Research of the Prediction of Performance in Basketball

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Abstract

Aimed to look at the different methods of predicting performance in basketball.

Introduction

This project was a literature search of different methods of predicting performance outcomes in the sport of basketball. Keywords used when searching for articles were: basketball, pattern recognition, biomechanics, machine learning, fitness testing, and prediction. We looked at a variety of methods of prediction, as well as different figures to predict such as free throws, layups, and in-game performance. The studies looked at varied in their uses of technologies and their primary focuses.

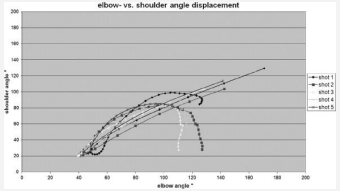

Image 1: Elbow vs Shoulder Angle Displacement

Image 2: Anthony Davis Wearing a Tracking device

Image 3: Vertical Jump Test

Prediction using shooting angles

- Using wearable trackers and Random Forest algorithm to analyze the player's level of physical activity and then use that to predict the performance and the outcome of the games.[3]
- Using AI to perform technical and tactical analysis, specifically using neural networking and decision tree classifier.[4]

Prediction Using Machine Learning

- Using the kinematic chain angles of the shoulder, elbow, and wrist to predic free throw accuracy, using MPU-6050 sensors in the shoulder and elbow, and a MPU-7361 sensor at the wrist.[1] They were able to track the movemen of different joints and the effects on performance (Image 1).
- Using angular displacement, angular velocity, and the animated stick figures created by markers on the kinetic chain.[2]

Prediction using anaerobic and aerobic testing

- Using the vertical jump test, the horizontal jump test, the lateral jump test to predict the performance of a 10-meter sprint and change of direction. The single-leg horizontal countermovement jump has the best results in predicting this performance.[5]
- Used maximal dynamic back squat, isometric midthigh pull, eccentric and concentric only back squat, and a countermovement jump to predict performance on two change of direction tests and a reactive agility test. Eccentric strength was the sole predictor of change of direction performance, although agility performance showed no correlation.[6]

Image 4: Different Joint Angles

Image 5: Optical Tracking

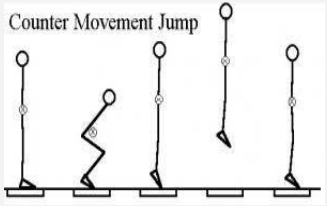

Image 6: Counter Movement Jump

Proposed Methodology

Given the recent technological advancements in tracking technologies, the ability to predict both a team's and an individual player's performance in basketball has improved vastly in the past few years. In order to best predict the performance, eccentric performance testing should be tested prior to the season, and then AI should be used in-season to predict performance. As technology advances, the multiple ways of predicting performance should be combined into one centralized system. The wearable AI should be developed to be able to predict muscle fatigue and the ability to vertically displace one's weight, in order to replace the need for pre-season fitness testing. GPS technology should be integrated into the wearable AI to combine the need for machine learning into needing only a singular sensor. Lastly, technology that is able to recognize joint angles from one location would be useful in order to predict free-throw performance. Further investigation into the integration of technology into a centralized AI should be done in order to create the optimal performance predictor.

Proposed Measurements

Pre-Season	In-Game	Post-Game
Vertical Displacement	Joint Angles	Recovery Needed
VO_2max	Muscle Fatigue	Overall Team Spacing

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