The Development of a Novel Prediction Model for Bipolar-I Disorder Utilizing Radiomic Analysis

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This project reports the development of a computational prediction model for the clinical classification of bipolar I disorder (BP-I) based on identification of structural abnormalities within the brain using magnetic resonance imaging (MRI) and machine learning. In the United States, about 2 million adults suffer from some form of bipolar disorder. This illness manifests in a spectrum of symptoms, the assessment of which can be subjective. There is an unmet medical need for early and accurate diagnostic approaches for BP. To address this, a prediction model was created using radiomic analysis of the medial frontal and temporal lobe from structural MRI images of both BP-I and healthy control patients (total n=76). LIFEx software was used to extract radiomic features from these two structures. To simulate prospective clinical use, the dataset was randomly separated into a training set (~67%) and a testing set (~33%). The prediction models were built using logistic regression on the selected most significant features in the training set. The prediction performance was further evaluated in the independent testing set. The receiver operating characteristic (ROC) analysis were also performed. ROC curves determined the specificity and sensitivity as functions of one another. The prediction model achieved a 71% accuracy in the training model for identification of BP-I patients confirming that this model can potentially serve as an effective tool for clinical diagnosis.

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