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ANALYSIS OF FOOTBALL PLAYERS' TECHNICAL AND TACTICAL PREPARATION USING ARTIFICIAL INTELLIGENCE

Nuriddinov Axrorjon Bahodir ugli
Asia International University
Lecturer at the Department of Physical Education
nuriddinovaxrorjonbahodirugli@oxu.uz

Abstract: In this article, the technical and tactical preparation of football players is analyzed using artificial intelligence technologies. In football, each player's movements on the field, striking techniques, passing accuracy, and tactical decision-making processes require the processing of large volumes of data. From this perspective, artificial intelligence tools (video analytics, machine learning, neural networks) make it possible to monitor the game process in real time, analyze the playing style of both the opponent and the team, and evaluate the effectiveness of athletes. The research results can be applied to an in-depth study of players' individual and team actions, optimization of the training process, and the development of scientifically grounded recommendations for coaches.

Keywords: Technical and tactical preparation, kinematic analysis, running speed, pressing efficiency, passing accuracy, shot power, VAR (Video Assistant Referee)

Introduction

In recent years, sports science has been directly linked with artificial intelligence (AI) technologies. In particular, in such a dynamic and complex game as football, the issue of objectively assessing players' technical and tactical preparation has been a constant subject of discussion. In Uzbek football as well, taking into account international experience, the use of AI programs is expanding the possibilities for analyzing and improving athletes' skills

Scientific perspective. In studying the technical and tactical preparation of football players, traditional methods (video analysis, statistical calculations) may allow for subjectivity. Artificial intelligence, however, based on computer vision, machine learning, and neural networks, records indicators such as players' running speed, pressing efficiency, passing accuracy, and shot power in real time.

Systems such as "Opta Sports" and "InStat" measure football players' technical actions in a single match according to more than 2,000 parameters.

Expected Goals (xG): Calculates the probability of a shot resulting in a goal, taking into account contextual factors such as the location and angle of the shot, its type (header or foot), and whether it was a "big chance" or not.

Expected Assists (xA): Analyzes the likelihood that the receiver of a pass will score, considering the type, length, and location of the pass, as well as the phase of the attack.

Expected Goals on Target (xGoT): Compares the quality of a shot, based on its final placement, with the goalkeeper's response.

Sequences & Possessions Analysis: Provides analysis and statistics on event sequences (for example, whether a shot was taken immediately after pressing), including the distance covered, the time span, and the number of passes involved in each sequence.

Categories of data collection and analysis

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Event data: These are systematically and thoroughly recorded details of all "on-ball" actions during the game (passes, shots, dribbles, recoveries, etc.). Each event includes the type of action, the time, the coordinates on the pitch, the player involved, and the outcome of the action (successful or not).

Tracking data: These are high-frequency records (for example, several times per second) of the movements of all players and the ball during the match. Such data provide comprehensive information on position, speed, acceleration, team formation during phases of play, and movement patterns.

Opta collects these data in real time not only with human analysts but also through AI and computer vision technologies, ensuring speed, accuracy, and complete coverage. From a scientific standpoint, this process is carried out on the basis of biomechanical analysis and statistical modeling.

Biomechanical analysis. Biomechanics is the science that studies the laws of human movement from the perspective of mechanics. In football players, it encompasses the following aspects:

Kinematic analysis: Evaluation of a player's running speed, shot angle, limb movements, and overall body coordination. For example, during a kick, the synchronization of the thigh, shin, and foot movements is measured.

Kinetic analysis: Assessment of force, acceleration, and impact impulse. For instance, the force of a strike (in Newtons) and the ground reaction force applied during the kick are recorded.

Biomechanical sensors: Devices such as GPS trackers, accelerometers, gyroscopes, and force plates are used to measure players' techniques in running, jumping, and striking. This allows coaches to identify technical flaws (e.g., incorrect kicking mechanics, body balance disruptions).

Statistical modeling. Statistical models provide a mathematical framework for analyzing players' recorded actions during the game. They can be divided into:

Descriptive statistics: Simple mathematical expressions that calculate indicators such as the number of passes, shot accuracy (%), pressing episodes, and dribbling success rate.

Inferential statistics: Comparative analyses of player groups (e.g., defenders vs. forwards in running distance), using t-tests, ANOVA, or regression models.

Predictive modeling: Used in the creation of indicators such as expected goals (xG) and expected assists (xA). In this case, factors such as the location of the shot, its angle, and the attacking situation are calculated through statistical regression and machine learning models.

Big Data analytics: Performance data from thousands of matches played by a single footballer are aggregated to forecast future outcomes.

A statistical model provides coaches with the ability to make informed decisions, compare a player with competitors, and individualize the training process.

Integration of biomechanics and statistics

From a scientific standpoint, the most important point is that precise physical indicators measured through biomechanical analysis are integrated into the statistical model. For example, a biomechanical sensor records that a player reached a running speed of 8.7 m/s. The statistical model then compares this speed with that of other players and expresses the player's pressing efficiency in percentage terms. The final result-combining the player's individual rating and tactical effectiveness-is presented to the coach.

Practical scientific applications:

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For coaches: Provides scientifically grounded insights into which players demonstrate higher pressing efficiency and whose shot accuracy is declining.
For players: Enables them to review their biomechanical movements and use the data for injury prevention.
In education: Supports the scientific teaching of physical culture and sports to students.
In innovative sports medicine: Facilitates the objective assessment of players' recovery processes after injuries.
Artificial intelligence - based football analysis is not merely simple statistical calculation. It integrates biomechanical data (speed, force, strike, movement coordination) with statistical models (descriptive, regression, predictive). This approach is of great importance not only for coaches and players but also for the advancement of sports science.
Historical perspective. The use of technology in football analysis began in the second half of the 20th century. Initially, video recordings were employed; later, GPS sensors, wearable devices, and drones were introduced. In the 21st century, AI-based programs have defined a new stage in football analytics.
Since the 2010s, VAR (Video Assistant Referee) technology has been introduced into football, ensuring more precise enforcement of the rules of the game.
In the 2020s, through machine learning, team tactics (for example, pressing lines and inter-zone transitions) have been elevated to the level of mathematical modeling.
Sociological perspective. From the standpoint of society, the integration of AI technologies into sports produces the following positive and negative aspects:
a.Positive aspects: Coaches gain access to objective data for decision-making; players are able to identify their strengths and weaknesses more quickly; and for spectators, the game process becomes more engaging and analytically rich.
b.Negative aspects: Some experts argue that the "human factor" is diminished, reducing the romantic appeal of football. In addition, clubs without equal access to technology may fall behind in competition.
Innovative perspective. At present, the following innovative approaches are being applied in the analysis of football players' technical and tactical preparation:
1.AI video analytics: Tracking players' movements through cameras and automatically generating statistical reports.
2.Virtual reality (VR) simulations: Used in training to enhance players' decision-making speed.
3.Big Data: Creating player profiles based on hundreds of matches and forecasting their future development.
Chatbots and AI coaches: Providing players with individual recommendations and adapting training programs. In Uzbek football as well, there are prospects for utilizing AI opportunities. In particular, by establishing dedicated data centers for Super League clubs, placing young players under digital monitoring from an early age, and delivering analytical information to coaches, it is possible to raise the level of technical and tactical preparation.
Virtual Reality (VR) technology, developed by Ivan Sutherland in 1965, is defined as media applications that transfer the real world into a digital environment and allow the user to directly interact with this created environment, while also possessing engaging and entertaining features. The strong impact of virtual reality in the field of education is related to the fact that the

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psychological processes occurring in the human mind resemble those formed through interaction with real-world events and objects.

The main purpose of virtual reality applications is to convince the user that they are in another environment. This state depends on the user's ability to be completely immersed in alternative environments created by computers. Special wearable technologies such as headsets, glasses, and gloves are used to access these artificial environments, which are presented through computer software and hardware in a way that leaves the impression of a real environment.

VR consists of three main components: immersion, interactivity, and visualization. Immersion refers to the user's natural interaction within the artificial world without being directly connected to the computer interface. Interactivity means that the user does not merely receive computer information passively, but also has the ability to control the environment by manipulating virtual objects. This feature distinguishes VR systems from traditional 3D animations. Visualization provides depth to the processes of perception and cognition, helping the user achieve better understanding by integrating logical and sensory perception.

Picture 1

In recent years, VR applications focused on education in sports have become important not only for amateur and professional athletes but also for coaches in planning training sessions. Through VR, it is possible to model various scenarios such as the playing style of opposing teams and players, their past matches, or upcoming competitions. In this way, training programs can be designed to meet the individual needs of each athlete. In sports such as tennis and baseball, however, additional physical equipment is required for VR applications. Training sessions performed with the help of VR can be transmitted synchronously to monitors, allowing the athlete's point of view to be observed by coaches, teammates, and managers.

Conclusion and Recommendations

Artificial intelligence is taking sports, particularly football, to a new stage. Through the use of these technologies in Uzbek football:

1.Players' technical and tactical preparation can be assessed objectively;
2.Coaches gain scientifically grounded approaches to decision-making;
3.Opportunities are created to forecast players' development in the long term;
4.A foundation is laid for increasing the competitiveness of the national team.
5.Therefore, the integration of AI technologies into football education and the training process should become one of the priority directions of Uzbekistan's sports policy.

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