Analysis and Prediction of PTSD through Functional Data Analysis

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Post-Traumatic Stress Disorder (PTSD) is a psychiatric condition arising from exposure to a traumatic event. Prior research indicates that PTSD symptoms are linked to changes in both behavioral factors and alterations in brain structure.

In our study, we propose a novel approach to explore the longitudinal trajectories and their associations during early development in PTSD. We aim to illustrate that Functional Data Analysis (FDA) offers a superior method for analyzing the longitudinal interactions of PTSD symptoms and behavioral factors, especially when dealing with irregularly and sparsely distributed data.

Utilizing data from an existing database with subjects measured at irregular intervals, we initially constructed longitudinal trajectories for PTSD symptoms and key behavioral factors, including the Depression Symptom Assessment from the Quick Inventory of Depressive Symptoms (QIDS), the Pittsburgh Sleep Quality Index (PSQI) Addendum for PTSD, and State-Trait Anxiety Inventory FORM X-1 (STAI.X1) using Functional Principal Component Analysis (FPDA). These trajectories serve to investigate interactions between PTSD symptoms and behavioral factors through linear mixed-effects models and nonparametric concurrent models. Additionally, we employed various machine learning methods, including random forest and recurrent neural networks, to predict PTSD based on behavioral factors. Prediction accuracies were assessed and compared using receiver operating characteristic (ROC) curves, demonstrating improved predictions when utilizing trajectories obtained from FPDA.

Our findings suggest that the FDA approach provides enhanced insights into comprehending the longitudinal associations between PTSD symptoms and their causal factors.

