Indoor Ranging System for Athletic Discus Throwing

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There is an urgent dilemma for discus throwers in some countries when they train indoors in winter or rainy seasons: the limitation of indoor spaces disabled discus to fly a complete trajectory and athletes to know the throwing distance. So far there is no relevant research on indoor ranging of discus throw worldwide. My engineering goal is to develop a cheap digital discus to predict the distance of indoor throwings and a training accessory application to analyze athletic performance. In this research, an integrated sensor is installed in the center of mass of a discus to detect and record the flight posture of the discus in real-time; a set of algorithms, including coordinate system conversion, calculation of velocity by integration, and Euler angle conversion are designed to process the raw data collected by the sensor. Then, based on the physical characteristics of discus throwing and experienced value range, the time of discus-leaving-hand is recognized; a machine learning method of non-linear regression with multiple variables is used on data fitting of values gained shortly after the time of discus-leaving-hand to simulate the complete flight trajectory and predict the distance. Finally, I tested the algorithm with public data on discus throw from the World Athletic Championships and the data collected from throwing experiments conducted by the professional discus throwers that I invited. Compared to actual results, my predicted results meet the ideal standard by reaching 95% accuracy. To facilitate athletes, I designed a mobile app that provides visualization of data related to discus throwing, and also technical analysis of their athletic performance. My indoor-ranging system is unique due to computer simulation from limited data and an athlete-friendly app.

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