INPhINIT
"la Caixa" Fellowship Programme

IBEC
Institute for Bioengineering of Catalonia

EXCELENCIA SEVERO OCHOA

IBEC participates in INPhINIT, "la Caixa" Doctoral Fellowship Programme with a set of stimulating PhD projects and excellent research groups to host the fellows

Biomedical signal processing and interpretation group

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Multimodal physiological biomarkers and mHealth tools for non-invasive monitoring and assessment of asthmatic patients

Among patients with chronic obstructive pulmonary disease, asthma is one of the most prevalent pathology. Patients with asthma have poor quality of life and consume many healthcare resources. The effect of asthma is characterized by persistent airflow limitation and is classically assessed by spirometry studying the bronchodilator response.

However, this classical approach does not permit an accurate estimation of asthmatic patient severity, assessment of drug response or early detection of acute exacerbations. Therefore, there is a need to develop new methods to identify and assess patients with asthma. These include the analysis of the activity of respiratory muscles, and the analysis of respiratory sounds, for the detection and characterization of continuous adventitious respiratory (CAS) sounds.

The aim of this study is to propose and develop novel multimodal physiological biomarkers (MPBs), estimated by signal processing algorithms to detect and characterize CAS, such as wheezes, which can differentiate asthmatic patients with and without significant bronchodilator response (BDR). On the other hand, non-invasive monitoring of these MPBs, including respiratory muscle activity, will be developed for mHealth tools in platforms including wearables and smartphones devices.

The project will be based on recent contributions to novel MPB, developed in our laboratory (Lozano et al. PlosOne 2017; Lozano et al. JBHI 2016, Lozano et al. Signal Processing 2016) and will be adapted and improved for non-invasive monitoring of asthmatic patients using mHealth tools.

The study will be carried out in collaboration with international and national scientific and clinical groups.

Recent group publications in this topic:

1. Lozano, M., Fiz, J. A., Martínez-Rivera, C., Torrents, A., Ruiz-Manzano, J., Jané, (2017) R. Novel approach to continuous adventitious respiratory sound analysis for the assessment of bronchodilator response PLoS ONE 12, (2), e0171455.

2. Lozano, M., Fiz, J. A., Jané, R., (2016). Automatic differentiation of normal and continuous adventitious respiratory sounds using ensemble empirical mode decomposition and instantaneous frequency IEEE Journal of Biomedical and Health Informatics 20, (2), 486-497.

3. Lozano, Manuel, Fiz, J. A., Jané, Raimon, (2016). Performance evaluation of the Hilbert–Huang transform for respiratory sound analysis and its application to continuous adventitious sound characterization Signal Processing 120, 99-116.

Job position description

The group's research addresses the design and development of advanced signal processing techniques and the interpretation of biomedical signals to improve non-invasive monitoring, diagnosis, disease prevention and pathology treatment.
Our main objective is to improve diagnosis capability through the characterization of physiological phenomena and to enhance early detection of major respiratory and cardiac diseases and sleep disorders.
Interdisciplinary research on ICT and m-Health tools.
Proposal of novel multimodal physiological biomarkers.
International collaboration with outstanding research centers and Hospitals