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Jakob Liker

NeuroInsight: AI-Powered Traumatic Brain Injury Classification

According to the CDC, there were approximately 214,110 traumatic brain injury (TBI) related hospitalization in 2020. With this magnitude of yearly concussions, there is a need to appropriately diagnose concussions in an objective manner. The objective of our study was to build an AI algorithm to model diffusion tensor imaging (DTI) data to correlate it to late Rivermead Post-concussion Questionnaire (RPQ) severity and secondarily to identify key tracts associated with a high late RPQ symptomology. The dataset contained 36 DTI datapoints representing descriptive metrics of brain tracts along with the corresponding DTI images. The late RPQ scores were separated into a high and low score, which was delineated by a score of 27, the average score in the database. The model was trained on 65% of the data while the other 35% was used for testing. The machine learning model used was Gradient Boosting Regression and a feature importance was used to determine the most important DTI tracts in determining whether the patient has a high or low late RPQ score. The best model produced an accuracy of 84.62%. The sensitivity and specificity were 77.78% and 100% respectively. Additionally, the area under the ROC curve generated was 0.85. Moreover, the results of the feature importance function indicate that the most important DTI tract metrics to identify the severity of TBI were the mean diffusivity (MD) of the right Frontal Aslant tract, followed by the fractional anisotropy (FA) of the left and right Uncinate Fasciculus. We have identified certain DTI metrics that are associated with the severity of TBI derived from PCS scores. This may help to serve as an objective foundation for a plethora of studies investigating the classification of TBI severity.