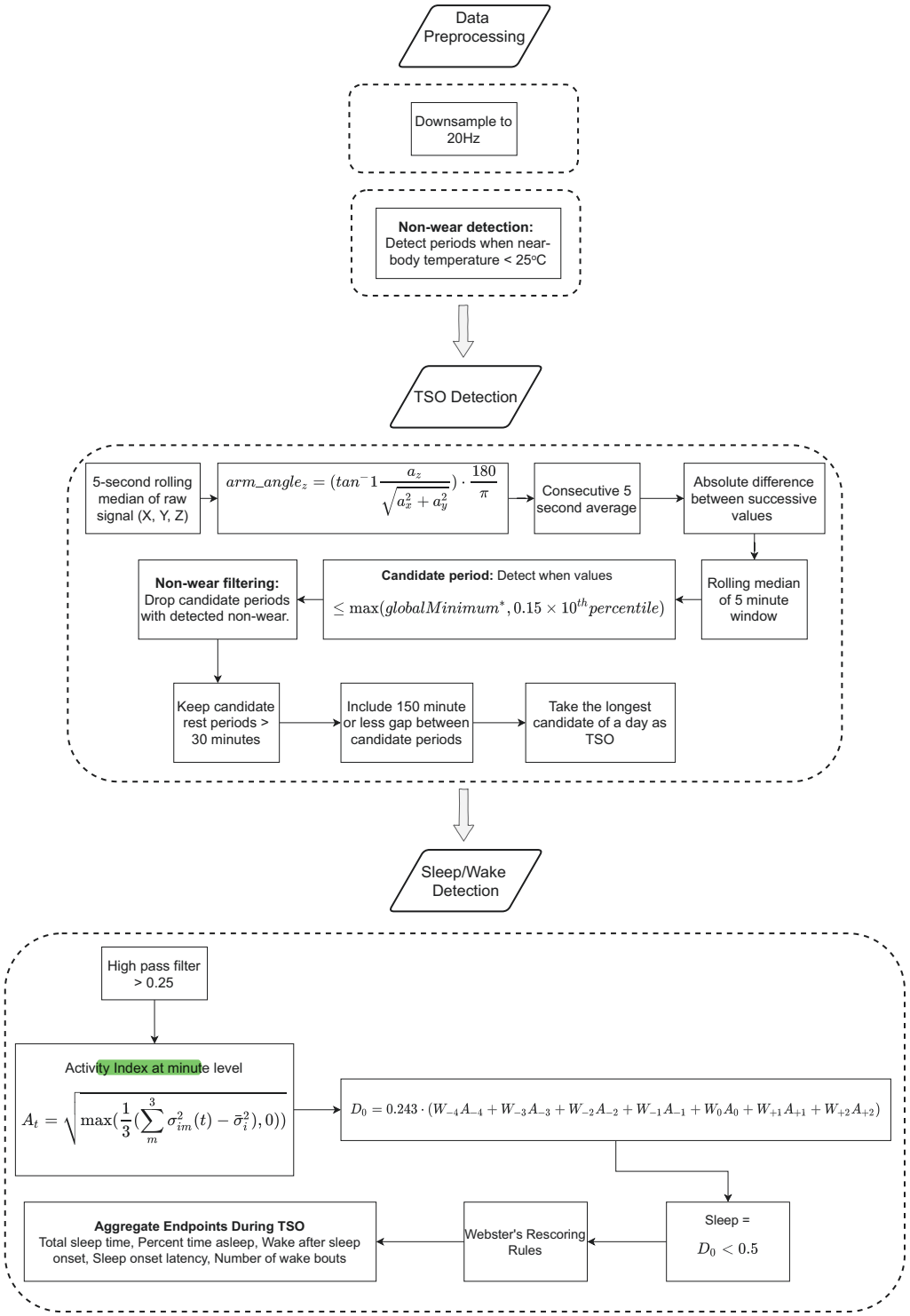

Fig. 4 Overview of the sleep module processing pipeline. The pipeline consists of data preprocessing, total sleep opportunity (TSO) and wear detection, sleep/wake classification, and sleep assessment. *Global minimum is set to 0.1 based on the 25th percentile value of all valid (on-body) data (see Supplementary Fig. 7). Block with a dashed outline provides a detailed illustration of steps in the preceding block with a solid outline.

which were not available for the wearable device used in this study. Therefore, an open-source activity index metric[32] was used as a proxy for activity counts in our implementation. Webster's rescoring rules were applied to the binary sleep–wake predictions to improve specificity[11]. Digital measures of sleep were derived for each 24-h segment by processing the sleep–wake predictions during the determined TSO window as seen in Table 4.

Scratch module

Predictions of nighttime scratch were generated via a two-tiered approach (Fig. 5b). First, the presence of hand movement was determined, and then those periods of hand movement were classified as either scratch or non-scratch events. Sample-level accelerometer data were segmented into 3-s non-overlapping windows within the selected TSO window for a given 24-h period. After testing multiple window lengths (1, 2, and 3 s), we found