

ARTIFICIAL INTELLIGENCE

DM629PNRR/DAUIN -AI algorithms for the detection of REM sleep behavior disorder (RBD) via tachogram and other biosignals measured via wearable devices

Funded By	Dipartimento DAUIN MINISTERO DELL'UNIVERSITA' E DELLA RICERCA [P.iva/CF:97429780584] UNIVERSITA' DI PISA [P.iva/CF:00286820501]
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Context of the research activity	<p>This project focuses on REM sleep behaviour disorder (RBD), a parasomnia with a conversion rate to Parkinson's disease (PD) exceeding 85%. Currently, the diagnosis of PD is clinical. However, when symptoms appear, neurodegeneration is already advanced. Early RBD diagnosis could pave the way for mass screening.</p> <p>The diagnosis of RBD requires video-polysomnography, not suitable for mass screening. We want use data from wearable devices and AI algorithms to get information from sub-optimal data</p> <p>Progetto finanziato dal PNRR a valere sul DM 629/2024 "Generica di ricerca PNRR" - CUP: E14D24002310006</p>
Objectives	<p>This project aims to fill the lack of automatic, non-invasive and low-cost techniques to support early diagnosis of neurodegenerative diseases. Based on encouraging preliminary results on the diagnosis of sleep disorders using lightweight and low-cost instrumentation, the objective is to develop ML/AI algorithms to perform an RBD/ non RBD classification based on a tachogram (sequence of time intervals between successive peaks of the ECG signal) recorded during sleep using a wearable device (chest heart rate monitor or wrist-based optical reader). In fact, it is known that heart rate variability is closely related to these disorders. Results can be enhanced by enriching the data with an EMG and/or EEG channel, to meet the sensitivity and specificity requirements required by screening applications (low false negative rates). The research will therefore focus on the implementation of algorithms characterized by:</p> <ul style="list-style-type: none">-use of multimodal data;-strict reliability requirements;

-high levels of interpretability (essential in clinical applications);
-high generalizability, to include data collected with different devices, in different conditions, on people with very different phenotypes and demographics.

These requirements are stringent and justify the need for very accurate implementation and validation of new algorithms. In this regard, the technique will be validated through a measurement campaign performed both in hospital and at home. The work will be carried out in the context of a long-lasting collaboration with various hospitals, including the Neurology department and the Center for sleep disorders of the Molinette Hospital, the Italian Auxological Hospital of Piancavallo (VB), the Policlinico Umberto I of Rome and others.

**Skills and
competencies
for the
development of
the activity**

- Knowledge in the fields of signal processing, data analysis, statistics and machine learning.
- Basic knowledge of biosignal data processing (EEG, ECG, EMG, EOG).
- Good knowledge of C, Python, Matlab, Simulink programming languages.
- Good interpersonal skills and knowledge of the Italian language, to effectively manage interactions with patients during evaluation studies.