The Seminars on "Information Technology Outlook" – PhD Program in Computer Science and Mathematics

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Explaining smartphone-based acoustic data with linguistic summaries for the mental health monitoring

The changes in the manner of speaking reflect the mood state very accurately and are used intuitively by psychiatrists in everyday practice. Considering the possibility of continuous speech data collection via a smartphone app, smartphones have tremendous potential to improve the early detection and monitoring of episodes of mental illnesses. Nevertheless, they are still underutilized in practice. Furthermore, there is still need for common standards and clear guidelines about machine learning algorithms and metrics to be applied when supporting mental health monitoring. Finally, there is still an unmet clinical need to explain relations between attributes, symptoms, and states for this particular applied context. During this seminar, an approach called PLENARY: exPlaining bLack-box modEls in Natural lAnguage thRough fuzzY linguistic summaries will be presented. PLENARY is an explainable classifier based on a data-driven predictive model. Model explanations are derived through the popular SHapley Additive exPlanations (SHAP) tool and conveyed in a linguistic form via fuzzy linguistic summaries. The linguistic summarization allows translating the explanations of the model outputs provided by SHAP into statements expressed in natural language. The approach was validated on preprocessed speech signals collected from smartphones from patients with bipolar disorder and on publicly available mental health survey data. The experiments confirm that fuzzy linguistic summarization is an effective technique to support meta-analyses of the outputs of AI models. This work is a part of the BIPOLAR project. BIPLAR's ambition is to provide an analytical software package that facilitates timely and contextual mental health monitoring aiming to set the foundations to further innovate in the intelligent sensor-based prediction of bipolar disorder episodes.

Katarzyna Kaczmarek-Majer received her M.Sc. in mathematics and M.Sc. in computer Science from the University of Poznań, Poland. Then she got her Ph.D. with distinction in computer science in 2015 from the Systems Research Institute of the Polish Academy of Sciences. Katarzyna Kaczmarek-Majer is currently an Assistant Professor at the Systems Research Institute of the Polish Academy of Sciences and the Principal Investigator of the "BIPOLAR: Bipolar disorder prediction with sensor-based semi-supervised learning" project (http://bipolar.ibspan.waw.pl/). Katarzyna's areas of expertise include soft computing, time series/data streams analysis and human-centered AI. She combines effectively her theoretical research with involvement in scientific projects with applications mainly in medicine and healthcare. She co-authored 40+ scientific publications. Some of them have been awarded at scientific conferences, e.g., with the Best Paper Award at FUZZ-IEEE 2022, Padova, Italy for article "Confidence path regularization for handling label uncertainty in semi-supervised learning: use case in bipolar disorder monitoring". She was a scientific committee member of many conferences and a reviewer of several scientific journals and international conferences. Katarzyna is also the President of the Information Technologies for Psychiatry Foundation and the coordinator of the eHealth section of Polish Information Processing Society.