chronic disorders of consciousness. Power spectrum total density was also negatively associated with widespread atrophy in regions of the left globus pallidus, right caudate, and in the brainstem. Furthermore, we showed that the combination of demographics, encephalographic, and imaging data in an analytic framework can be employed to aid behavioral diagnosis.

**Conclusions.** These results ground, for the first time, electroencephalographic presentation detected with routine clinical techniques in the underlying brain pathology of disorders of consciousness and demonstrate how multimodal combination of clinical, electroencephalographic, and imaging data can be employed in potentially mitigating the high rates of misdiagnosis typical of this patient cohort.



 



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## PROVA 2

1. Hai a disposizione dei dati multimodali (es. EEG, MRI, clinici) ottenuti su soggetti con cerebrolesione e controlli. Illustra un'opportuna procedura di analisi per integrare questi dati e per costruire e valutare le performance di un algoritmo di machine learning
2. Cos'è Python e a cosa serve?
3. Leggere e tradurre il seguente testo

# Multimodal Study of Default-Mode Network Integrity in Disorders of Consciousness

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**Objective:** Understanding residual brain function in disorders of consciousness poses extraordinary challenges, and imaging examinations are needed to complement clinical assessment. The default-mode network (DMN) is known to be dysfunctional, although correlation with level of consciousness remains controversial. We investigated DMN activity with resting-state functional magnetic resonance imaging (rs-fMRI), alongside its structural and metabolic integrity, aiming to elucidate the corresponding associations with clinical assessment.

**Methods:** We enrolled 119 consecutive patients: 72 in a vegetative state/unresponsive wakefulness state (VS/UWS), 36 in a minimally conscious state (MCS), and 11 with severe disability. All underwent structural MRI and rs-fMRI, and a subset also underwent <sup>18</sup>F-fluorodeoxyglucose positron emission tomography (FDG-PET). Data were analyzed with manual and automatic approaches, in relation to diagnosis and clinical score.

**Results:** Excluding the quartile with largest head movement, DMN activity was decreased in VS/UWS compared to MCS, and correlated with clinical score. Independent-component and seed-based analyses provided similar results, although the latter and their combination were most informative. Structural MRI and FDG-PET were less sensitive to head movement and had better diagnostic accuracy than rs-fMRI only when all cases were included. rs-fMRI indicated relatively preserved DMN activity in a small subset of VS/UWS patients, 2 of whom evolved to MCS. The integrity of the left hemisphere appears to be predictive of a better clinical status.

**Interpretation:** rs-fMRI of the DMN is sensitive to clinical severity. The effect is consistent across data analysis approaches, but heavily dependent on head movement. rs-fMRI could be informative in detecting residual DMN activity for those patients who remain relatively still during scanning and whose diagnosis is uncertain.

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### PROVA 3

1. Devi organizzare la pipeline di uno studio sui pazienti in sedazione/anestesia per studiare i modelli di coscienza. A che indagine sottoporresti i pazienti e con che scopo?
2. Cos'è Matlab e a cosa serve?
3. Leggere e tradurre il seguente testo

#### Sleep patterns associated with the severity of impairment in a large cohort of patients with chronic disorders of consciousness



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#### HIGHLIGHTS

- PSG is a reliable means of studying chronic DOC patients.
- UWS/VS patients with even severe impairment show residual sleep patterns.
- The presence of slow-wave sleep is correlated with high CRS-R scores.

#### ABSTRACT

**Objective:** We assessed sleep patterns in 85 patients with chronic disorders of consciousness (DOC) in order to reveal any relationship with the degree of the impairment.

**Methods:** Nocturnal polysomnography (PSG) was scored in patients classified as being in an unresponsive wakefulness syndrome/vegetative state (UWS/VS; n = 49) or a minimally conscious state (MCS; n = 36) in accordance with the rules of the American Academy of Sleep Medicine. The PSG data in the two diagnostic groups were compared, and the PSG parameters associated with the degree of impairment were analysed.

**Results:** In 19/49 UWS/VS patients, signal attenuation was the only EEG pattern detectable in sleep. Non-REM 2 (NREM2) and slow-wave sleep (SWS) (but not REM) stages were more frequent in the MCS patients. The presence of SWS was the most appropriate factor for classifying patients as UWS/VS or MCS, and the duration of SWS was the main factor that significantly correlated with revised Coma Recovery Scale scores.

**Conclusion:** The presence of NREM sleep (namely SWS) reflects better preservation of the circuitry and structures needed to sustain this stage of sleep in DOC patients.

**Significance:** PSG is a simple and effective technique, and sleep patterns may reflect the degree of impairment in chronic DOC patients.

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