6.2 Related works

6.2.1 COPD Ambulatory Monitoring

The automatic monitoring and analysis of chronic diseases has always been central in research on wearable sensors. Physical activities in patients with moderate to very severe COPD has been objectively documented using motion sensors, which provide more accurate, individualized, and detailed information on body movement than questionnaires [127]. Liao et al. [128] provided a review focused on describing current wearable technologies for measuring the PA level of COPD patients. In particular, validated devices should be used, since activity monitors can be less accurate in patients whose walking speeds is as low as 0.5 miles/h. The use of data from ten wearable sensors as indicator of PA levels and physiological responses to recognize a set of 11 scripted activities is illustrated in [129]. In particular, a comparative study of supervised machine learning techniques is presented with emphasis placed on achieving high recognition accuracy. The number of sensors and the complexity of the algorithms are second to that objective. Research on PA levels of COPD patients usually deploys one single activity monitor to minimize obstructiveness.

6.2.2 COPD Physical Activities

It has been consistently shown that COPD patients have lower PA levels than their healthy peers [130], and that reduced levels of PA are related to an increased risk of hospital admission and mortality [17]. Outcome variables related to this type of analysis are focused mainly on amount and volume parameters, such as number of steps, walking time, volume of PA as expressed by total number of counts, and total EE. Although these are important health markers of patients suffering from COPD, interventions thus far have failed to demonstrate important increases in these outcome variables. Moreover, the relation with severity of the disease, assessed by the forced expiratory volume in the first second (FEV_1), is not strong or not significant [45]. Bouts of PA described by their frequency, duration, and intensity were introduced by Gonzalez et al. [51] in order to explore whether these patients meet the general guidelines for PA for older adults. Information about physiological responses was not considered in the analysis.

6.2.3 Symbolic Representation of Data

Alternatively to the selection of statistical attributes (such as mean duration of activity bouts within a day or the time spent in activity bouts of different intensities) which are mainly driven by intuition and experience, other approaches can be used to represent and analyse patient's data. Symbolic representation of continuous data offers several advantages, such as the possibility to be used in combination of a wide set of algorithms from the text processing community. Symbolic approaches like SAX [131] have been proposed to reduce efficiently a time series to a set of symbols of a vocabulary. In addition to the a priori fixed size of the vocabulary, this method assumes a particular distribution, which may not be always valid and may limit the performance of series mining tasks [132], [133]. In order to construct features for discriminative