Analysis of mouse blood serum in the dynamics of U87 glioblastoma by Terahertz spectroscopy and Machine learning

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Glioblastoma is one of the most rapidly progressing oncological diseases with the most unfavorable survival prognosis because of a late diagnostic. Early and noninvasive diagnosis of oncological diseases can be achieved by body fluids analysis via terahertz time-domain spectroscopy. In this work we use THz-TDS to study the blood serum of mice in the dynamics of the development of experimental U87 glioblastoma. The THz absorption spectra of blood serum do not have any specific spectral features. To identify differences between the control and experimental groups and estimate informative THz frequencies, we proposed machine learning (ML) pipeline, which includes Savitzky-Golay filter for smoothing, isolation forest for outlier removal, principal component analysis together with linear kernel support vector machine for informative feature selection and data separability investigation. ML models were verified by k-fold cross validation. Additional study included regression analysis of THz spectra and tumor size by the LASSO method. Specific THz frequencies were determined to be prominent for the glioma development.

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