

Master 2 Internship

Title: Time-frequency analysis of physiological data during sleep

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PhD funding (if any): proposal to ANR and CNRS prematuration projects fundings

Project:

Scientific background and objective of the project: Obstructive sleep apnoea/hypopnoea syndrome (OSAHS) is a common, often undiagnosed disorder that is increasingly being identified as a potential risk factor for the development of chronic diseases (cardio-respiratory, metabolic, neurological), as well as a life-threatening condition in untreated cases. It is characterised by the repetition of partial breathing pauses (hypopnoeas) or total breathing pauses (apnoeas) during sleep. The apnoea/hypopnoea index (AHI), proposed in the 1970s by C. Guilleminault (Guilleminault et al. 1973), and since recognised as the universal (and only) marker of the severity of OSA, is now revealing its many limitations in predicting the adverse effects of OSA and the response to treatment. As a result, new physiological measures are now being sought to gain a better understanding of the severity of OSA. In this context, we have developed an original analysis based on the time/frequency coherence (wavelet function analysis) of cardiorespiratory signals, from which we have extracted a low-frequency mode (apneic mode) (Guillet 2021). Analysis of the dynamics of this mode leads to calculation of the Regularity of the Apneic Mode (RAM) and its intensity (RMAi). The aim of this project is to confirm the value of RMA and RMAi in the diagnosis of OSAHS and to quantify their effectiveness as markers of the severity and/or severity of OSAHS. The aim is then to use them to identify phenotypes (classification of forms of OSAHS in relation to other pathologies, age, sex, ancestry, blood group and lifestyle...), to guide treatment and/or to predict associated risk factors in order to participate in the development of precision and/or personalised medicine for OSAHS.

Internship : The OSAHS markers proposed in this project have taken advantage of the most advanced advances made by teams of physicists and mathematicians in the study of spatio-temporal correlation in non-stationary signals (Chavez et al. 2019, Guillet 2022), to define the two markers RMA and RMAi proposed here in the context of OSAHS. RMA and RMAi are innovative markers because they correspond to a biophysical identification of sleep apnoea as a resonant mode. The analysis is based on the time/frequency coherence of cardiorespiratory signals, from which a low-frequency mode (apnoeic mode) is extracted. Once the extraction of the mode has been optimised, a second step consists of analysing the temporal dynamics of this mode to extract the Regularity of the Apneic Mode (RMA) and its intensity (RMAi). Computer software for calculating RMA and RMAi has already been designed and tested on NSSR (National Sleep Research Resource - standardised files in EDF (European Data File) format) sleep databases. The trainee student will work on the numerical codes already developed, adapting them to the databases of the team of Bordeaux clinicians involved in this project (SANPSY) and validating the markers previously identified on the NSSR databases.

Length of intership: 4-6 months

Trainee's area of expertise: computer engineering, programming. Interest in medical issues. Applications must include a cover letter and CV.

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Partner Laboratory: Contact: Jacques Taillard, CNRS Research Engineer, UMR 6033 SANPSY (Sleep, Addiction and Neuropsychiatry). Email: Jacques.taillard@u-bordeaux.fr

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