

## **Computational intelligence methods for change point detection in medical processes**

### **Topic supervisor:**

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**Institute:** Instytut Badań Systemowych PAN, ul. Newelska 6, Warszawa

**Discipline:** Informatyka Techniczna i Telekomunikacja

**Recruitment:** interview

**Number of positions:** 1

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### **Description:**

The primary objective of this project is to **develop algorithms to accurately predict phase change in bipolar disorder** using data collected from various sources, namely, smartphones and psychiatric assessments. Bipolar disorder is a serious mental illness affecting more than 2% of the world's population and characterized by fluctuations between different mood phases, ranging from depression to manic episodes and mixed states. Many challenges remain open in regards to the analysis, monitoring and prediction of the mental state of a patient. The mental state was observed only indirectly using smartphone-based data and psychiatric assessment data. Research problems to be solved are the following:

1. **Monitoring stability of indirectly observed process using intelligent combination** of statistical process control and predictive modeling and change point detection approaches
2. **Multilabel classification** approaches
3. **Linguistic summarization for human-machine communication** about change point detection in indirectly observed patients' state

**Real-life heterogeneous dataset of high medical importance** will be enabled for this research. Dataset was collected in the recent years (2017-2019) during the observational study, which was conducted in collaboration of Systems Research Institute, in the Department of Affective Disorders, Institute of Psychiatry and Neurology in Warsaw and in the centre specializing in the clinical trials – Prosen Net. During the study, a dedicated smartphone app was developed and installed on patients' smartphones. It worked in the background to record daily statistics about calls and text messages and to extract the acoustic features of the patient's voice during phone calls, such as for example loudness or pitch. Crucially, the psychiatric state of each study participant was also assessed by doctors.

### **Bibliography**

1. K. Kaczmarek-Majer et. al (2018) Control Charts Designed Using Model Averaging Approach for Phase Change Detection in Bipolar Disorder, Advances in Intelligent Systems and Computing book series (AISC, volume 832), 115-123.
2. O. Kamińska, K. Kaczmarek-Majer, K. Opara, W. Jakuczun, M. Dominiak, A. Antosik, Ł. Świącicki, O. Hryniewicz (2019), Self-organizing maps using acoustic features for prediction of state change in bipolar disorder, In 17th Conference on Artificial Intelligence in Medicine.