Predicting PTSD Development with Early Post-Trauma Assessments: A Concise Tree-Based Classification Method

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Background: Approximately 70% of individuals globally experience at least one traumatic event in their lifetimes, potentially leading to posttraumatic stress disorder (PTSD). Understanding PTSD's development and devising prevention strategies is crucial. This study aimed to design a concise tree-based adaptive test using Classification and Regression Trees (CART) to predict PTSD development.

Methods: Utilizing data from a longitudinal neuroimaging study, adult trauma survivors were enrolled from hospital emergency departments within 48 hours of experiencing trauma. The study incorporated 131 features spanning demographic, trauma-related, and behavioral and clinical symptoms for 144 subjects. Predictive models were built based on psychological evaluations conducted within 2 weeks post-trauma. The performance of the CART model was benchmarked against other machine learning algorithms: Random Forest (RF), Gradient Boosting (GB), Logistic Regression (LR), and Logistic Regression with an L2 Penalty (L2).

Results: The CART model demonstrated superior predictive capabilities in forecasting PTSD development among trauma survivors, excelling in its sensitivity. Specifically, the CART model led with a sensitivity of 0.78, followed by both RF and GB at 0.72, LR at 0.67, and L2 with 0.61. In terms of accuracy, the CART and GB models achieved the highest accuracy at 0.75, followed by LR at 0.71, and both RF and L2 with 0.64. Specificities were 0.80 (GB and LR), 0.70 (CART and L2), and 0.50 (RF).

Conclusion: The CART framework offers a streamlined approach to predicting PTSD onset in trauma survivors. Its ability to provide accurate insights holds potential for enhancing early intervention strategies, ultimately benefiting individuals at risk of developing PTSD.

