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(54) Title: DETERMINING REAL-TIME SLEEP STATES USING MACHINE LEARNING TECHNIQUES

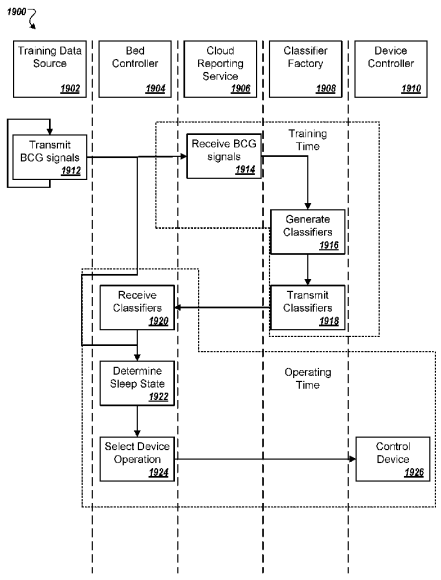

FIG. 19

(57) Abstract: Cardiac data defining at least inter-beat interval (IBI) sequences is received. Tagging data that defines tags of sleep-states for the IBI sequences is received. A sleep-state classifier is generated using the cardiac data and the tagging data, the generating may include: extracting the IBI sequences from the cardiac data; training a convolutional neural network (CNN) using as input the cardiac data and the tagging data to generate intermediate data; and iteratively training a recurrent neural network (RNN) configured to produce state data as output, the iterative training of the RNN using i) the intermediate data as an initial input and ii) the intermediate data and a previous state data as subsequent input.

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