

# COMPASS: COntinuous Multi-variate monitoring for Patients Affected by chronic obstructive pulmonary diSeaSe

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## INTRODUCTION

Demographic development in the past years have shown that populations are growing older. This leads to more patients with chronic diseases. Chronic Obstructive Pulmonary Disease (COPD) is one such chronic disease and is the fourth leading cause of death worldwide [1]. To mitigate the effects of COPD, fast detection of exacerbation episodes is essential. This project will combine the expertise of Biovotion in multi-sensor development for healthcare applications with those of HES-SO in the integration and evaluation of multi-variate data. The results of this collaboration will be a Swiss telemedicine eHealth environment to monitor patients affected with COPD and be able to recognize or even predict episodes of exacerbation.

## AIMS

Solutions will be developed for reducing the mass of increasingly available sensor information into meaningful actionable medical information. There are varied requirements for delivery of this actionable information to health care providers such as nurses and doctors. The outcome of this project will be the availability of an advanced, interoperable personal health system that is comfortable to use for COPD patients. This system will allow doctors and patients to easily access a high quality machine learning analysis performed on the multi-variate data produced, based on data measured with the Biovotion Vital Sign Monitor (VSM). The project has three main aims: Interoperability Technology, Pervasive Healthcare and Machine Learning for COPD.

## INTEROPERABILITY TECHNOLOGY

Interoperability technology, as recommended by the Swiss confederation (HL7, IHE) allows for a better control of the costs and a reduction in administrative work and medical errors. Our interest resides in using interoperability technologies to handle the storing and representation of the data, but also to allow connectivity of our devices with existing standards.

## PERVASIVE HEALTHCARE

In COMPASS, we are interested in creating a Pervasive Patient Monitoring Service (PPMS) [2] to monitor health conditions at any time in any location. One of the challenges and novelty that COMPASS will bring to pervasive healthcare resides in the definition of mobile techniques for feature extraction in multivariate physiological time series. The contribution will be a PPMS that can provide efficient processing and transmission of data in a mobile platform. The transmission of data is three orders of magnitude more expensive than processing the same data, so if processing capabilities are available, it is convenient to make use of them in the mobile platform and thus compress the data to a simple set of features to be used in subsequent machine learning tasks.

## MACHINE LEARNING FOR COPD

The interesting innovation that we can propose with COMPASS is to use machine learning techniques to provide an accurate prediction of when the patient may move from a stable state to an exacerbated state. In addition we will develop a solution that can provide predictions on how the patient is responding with respect to the rehabilitation process that follows an exacerbation. The technical objective of the prediction task is to be able to master the use of linear and non-linear multivariate regression techniques to provide an accurate prediction of the patient future physiological values.

1 Russi, EW, Karrer, W, Brutsche, M, Eich, C, Fitting, JW, Frey, M, Geiser, T, Kuhn, M, Nicod, L, Quadri, F, Rochat, T, Steurer-Stey, C, Stolz, D (2013). Diagnosis and management of chronic obstructive pulmonary disease: the swiss guidelines. Official guidelines of the swiss respiratory society. *Respiration*, 85, 2:160-74.

2 Varshney U., *Pervasive Healthcare Computing: EMR/EHR, Wireless and Health Monitoring*. Springer Publishing Company, Incorporated, 2009