always hold. Therefore, next to finding the light on and light off markers, it is of interest to have an indicator whether such a model is applicable at all.

Multi-sensor activity monitors, such as the SWA, allow the assessment of sleep and wakefulness period. In particular, in the SWA, actigraphy data is classified in a binary form into wake = 0 and sleep = 1 for each specific minute. The same minutes are also classified into lying down = 0 or not lying down = 1 according to the activity monitor's proprietary algorithm.

The method to find light on and light off markers relies on an algorithm able to segment several days of continuous actigraphy data in time in bed and time out of bed. The algorithm is based on the minutes assessed as lying down moments by the SenseWear armband. A probability distribution and a measure of uncertainty are derived and used to initialize a biphasic model (time in bed-time out of bed). The model is further refined according to the closest lying epochs assessed by the multi-sensor activity monitor.

In a nutshell the algorithm clusters together sleeping epochs related to the time in bed of the subject and it quickly classifies the sleeping pattern of a subject during the assessed days as regular or irregular (i.e. not fitting to the concept of a biphasic model).

In essence the approach is a three-step procedure. In the first step, an average sleep-awake probability distribution or model is created together with an uncertainty distribution or model. The second step is to adapt this average model to each specific day (24 hours sequence) in order to determine the specific time in bed period for that particular sequence. As a third step, the sleep measures depending on the bed/awake segmentation are calculated per day. The first step also directly yields means to generate indicators for the properness of a biphasic model.

Figure 26 shows the output of the SenseWear activity monitor including metabolic equivalent of task (MET), sleep and lying down periods. As can be seen both the lying down (light green) and the sleep (magenta) periods yield fragmented episodes within each 24 hours preventing a straightforward association with desired sleep /awake indicator.

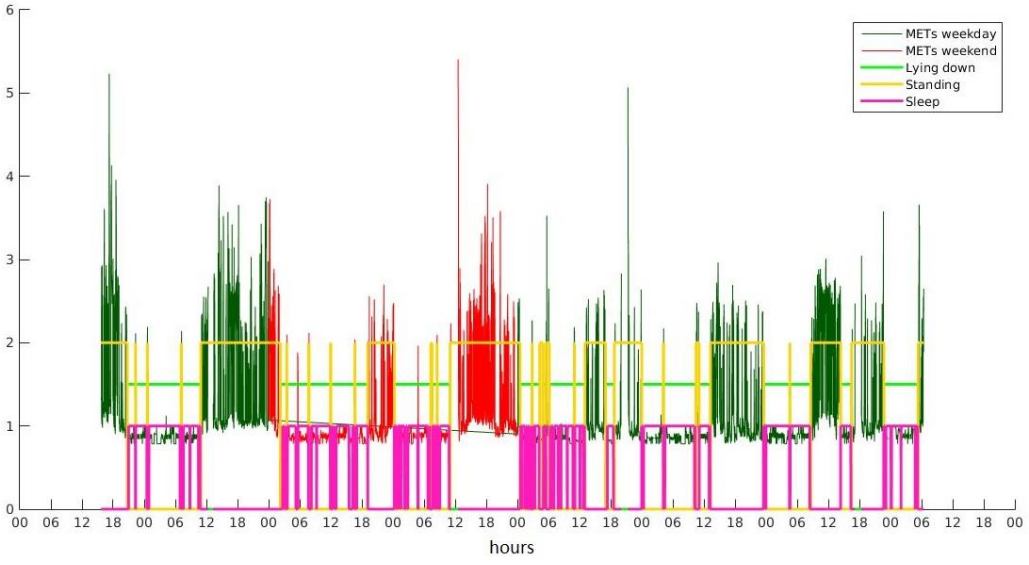

Figure 26 Several days of data recordings. In yellow: on=standing, in light green: on=lying down, in magenta: on=sleeping, in dark green and red metabolic equivalent of tasks (METs) estimates for weekdays and weekend days, respectively. For clarity, the lying down and standing are scaled to the intervals [0, 1·5] and [0, 2], respectively.