Doctoral School of Information and Biomedical Technologies Polish Academy of Sciences

Modeling uncertainty in sensor-based monitoring of bipolar disorder

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Dyscipline: Informatyka Techniczna i Telekomunikacja

Recruitment: interview

Number of positions: 1

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Description: This PhD project aims at the development of uncertainty-aware computational methods for sensor-based monitoring of bipolar disorder patients. Bipolar disorder (BD) is a complex, chronic and severely debilitating illness, that characterizes with fluctuations between different mood states, ranging from depression to hypomanic/manic episodes, as well as mixed states. Early recognition of phase change is crucial to increase the patient's chance of an early intervention. Previous studies on BD episode prediction tend to apply either the supervised approach assuming ground truth for the analyses or an unsupervised approach taking limited benefit from the psychiatric labels. This PhD project will specifically focus on modeling uncertainty related to the sensor and psychiatric data, and thus, will enable to include all sensor and psychiatric data in monitoring of BD patients. The primary ambition of this PhD project is to improve predictive performance due to adequate consideration of imprecision related to sensor data and psychiatric assessments. Modeling the level of confidence based on the time that passed from the interview with a psychiatrist is a novel idea in the bipolar disorder context. This PhD project will integrate elements from computational intelligence and signal processing to support the challenging problems of (1) modeling uncertainty related to the outcomes of the psychiatric assessments about the severity of depressive and manic symptoms; (2) modeling imprecision related the measurements from sensors for improved data aggregation. Fuzzy set theory will be applied to model the related uncertainty. Assigning the degree of credibility of psychiatric assessment to sensor measurements and incorporating this imprecision into predictive algorithms is relatively ambitious and promising idea which is expected to contribute to the overall quality of the BD monitoring. Real-life heterogeneous datasets of high medical importance will be enabled for this research. The developed uncertainty-aware approaches will be demonstrated in two use cases: (1) smartphone sensors for monitoring of depression and mania; (2) locomotor sensors for monitoring of psychomotor disturbances in depression. Digital data from sensors are anonymize and stored on secure servers.

Bibliography

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2. Antosik-Wójcińska, A.Z., Dominiak, M., Chojnacka, M., **Kaczmarek-Majer, K.,** Opara, K., Radziszewska, W., Olwert, A., Święcicki, Ł. (2020) **Smartphone as a monitoring tool for bipolar disorder: a systematic review including data analysis, machine learning algorithms and predictive modelling**. International Journal of Medical Informatics, 138:04131.

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