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Parameters to Evaluate the Performance of Sports Person Using Machine Learning

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Abstract: Fantasy sports have become increasingly popular in recent years. The use of Big Data Analysis and Machine Learning Techniques to assess the safety of athlete training and develop a complex control model for athlete training safety evaluation has brought people's attention to enhance Big Data analysis. This paper analysis the sports specific parameters using machine learning.

Keywords:Machine Learning, Performance, Sports, Decision Tree

I. INTRODUCTION

Sports are a truly popular and widespread form of free time spending, being safe and earning money. Management of sport teams spend huge sums of money in upgrading their players and technical equipment and facilities. Collecting player and match data helps researchers to analyze prior team results as a unit to deduce effects of various influences on team outcomes. The area of predictive analysis is also well-known, closely related approach to sport.As long as sport is a complex activity performed by human beings, there is usually an inconsiderable randomness factor and other aspects such as weather, player psyche or media and fans impact. For the researchers and commentators, therefore, the sport forecasts have always been difficult and football (soccer) is considered a sport of this sort. There are two areas in general, where forecasts can be implemented. Gambling companies' brokers use figures to determine betting odds for the various teams, players and matches to earn money for their businesses.There are men, on the other hand, who are trying to beat these odds and earn money for good combinations of single match tips. Although this is considered a dangerous operation, it is showing up as an interesting scientific issue.

While sport competitions continue to improve, athletes ' accomplishments have been brought to the attention of researchers, and the success of sportspeople is closely connected to various factors, including the level of training, the physical fitness of athletes, and sports facilities. Athletes need to control the improvements in performance of athletes correctly and thoroughly in order to ensure that better results are obtained. Therefore, modeling and predicting the success of athletes is becoming increasingly important in sports science research [3].

This paper is divided in various sections:

Section I gives simple demonstration of machine learning need for sports. Sections II and III address the different models of machine learning and the literature review, respectively. Section IV shows parameters of some sports using machine learning.

II. MACHINE LEARNING MODELS

Sports organizations can use their data with software for AI and machine learning to enhance any aspect of their operations. From recruiting and production of players to ticket sales, predictive analytics can help make informed decisions and strategic improvements that affect a sports organization's every area.

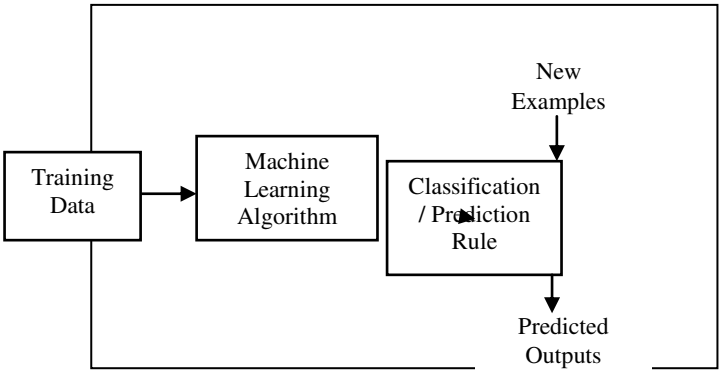

Figure 1. A Typical Machine Learning Approach

Machine Learning tasks are typically classified into different broad categories depending on the learning type (supervised/unsupervised), learning models (classification, regression, clustering, and dimensionality reduction), or the learning models employed to implement the selected task.

- **Regression**

Regression constitutes a supervised learning model, which aims to provide the prediction of an output variable according to the input variables, which are known. Most known algorithms include linear regression and logistic regression, as well as stepwise regression. Also, more complex regression algorithms have been developed, such as ordinary least squares regression, multivariate adaptive regression splines, multiple linear regression, cubist, and locally estimated scatterplot smoothing.

- **Clustering**

Clustering is a typical application of unsupervised learning model, typically used to find natural groupings of data (clusters). Well established clustering techniques are the k-means technique, the hierarchical technique, and the expectation maximization technique.

- **Bayesian Model**

Bayesian models (BM) are a family of probabilistic graphical models in which the analysis is undertaken within the context of Bayesian inference. This type of model belongs to the supervised learning category and can be employed for solving either classification or regression problems. Naive bayes, gaussian naive bayes, multinomial naive bayes, bayesian network, mixture of gaussians, and bayesian belief networkare some of the most prominent algorithms in the literature.

- **Decision Trees**

Decision trees (DT) are classification or regression models formulated in a tree-like architecture. With DT, the dataset is progressively organized in smaller homogeneous subsets, while at the same time, an associated tree graph is generated. Each internal node of the tree structure represents a different pairwise comparison on a selected feature, whereas each branch represents the outcome of this comparison. Leaf nodes represent the final decision or prediction taken after following the path from root to leaf. The most common learning algorithms in this category are the classification and regression [10].

- **Artificial Neural Networks**

Artificial neural networks (ANNs) are divided into two categories; “Traditional ANNs” and “Deep ANNs”. ANNs (Shirahatti et al., 2018) are inspired by the human brain functionality, emulating complex functions such as pattern generation, cognition, learning, and decision making. The human brain consists of billions of neurons that inter-communicate and process any information provided. Similarly, an ANN (CN et al., 2019) as a simplified model of the structure of the biological neural network, consists of interconnected processing units organized in a specific topology.ANNs are supervised models that are typically used for regression and classification problems [11].The learning algorithms commonly used in ANNs include the radial basis function networks, perceptron algorithms, back-propagation, and resilient back-propagation.

III. LITERATURE SURVEY

Despite cricket being a very competitive game, bettors and bookies are encouraged to bet on the outcome of the match because it is a ball-by-ball game that shifts. The work by **Kapadia *et al.*, (2019)** looks at machine learning technology to address the problem of predicting cricket match results based on the IPL's historical match records.Using filter-based methods, including correlation-based feature selection, information gain (IG), ReliefF, and Wrapper, influential data set features were identified. More specifically, machine learning techniques like Naïve Bayes, Random Forest, K-Nearest Neighbor (KNN) and Model Trees (regression classification) were adopted to produce predictive models from distinguishing feature sets derived from filter-based techniques. Two featured subsets have been created, one based on the benefit of the home team and the other based on the Toss result. For the determination of a predictive model, selected machine learning techniques were applied on both feature sets.

Bunker *et al.* (2019) paper offers a critical analysis of ML literature, which focuses on the application of the Artificial Neural Network (ANN) to prediction of sport outcomes. In doing so, we describe the learning methodologies used, data sources, effective means of model assessment and particular challenges of predicting sport outcomes. This then leads us to suggest a novel system for sport prediction, through which ML can be used as a learning strategy.

Artificial Intelligence (AI) technology opens up an interesting opportunity for predicting injury risk and success in team sports. A better understanding of the AI techniques used and the sports which use AI is clearly justified.The study by **Claudino*et al.*, (2019)** covered fifty-eight reports, with 11 AI approaches or methods being applied in 12 team sports. The pooled sample consisted of 6456 participants (97% male, 25 ± 8 years of age; 3% female, 21 ± 10 years of age) with 76% being professional athletes. For all of them, the most commonly used AI techniques or methods were artificial neural networks, decision tree classifier, support vector machine and Markov cycle with good performance metrics. Soccer, basketball, handball, and volleyball were team sports that included more AI applications.

A model of performance prediction based on machine learning algorithm is suggested by **Zhu *et al.*, (2019)**, in order to accurately predict the performance of athletes and the particular changes in performance of athletes. The current research status of the simulation and prediction of competing sports athletes is analyzed and the current model of predicting success is found. We examine the flaws in the model. Analyzing the explanation for the model's poor prediction precision.The chaotic approach is then used for analyzing the athletes ' historical data and discovering the secret rules. Finally, athletes ' Performance Prediction model is adopted by using the machine-learning algorithm that supports the vector machine, and a particle swarm is taken. The algorithm speeds up and optimizes the model's preparation.

The system of the physiological index tracking and training health evaluation of sportspeople based on machine learning is proposed by **Wang *et al.*, (2019)** to perform the monitoring and adaptive assessment of the safety of athletes ' training. The monitoring of the big data monitoring model of training athlete safety evaluation is constructed on the physiological index parameters of heart rate HR, maximum

oxygen uptake of VO2 max, oxygen pulse O2P, respiratory entropy RQ, and high ventilation (VEmax) as restrictive indexes.Athletes ' training safety evaluation is based on a statistical analysis and optimization control model, and machine learning provides the athletes ' physiological index surveillance and training safety valuation. The findings from the simulation show that the level of confidence of this approach is high and the evaluation process converges well, which makes it perfect for athlete training and physiological testing applications.

Selection of players is one of the most important tasks of any sport and cricket is no exception. The players ' performance depends on different factors such as the opposition team, the venue, his current form etc. The team management, the coach and the captain pick 11 players from a squad of 15 to 20 players for each match. To select the best playing 11 for each match, they evaluate different characteristics and player statistics. Each batsman contributes by scoring the maximum possible runs and every bowler contributes by taking the maximum wickets and making minimum runs.**Passi& Pandey (2018)**tries to predict players ' success as how many runs each batsman will make, and how many wickets each bowler will take for both teams. Both the problems are treated as problems of classification where the number of runs and the number of wickets are categorized into different range. The author used naïve bays, random forests, multiclass SVM classifiers and decision tree classifiers to create prediction models for both issues. For both the problems, the random Forest classifier was found to be the most accurate.

IV. COMPARISON PARAMETERS

Individuals have some changes in their physiological properties and parameters during sports processes, such as muscle excitement, increased breathing speed, heart rat e promotion, suddenness, changed temperature. Such physiological parameters are closely related to the amount of exercise and the length of the sports cycle. Table 1 shows examples of some sports parameters in context to the different activities [12, 13]:

Table 1. Sports Specific Parameters

Activity/ Sport	Parameters
Running	• Heart Rate • Length of Track • GPS (positioning) • Number of Strides
Mountain Biking	• Altitude • Heart Rate • Velocity • Gear • Inclination • Pedal Frequency
Cricket	• Number of Innings • Batting Average • Strike Rate • Venue • Match Time
Endurance and Strength Training	• Heart Rate • Weight • Repetitions • Joint Angles • Duration
Weight Training	• Mean Body Mass • Load • Number of Sets • Age • Sex

V. CONCLUSION

The paper shows the empirical analysis of three different techniques used in machine learning. It ends with the comparison analysis of the different specific sports parameters used in the related field. This paper discusses quite a lot of research work concerning applications of machine learning in sports.

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