Hit or Miss? Using Mathematical Computations Based on Existing Physics Theorems to Evaluate Head Impacts in the National Football League

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Chronic Traumatic Encephalopathy (CTE) is a medical condition that results from head impact injuries in contact sports. A Boston University study reports occurence of CTE in 87% of the cases examined. CTE is a progressive disease and a silent killer as symptoms often appear years after the injuries, aggravated further by other non-traumatic hits. The current research, using equations of physics during head impacts in NFL games, predicts inception of CTE in players who can be treated proactively. It gives us the ability to develop a software based solution using the players' physical data and real time play dynamics in arriving at a conclusion. The tool also utilizes machine learning concepts that can aid in predicting whether a player will develop CTE based on the injuries that he sustained over the course of his career. Monte Carlo type simulation for positions, routes, and ball velocity are used in the numerical experiments in evaluating the 'g' factor that indicates CTE occurrence or concussion. The results confirm the experimental data in the literature. Real time dynamic data from analysis of NFL game video footage serving as input to the tool predicted concussion of the players as confirmed in the NFL post game injury reports. The tool developed in this study gives the ability to predict concussion or CTE through analysis of real time game data. This novel approach is minimally invasive with no modifications to player outfits or technology components, thus providing a low cost solution to a complex problem.

Awards Won:
Samvid Education Foundation: Honorable Mention