Claims

1. A method for identifying an event, the method comprising:

receiving first data comprising concurrently recorded electroencephalogram (EEG) and electromyogram (EMG) signals from a user, the EEG and EMG signals resulting from movements by the user;

forming first segments from the first data;

computing at least one statistical property of each first segment and forming a histogram to determine thresholds of the statistical property based on:

the number of trials; and

a number of segments in which the at least one statistical property indicated the event based on the at least one statistical property and the thresholds;

receiving second data comprising further EEG and EMG signals recorded from the user;

forming second segments from the second data and computing the statistical property for each second segment; and

processing the second segments using the histogram to determine whether the event has occurred.

2. The method of claim 1, wherein processing the second segments using the histogram to determine whether the event has occurred comprises determining whether the event has occurred based on a number of second segments in which the at least one statistical property exceeds a first threshold defined by the at least one statistical property.

3. The method of claim 2, wherein the event is determined to have occurred if the number of indicative second segments exceeds a second threshold.

4. The method of claim 1, wherein the at least one statistical property includes a peak-to-trough value.

5. The method of claim 4, wherein the at least one statistical property includes a peak-to-trough value for each channel on which the EEG and EMG values are recorded.

6. The method of claim 1, wherein each first segment is a sample formed by sliding window sampling the first data.

7. The method of claim 1, further comprising, upon determining the event has occurred:

comparing the second data to a classification model to determine a user movement represented by the second data; and

determining a control signal for controlling an autonomous vehicle, based on the user movement.

8. A method for classifying signals for movement control of an autonomous vehicle, comprising:

receiving first data comprising concurrently recorded electroencephalogram (EEG) and electromyogram (EMG) signals from a user, the EEG and EMG signals resulting from movements by the user;

training a classification model based on the recorded signals, wherein the classification model comprises one or more data segments, by:

forming first segments from the first data;

computing at least one statistical property of each first segment and forming a histogram to determine thresholds of the statistical property based on:

the number of trials; and

a number of segments in which the at least one statistical property indicated the event based on the at least one statistical property and the thresholds;

receiving second data comprising further EEG and EMG signals recorded from the user;

forming second segments from the second data and computing the statistical property for each second segment; and

processing the second segments using the histogram to determine whether the event has occurred;

upon determining the event has occurred, comparing the second data to the classification model by:

extracting a segment of the second data; and

determining one or more similarity measures between the extracted segment and data segments of the classification model, to determine a user movement represented by the second data; and

determining a control signal for controlling the autonomous vehicle, based on the user movement.

9. The method of claim 8, wherein determining a control signal for controlling the autonomous vehicle comprises identifying a two-dimensional movement of the autonomous vehicle corresponding to the user movement.

10. The method of claim 8, wherein receiving the first data comprises recording EEG and EMG from the forehead of the user using one or more 2-channel sensors.

11. The method of claim 8, wherein receiving the second data comprises recording EEG and EMG from the forehead of the user using one or more 2-channel sensors.

12. The method of claim 8, wherein the one or more similarity measures include Euclidean Distance or Dynamic Time Warping Distance between the segment extracted from the second data and each data segment of the classification model.

13.An apparatus for classifying signals for movement control of an autonomous vehicle, comprising:

at least one electroencephalogram (EEG) sensor for positioning on a forehead of a user;

at least one electromyogram (EMG) sensor for positioning on the forehead of the user;

memory; and

at least one processor, the memory comprising instructions that, when executed by the at least one processor, cause the apparatus to:

receive, at the at least one processor, first data from the at least one EEG sensor and at least one EMG sensor, the first data comprising concurrently recorded electroencephalogram (EEG) and electromyogram (EMG) signals from a user, the EEG and EMG signals resulting from movements by the user;

train, using the at least one processor, a classification model based on the recorded signals, wherein the classification model comprises one or more data segments, by:

forming first segments from the first data;

computing at least one statistical property of each first segment and forming a histogram to determine thresholds of the statistical property based on:

the number of trials; and

a number of segments in which the at least one statistical property indicated the event based on the at least one statistical property and the thresholds;

receive, at the at least one processor, second data from the at least one EEG sensor and at least one EMG sensor, the second data comprising further EEG and EMG signals recorded from the user;

forming second segments from the second data and computing the statistical property for each second segment; and

processing the second segments using the histogram to

determine whether the event has occurred;

upon determining the event has occurred, compare, using the at least one processor, the second data to the classification model by:

extracting a segment of the second data; and

determining one or more similarity measures between the extracted segment and data segments of the classification model,

to determine a user movement represented by the second data; and

determine, using the at least one processor, a control signal for controlling the autonomous vehicle, based on the user movement.

14.The apparatus of claim 13, wherein determining a control signal for controlling the autonomous vehicle is performed by identifying a two-dimensional movement of the autonomous vehicle corresponding to the user movement.

15.The apparatus of claim 13, wherein each sensor of the at least one EEG sensor is a 2-channel sensor.

16.The apparatus of claim 13, wherein each sensor of the at least one EMG sensor is a 2-channel sensor.

17.The apparatus of claim 13, wherein the at least one processor, before receiving second data from at least one EEG sensor and at least one EMG sensor, causes the apparatus to:

receive, at the at least one processor, event detection data from the at least one EEG sensor and at least one EMG sensor, the event detection data comprising concurrently recorded electroencephalogram (EEG) and electromyogram (EMG) signals

from a user, the EEG and EMG signals resulting from movements by the user;

form, using the at least one processor, first segments from the first data;

compute, using the at least one processor, at least one statistical property of each first segment and forming a histogram to determine thresholds of the statistical property based on:

the number of trials; and

a number of segments in which the at least one statistical property indicated the event based on the at least one statistical property and the thresholds;

receive, at the at least one processor, the second data;

form, using the at least one processor, second segments from the second data and computing the statistical property for each second segment; and

process, using the at least one processor, the second segments using the histogram to determine whether the event has occurred.

18.The apparatus of claim 17, wherein the at least one statistical property includes a peak-to-trough value.

19.The method of claim 18, wherein the at least one statistical property includes a peak-to-trough value for each channel on which the EEG and EMG values are recorded.

20.The method of claim 17, wherein each first segment is a sample formed by sliding window sampling the event detection data.