has triggered the investigation of specific groups of patients to which tailor effective interventions, and to research the factors related to the spontaneous participation in daily physical activity.

New technologies such as wearable sensorized systems, deployed on a large scale, and data analysis techniques offer new opportunities beyond the traditional way of collecting and interpreting clinical data and may play a major role in understanding and generating new insights into this complex disease. With the availability of large sets of health data, medical doctors and other healthcare professionals may benefit from new diagnostic and therapeutic opportunities far beyond what is possible with today's occasional examinations. They will have access to long-term recordings of physiological data measured in natural environments including patient's activity and the situations to which he has been exposed to. An important component in this ecosystem is data analytics, giving value and meaning to the collected data and enabling the personalized healthcare decisions in the full circle of care around an individual. Specifically, the collected data should be the input for analysis and generation of features that can represent the condition (status and trend) of the patient, at multiple levels. It is therefore essential to investigate new techniques to analyse these data in order to fully exploit their potentials, allow the permeation of these new technologies, and in turn enable new care services such as automatic coaching systems and diagnostic supportive systems.

1.3 Aim of the thesis

The thesis aims at developing training, monitoring and decision making systems for patients suffering from chronic diseases with the goal to meet the healthcare challenges by paving the way for a pervasive, user-centred and preventive healthcare model. The overall project objective aims at finding new insights into the disease in order to increase the efficacy of pulmonary interventions and to lay the foundations for the new generation of healthcare services, whilst increasing efficiency to cope with shortage of healthcare staff.

1.4 Scope of the thesis

This thesis concerns the following main areas: i) ubiquitous patient monitoring and training, ii) mining of data from a large cohort of patients, iii) machine learning approaches for physical activity pattern identification and patient classification. In particular, the thesis contains the following contributions:

- Two smartphone-based frameworks have been implemented for the rapid prototyping of healthcare applications able to 1) interconnect external devices and therefore enabling multiple sensing modalities especially suitable for patient monitoring; 2) utilize only the smartphone internal sensors for convenient patient training.
- New insights that may increase the efficacy of tailored physical activity enhancement interventions in patients with COPD were derived analysing a large cohort of patients. In particular, 1) using clustering analysis groups of patients were identified with different physical activity patterns and characteristics; 2) it has been shown that patients having had a better night of sleep as assessed by objective measures spontaneously engaged in more physical activity the following day.