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COACHING DECISION SUPPORT SYSTEM USING INFORMATION TECHNOLOGY

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Among all sports, football stands out as the most popular one, characterized by intense competition where teams constantly seek ways to improve their performance. Football, being one of the oldest games, has begun to adapt to the rapid development of artificial intelligence. Increasingly, teams employ AI to analyze their opponents, study tactical behaviors on the field, detect open spaces that frequently appear during attacks or defense, and uncover other critical aspects of the game.

Therefore, the relevance of this research is driven by the progress of artificial intelligence and the high level of competition in football, where new strategies for victory are sought every day.

In modern football, decision-making increasingly relies not only on the intuition of coaches but also on objective data obtained from analytical systems. For this reason, this work presents the development of an intelligent analytical system that uses match video recordings to provide objective insights and decision support.

A key aspect of evaluating player performance is the formation of a metric system that reflects both individual and team characteristics of the game. For example, for a forward, the system collects data such as average speed, maximum speed, and total distance covered during a match. Based on these data, a profile of the player's physical activity is generated, allowing assessment of his readiness for different tactical scenarios and overall on-field efficiency.

Additionally, spatial aspects of the game must be considered. Using player coordinates extracted from video analysis, the system constructs two-dimensional maps of player positions, heatmaps, and influence zones. These data allow the coach to evaluate not only individual performance but also interactions between players — for example, how often a forward finds himself in potentially dangerous areas or how effectively he utilizes open spaces created by teammates.

To enable such functionality, the system must accurately detect in-game events, achieved through computer vision models. Among publicly available architectures, YOLO (You Only Look Once) was selected, as it has become a de facto standard in object detection tasks due to its speed and accuracy — key characteristics for the

proposed solution. The use of YOLO enables the detection of player positions, the ball, referees, and even team affiliation based on uniform colors, forming the foundation for data collection and further analysis.

Based on the obtained coordinates and movement metrics, the system calculates player performance indicators such as average movement speed, total distance covered, and the number of successful actions. By analyzing these metrics, the system provides recommendations for the coaching staff — for instance, regarding lineup optimization or tactical adjustments against a specific opponent. Thus, the system functions not only as an analytical tool but also as an intelligent assistant for strategic decision-making.

The integration of artificial intelligence with advanced data collection tools such as GPS trackers, optical tracking systems, and match statistics providers enables the development of more comprehensive analytical models. By combining visual data obtained via YOLO with external data sources, the system delivers deeper analytical insights — from assessing player fatigue to identifying tactical inefficiencies invisible to the human eye [1].

The system is implemented using a microservice architecture, where each component can be scaled, adapted, and allocated resources independently depending on workload. This approach increases the system's resilience and cost efficiency.

System components interact through a centralized gateway — NGINX, which acts as a service registry and request router. It receives HTTP requests from the client web application running in the browser and redirects them to the appropriate microservices according to configuration. This architecture ensures logical isolation of components, enhances security through access control, and enables flexible routing for load balancing and API versioning.

Each microservice is deployed in a Docker container, ensuring platform independence and execution environment isolation. Containers are orchestrated using Kubernetes, which automatically manages deployment, scaling, and recovery in case of failures. The use of Kubernetes maintains system stability under high load, facilitates zero-downtime updates, and increases infrastructure reliability [2].

The main components of the system include: a computer vision module that uses YOLO for match video processing; a metric calculation module built with the Elysia framework for fast computation of performance indicators; and the core information management module developed with Nest.js, which handles data on matches, teams, and players, storing it in a PostgreSQL database and exposing it through a Next.js web application. The client interface enables users to view real-time statistics, analytical insights, and system-generated recommendations.

The system also supports scalability and future extensions, such as integrating real-time video stream processing for large-scale data handling and implementing predictive models capable of forecasting attack developments or evaluating player potential based on historical statistics [2].

Thus, the development of a football match analysis and coaching decision support system represents not only a relevant research direction but also an essential step toward the digital transformation of sports, where every decision is grounded in objective data.

References

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