CLAIMS

1. A method for profiling sleep of an individual including:

defining a sleep feature space for the individual based on electroencephalogram (EEG) training data that is obtained prior to sleep to be profiled;

measuring a brain wave for the individual during the individual's sleep;

mapping the sleep feature space in response to a comparison of the brain wave during the individual's sleep and a previous brain wave based on the training data that is obtained prior to the sleep to define the sleep feature space;

modelling the mapped sleep feature space in response to recognized neural network patterns corresponding to each of a plurality of sleep stages derived from recognizing the neural network patterns from the sleep feature space by identifying same neural network patterns defined in both the sleep feature space based on the training data that is prior to the sleep and the sleep feature space obtained during the individual's sleep; and

deriving a sleep profile for the individual that provides a representation of change in sleep from sleep stages determined in response to the modelled mapped sleep feature space and the brain wave of the individual.

2. The method in accordance with claim 1, further comprising calculating an energy power ratio instead of absolute energy power in order to determine measurements of spectrum power that are subject-independent.

3. The method in accordance with claim 1 or claim 2, wherein the step of defining a sleep feature space for the individual includes:

extracting a predetermined number of spectral power ratios of the brain wave;

processing the predetermined number of spectral power ratios to extract spectral envelope features of the brain wave; and

extracting Gaussian parameters of the brain wave to define the sleep feature space for profiling sleep of the individual.

4. The method in accordance with claim 3, wherein extracting a spectral power ratio includes:

identifying a plurality of temporally shifted overlapping spectrum windows from the brain wave;

extracting spectral features of the plurality of temporally shifted overlapping spectrum windows;

determining a total power for a predetermined number of cutoff frequency bands within the brain wave; and

determining the predetermined number of spectral power ratios of the brain wave in response to the total power and a spectral power band for each of the predetermined number of cutoff frequency bands.

5. The method in accordance with claim 3, wherein processing the predetermined number of spectral power ratios to extract spectral envelope features of the brain wave includes envelope-based spectral filtering the predetermined number of spectral power ratios by a Chebyshev type II filter to extract multiple spectral envelope features for each spectral power ratio of the brain wave.

6. The method in accordance with claim 3, wherein extracting the Gaussian parameters includes extracting mean and variations of the predetermined number of spectral power ratios of the brain wave and of the multiple spectral envelope features of the predetermined number of spectral power ratios to form the sleep feature space for profiling sleep of the individual.

7. A method for modelling sleep profiles for an individual including:

measuring a brain wave for the individual;

extracting a predetermined number of spectral power ratios of the brain wave;

processing the predetermined number of spectral power ratios to extract spectral envelope features of the brain wave that make evident a periodic nature of a categorical time series and variation of the spectral power ratios over time; and

modelling the spectral power ratios with a Gaussian distribution in order to extract Gaussian parameters of the brain wave to form a sleep feature space for profiling sleep of the individual.

8. The method in accordance with claim 7, wherein measuring includes measuring an EEG of the individual.

9. The method in accordance with claim 7, wherein extracting a spectral power ratio includes:

identifying a plurality of temporally shifted overlapping spectrum windows from the brain wave;

extracting spectral features of the plurality of temporally shifted overlapping spectrum windows;

determining a total power for a predetermined number of cutoff frequency bands within the brain wave; and

determining the predetermined number of spectral power ratios of the brain wave in response to the total power and a spectral power band for each of the predetermined number of cutoff frequency bands.

10. The method in accordance with claim 7, wherein processing the predetermined number of spectral power ratios to extract spectral envelope features of the brain wave includes envelope-based spectral filtering the predetermined number of spectral power ratios by a Chebyshev type II filter to extract multiple spectral envelope features for each spectral power ratio of the brain wave.

11. The method in accordance with claim 7, wherein extracting the Gaussian parameters includes extracting mean and variations of the predetermined number of spectral power ratios of the brain wave and of the multiple spectral envelope features of the predetermined number of spectral power ratios to form the sleep feature space for profiling sleep of the individual.

12. A method for profiling sleep of an individual including:

defining a first sleep feature space for the individual based on electroencephalogram (EEG) training data that is obtained prior to sleep to be profiled;

measuring a brain wave for the individual during the individual's sleep and generating a second sleep feature space representative of the measured brain wave;

mapping the second sleep feature space to the first sleep feature space by comparing the brain wave and a previous brain wave measurement used to define the first sleep feature space that is based on the EEG training data;

modelling the first sleep feature space using recognized neural network patterns in EEG data corresponding to each of a plurality of sleep stages with particular EEG features that are associated with groups of features in the first sleep feature space; and

deriving a sleep profile for the individual from sleep stages by applying the modelled sleep feature space to the mapped sleep feature space and by comparing the groups of features in the first sleep feature space with similar features in the second sleep feature space.

13. A method for profiling sleep of an individual including:

defining a sleep feature space comprising spectral power ratios and spectral envelope features for the individual that make evident a periodic nature of a categorical time series and variation of the spectral power ratios over time;

measuring a brain wave for the individual during the individual's sleep;

mapping features of a further sleep feature space acquired from the brain wave measurement during the individual's sleep to the spectral power ratios and the spectral envelope features;

modelling the mapped sleep features in response to recognized neural network patterns corresponding to each of a plurality of sleep stages derived from recognizing the neural network patterns from the sleep feature space by identifying

same neural network patterns defined in both the sleep feature space based on training data that is prior to the sleep and the further sleep feature space obtained during the individual's sleep; and

deriving a sleep profile for the individual from sleep stages determined in response to the modelled mapped sleep feature space and the brain wave of the individual.

14. A method for profiling sleep of an individual including:

defining a first sleep feature space for the individual using electroencephalogram (EEG) training data that is obtained prior to sleep to be profiled;

measuring a brain wave for the individual during the individual's sleep and generating a second sleep feature space representative of the measured brain wave;

mapping the second sleep feature space by comparing the first sleep feature space with the second sleep feature space;

modelling the first sleep feature space using recognized neural network patterns in EEG data corresponding to each of a plurality of sleep stages with particular EEG features that are associated with groups of features in the first sleep feature space; and

deriving a sleep profile for the individual from sleep stages by applying the modelled sleep feature space to the mapped sleep feature space and by comparing the groups of features in the first sleep feature space with similar features in the second sleep feature space.