Recognition of Sleep Dependent Memory Consolidation with Multi-modal Sensor Data

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Motivation

Sleep dependent memory consolidation?

Significant performance improvement on a Visual Discrimination Task (VDT) becomes proportional to the amount of sleep in excess of six hours

Correlation in performance to the sleep stages:
1Q: SWS (Slow Wave Sleep)
4Q: REM (Rapid Eye Movements)

Can we predict whether sleep-dependent memory consolidation occurred by using automated analysis of sensor data during sleep?

Data Collection

24 healthy university students (ages 18-22, 16 males)
3 nights of measurements

VDT(PM) → Sleep → VDT(AM)

Measurements

1) Electroencephalogram (EEG, C3, C4, O1 and O2) for the nights in the sleep labs
2) Sleep stage
3) Electrodermal activity (EDA, a measure of sympathetic nervous system activity)
4) Actigraphy (3-axis accelerometer, ACC) from the wrist
5) Task performance improvement on VDT (PM-AM)

Results

The features from EDA alone showed the highest accuracy, around 60-70%

The features from EDA solo or EDA+ACC showed the highest accuracy, 67%, followed by EEG +EDA +ACC.

Conclusions

In all the comparisons here, overall, either solo EDA features or EDA +ACC features improved the classification accuracy compared to use of sleep stages and to use of only EEG.