

THE ROLE OF ARTIFICIAL INTELLIGENCE (AI) IN SPORTS

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Abstract:

Artificial Intelligence (AI) has become an integral component of modern sports, significantly enhancing performance, strategy, and engagement. In cricket, football, and kabaddi, AI has played a transformative role through advanced analytics, predictive modelling, and injury prevention.

Cricket teams employ AI to evaluate pitch conditions, analyze batting and bowling strategies, and identify player performance trends using video data. In football, AI-based tracking systems provide insights into player positioning, movement, and match dynamics, enabling coaches to design strategies and predict outcomes.

In kabaddi, AI applications focus on player tracking, opponent behaviour analysis, and match forecasting, thereby improving training methods and competitive approaches. This paper explores the current applications and future prospects of AI in these sports, emphasizing its significance in strategic decision-making, performance optimization, and the transformation of sports analytics.

Keywords — Artificial Intelligence (AI), Sports Analytics, Performance Enhancement, Machine Learning, Predictive Modelling, Cricket, Football, Kabaddi

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Introduction:

Over recent years, sports have witnessed an exponential growth in data generation from high-speed cameras, wearable sensors, positional tracking, and broadcast video. Parallel to this, advances in Artificial Intelligence (AI) and machine learning (ML) have enabled the extraction of insights from this data. The intersection of AI and sports is thereby creating new opportunities: optimizing athlete performance, refining tactical decision-making, enhancing spectator engagement, and improving operational efficiency of teams and leagues.

AI in sports is not simply analytics on steroids it represents a shift from descriptive statistics to predictive and prescriptive intelligence. As described in the literature, AI is being applied in athlete

monitoring, performance modelling, injury prevention, and even in fan engagement and business operations. [1]

This paper focuses on three sports cricket, football and kabaddi as case studies to illustrate how AI is applied in different contexts, each with unique demands and data-ecosystems. The aim is to elucidate the role of AI in strategic decision-making, performance optimisation and analytics transformation, then to discuss future prospects, challenges, and implications.

AI in Sports: Key Concepts and Methodologies

1. AI/ML Techniques in Sports Analytics

AI techniques widely used in sports include computer vision (from broadcast or dedicated cameras), tracking systems (wearables, optical tracking), sensor data (heart-rate, accelerometers),

and modelling/learning algorithms (supervised ML, deep learning, reinforcement learning). For example, a systematic review found that deep learning and computer vision models in sports performance frequently achieved >90% accuracy in movement-intensive sports.[2,3] Additionally, modelling approaches such as player performance prediction, injury risk forecasting, and tactical outcome simulation are becoming more commonplace. [1]

2. Framework of Application – Performance, Strategy, Engagement

The applications of AI in sports can be broadly grouped into three domains:

- **Performance optimisation:** monitoring athlete loads, biomechanics, fatigue, injury risk, and refining training programmes.
- **Strategy and decision-making:** analysing tactical behaviours, opponent tendencies, game forecasting, and aiding coaches in devising game plans.
- **Engagement and operations:** enhancing fan experience via personalised content, automating highlight generation, improving stadium operations, ticketing and business analytics. [4]



Fig.1; Hawk-Eye

Teams utilize AI-powered systems to assess player performance through data collected from cameras, sensors, and match statistics. Machine learning models analyze batting techniques, bowling speeds, and field placements to optimize player training and

3. Case Studies

1. Cricket

In cricket, AI is helping teams evaluate pitch conditions, analyze batting and bowling strategies, and identify player performance trends via video and sensor data. For instance, a case study describes how teams use video-based player recognition and performance analytics for automated insights. [5] Specifically, AI can recognise bowler release point, detect slight changes in batting stance, and forecast likely outcomes given certain conditions (pitch, opposition, match situation). Through such analytics, coaches and select better informed when forming playing XI or planning sessions. Moreover, injury prevention and load monitoring via AI and wearables are starting to appear in the cricket ecosystem, though less documented in the literature compared to football/other sports. AI has reshaped cricket through technologies that enhance decision-making, performance analysis, and fan engagement. Modern cricket relies on tools such as **Hawk-Eye** (Fig.1), **Ultra Edge**, (Fig.2) and **AI-based video analytics** to ensure accuracy and fairness.



Fig.2; Ultra Edge

match strategies. Predictive analytics help forecast player form, injury risks, and match outcomes. Artificial Intelligence (AI) plays a crucial role in enhancing the accuracy and reliability of decision-making in cricket, particularly through the

UltraEdge technology used in the **Decision Review System (DRS)**.[9] UltraEdge assists umpires in determining whether the ball has made contact with the bat or gloves before being caught or hitting the

Fig.3; Decision Review System (DRS For Runout)



pad, which is vital for adjudicating **caught-behind** and **leg-before-wicket (LBW)** appeals. Presently DRS system of AI is used in Catch (Fig.3) And runout (fig.4) critical systems.

Fig.4; Decision Review System (DRS for Catch)



UltraEdge is often used alongside other AI-powered systems like **Hawk-Eye** [10] (for ball trajectory prediction) Fig.1 and **Hot Spot** (for thermal impact detection). The integration of these systems provides a multi-sensor, data-driven foundation for more reliable DRS outcomes.

- Enhances **accuracy** and **consistency** of umpiring decisions.
- Minimizes **subjectivity** and **bias** in close calls.
- Reduces **false positives** caused by background noise.
- Supports **real-time** and **evidence-based** decision-making.

2. Football

In football (soccer), positional tracking systems using optical or wearable sensors feed AI models that analyse movement patterns, spacing, pressing behaviour, and team formations. These insights allow coaches to adjust tactics, substitutions, and training drills. In a broader review, sports analytics literature identifies “tactical tracking” as one of the major domains of AI application. For example, ball

trajectory inference from multi-agent sports contexts has been achieved by transformer/LSTM models, enabling performance metrics beyond raw tracking. Thus, in football, AI plays a strong role in game-strategy, opposition analysis, and performance monitoring.

AI has significantly influenced football through data analytics, video tracking, and real-time decision systems. Advanced AI-driven cameras and sensors monitor player movements, ball possession, and tactical formations. Coaches and analysts use AI to interpret massive datasets from matches, enabling data-driven formation design and strategy adjustments. Machine learning algorithms analyze opponents’ strengths and weaknesses, helping in tactical planning and player selection.

The **Video Assistant Referee (VAR)** Fig.5[13] system uses AI to aid referees in making precise decisions regarding goals, offsides, and fouls. Computer vision detects player positions and movement patterns in real time, ensuring accurate calls. Additionally, AI assists in **goal-line**

technology, (Fig.6) determining whether the ball has fully crossed the goal line. Wearable sensors and AI-based models monitor player health metrics,

3.Kabaddi

Fig.5; VAR Room



including fatigue and movement strain. Predictive algorithms identify injury risks and recommend optimal rest and training schedules.

Fig.6; Goal-line technology



Fig.7; Player Tracking

Though less widely studied in academic literature compared to cricket and football, kabaddi is also starting to benefit from AI: player tracking, (fig.7) opponent behaviour analysis, match forecasting, and improving training methods. For instance, the reference you provided (the DOAJ article) mentions AI in kabaddi for player tracking and opponent behaviour. DOAJ As kabaddi becomes more professionalised and widescreen broadcasts become common, the data availability (video, sensor) increases, making AI adoption more realistic.



Fig.8; DRS (Player touch)

Although a traditional sport, kabaddi has embraced modern technology to enhance team performance and fan experience.[14]

AI-powered systems analyze raider and defender movements, strike rates, and tackling efficiency. Machine learning helps teams understand opponent patterns and adapt strategies dynamically. Using motion sensors and AI models, teams monitor player movement intensity and detect signs of fatigue or imbalance that may lead to injury. (fig.8) This data-driven approach improves player safety

and extends career longevity. AI-based analytics enhance fan engagement through predictive match outcomes, performance highlights, and interactive digital platforms.

Benefits and Impact:

- **Enhanced performance & injury prevention:** AI models can spot early signs of fatigue or technique drift, helping prolong athlete careers and reduce injuries. [2]
- **Better strategic decision-making:** Coaches and analysts can leverage AI insights to make data-driven choices on tactics, player selection, substitutions, etc.
- **Operational efficiency and fan engagement:** From automating highlight generation (e.g., AI for sports highlight videos) to improving stadium operations, AI contributes to the business side of sports. [8]
- **Extending to smaller or less-resourced sports:** The review of AI in sports indicates that even in less-popular sports (with limited data) domain-adapted AI models (e.g., fuzzy logic) have matched expert performance. [2]

Challenges and Limitations:

Despite the promise, several key challenges remain:

- **Data availability and quality:** Many teams or sports lack high-quality tracking or sensor data, particularly in developing regions.
- **Interpretability and trust:** Coaches and athletes may hesitate to rely on “black box” AI models; explainability is crucial. [1]
- **Ethical, privacy and bias issues:** Collection of athlete data and monitoring raises privacy concerns; algorithmic bias is also possible. [4]
- **Infrastructure and cost:** Implementing AI systems requires investment in hardware, software and skilled personnel smaller teams may struggle.
- **Human-machine collaboration:** While AI provides insights, human intuition, context, and

leadership remain essential; over-reliance on AI can risk losing the human element of sport.

Future Prospects:

- **Real-time and in-match decision support:** As processing and data pipelines improve, we will see more real-time AI feedback to coaches and athletes during matches.
- **Wider adoption in emerging sports and regions:** Sports like kabaddi in India and other regional sports can leapfrog traditional models with AI adoption.
- **Explainable AI and fair decision-making:** The trend toward AI systems that provide understandable reasoning will increase trust and adoption.
- **Fan-centric AI experiences:** From personalised content to immersive AR/VR experiences, AI will further transform spectator engagement.
- **Integration with wearable and IoT ecosystems:** As sensor technologies become cheaper and more pervasive, AI will integrate seamlessly into training, recovery, and performance monitoring.

Conclusion:

AI is undeniably transforming the sports industry from improving athlete performance and enabling smarter strategies, to enhancing fan engagement and organisational efficiency. In cricket, football and kabaddi, the applications differ in scale and data maturity, but the underlying potential is common: better insights, better outcomes. Nevertheless, to fully realise this potential, the challenges of data, ethics, cost, and human-AI collaboration must be addressed. As sports continue to evolve in the digital era, AI will play an ever-more central role not replacing human judgement, but augmenting it.

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