Novel metrics, that can be used for patient's assessment and monitoring, and the development of classification algorithms to process multiple input parameters were developed. Chapter 6 discusses a methodology able to integrate and analyse physical activity measures, thereby creating a set of probabilistic features that could be valid constructs to quantify physical activity behaviour change. The methodology discovers the main physical activity routines that are active in the assessed days of the subjects under study and these prove to be substantially different between healthy subjects and COPD patients regarding their composition and moments in time at which transitions occur. Furthermore, these routines show consistent trends relating to disease severity as measured by standard clinical practice. In chapter 7 a technique for predicting the pathological condition in patients with COPD is introduced based on features extracted from multimodal sensor data during night-time only. The usefulness of the proposed approach has been demonstrated by applying it to a real-world COPD patient cohort. The results showed that it is possible to differentiate between healthy and patients with COPD with 94% accuracy and between disease severity and dyspnoea severity with an accuracy of 94% and 93%, respectively.