



Biometric Healthcare Research Platform: preliminary results using wearable sensors for multi-modal monitoring in epilepsy

Zibrandtsen, Ivan Chrilles; Masulli, Paolo; Jeuris, Steven Tom; Andersen, Tobias; Kjaer, Troels W.

Published in:

Second International Congress on Mobile Health Devices and Seizure Detection in Epilepsy - Book of abstracts

Publication date:

2019

Document Version

Publisher's PDF, also known as Version of record

[Link back to DTU Orbit](#)

Citation (APA):

Zibrandtsen, I. C., Masulli, P., Jeuris, S. T., Andersen, T., & Kjaer, T. W. (2019). Biometric Healthcare Research Platform: preliminary results using wearable sensors for multi-modal monitoring in epilepsy. In *Second International Congress on Mobile Health Devices and Seizure Detection in Epilepsy - Book of abstracts* (pp. 60-60)

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Ivan ZIBRANDTSEN (1), Paolo MASULLI (2), Steven JEURIS (3), Tobias ANDERSEN (2), Troels KJAER (1)

(1) Zealand's University Hospital, Denmark, (2) Department of Applied Mathematics and Computer Science DTU Compute, Technical University of Denmark, Denmark, (3) Department of Health Technology, Technical University of Denmark, Denmark

Seizures may affect different functional brain areas to produce varied clinical manifestations that have measurable correlates in multiple periodic biological signals originating from the heart and brain. The Biometric Healthcare Research Platform (BHRP) is a software architecture suited for collection and analysis of multiple biosignals recorded in different environments. We analyze heart rate and body acceleration from preliminary results of multi-modal monitoring in epilepsy from an epilepsy monitoring unit (EMU).

Data from one of four patients monitored by ECG, EEG and accelerometry in the epilepsy monitoring unit is presented here. During anti-epileptic-drug (AED) tapering, the patient had an accumulating burden of generalized spike-wave paroxysms, increasing over hours from brief transient activity to a continuous epileptiform pattern, clinically manifesting as non-convulsive status epilepticus. We compare accelerometry and ECG measurements from seizure intervals to non-seizure intervals on subsequent days when the patient was normal.

There was a significant difference in HR [$F(4, 29.21) = 103.45, p < 10^{-6}$] between seizure intervals and non-seizure intervals. The Games-Howell post-hoc test shows a significant increase in HR between seizure vs non-seizure intervals ($D = 32.2$ BPM (CI 26.8-37.6), $p < 0.01$) but not between seizure compared to seizure or non-seizure compared to non-seizure. Tests of the acceleration magnitude differences across seizure and non-seizure intervals did not show significance in all comparisons, excluding the possibility that the variation in HR is caused by physical exertion. These preliminary results show the potential of the BHRP platform in allowing the collection of multi-modal data in epilepsy research, which can shed light on the connections between sensor data and ictal activity. Furthermore, that BHRP will be able to operate not only in an EMU setting, but also in a home environment and outdoors.