Title: Findings from Modeling Peaks in Electrodermal Activity during Sleep as a Point Process

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Abstract:
We collected nearly continuous electrodermal activity (EDA) from a wrist sensor worn 30 days by each of 62 undergraduate students as part of the study SNAPSHOT (Sleep, Networks, Affect, Performance, Stress, and Health using Objective Techniques). The students filled out an online survey each morning to report their sleep timing and energy level. Sleep EDA was modeled as a point process by first making the raw EDA signal binary. This signal was then downsampled to 1Hz. We found that the median number of peaks detected per night was 74. Then we modeled this signal for each participant as a point-process by fitting a generalized linear model with a poisson distribution and log link. The rate function of this model depended on the time since sleep start and the history of peaking for up to 180 seconds in the past. We fit several models to each participant by varying the number of seconds the history component considered. The optimal model for each participant was found by minimizing the Akaike Information Criterion (AIC). We found that the median required peaking history is 60 seconds. We also found that the rate of peaking in the first 3 hours of sleep is significantly higher than during the last 3 hours ($p<0.001$). There is a suppression in the rate of peaking 1-2 seconds after a peak, while 3-4 seconds after a peak there is an average 4.9 fold increase in rate of peaking ($p<0.01$). Finally, there is a correlation of -0.38 between the expected first peak time of the EDA during the night's sleep and the average energy reported the following morning ($p<0.01$).

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