

Smart Coaching with AI: Designing an Ethical AI Model for Real-Time Sports Analytics

Leveraging the Role of AI in Sports: Advancing Strategies and Mitigating Ethical Risks

A Thesis Prospectus

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By

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On my honor as a University student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments.

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Introduction

At just 23 years old, Jayden Daniels, rookie quarterback for the Washington Commanders, has already carved his name into National Football League (NFL) history as one of the most impressive quarterbacks the league has ever seen. Ten weeks into the season, Jayden has won Rookie of the Week seven times and made NFL history as the first quarterback to pass for over 1,000 yards and rush for more than 250 yards in his first five games (Koplowitz-Fleming, 2024). Growing up as a lifelong fan of the Washington Commanders, I've followed every game this season, watching my quarterback, Jayden Daniels, and the newly energized Commanders team be successful. Jayden's exceptional playing left me wondering how our team reached this level with a rookie quarterback and what technologies might have played a part in this improved performance. Recent reports revealed that Jayden uses a VR headset, which simulates real game scenarios, allowing him to hear plays from his offensive coordinator as if he were on the field. This headset, powered by AI, helps him analyze defenses 80% faster and adapt to his coaches' calls with ease (Menon, 2024). These findings sparked my curiosity about the role of AI in sports, particularly how AI assists coaches with player development and game strategy.

I will explore AI's growing influence on sports through two projects. My technical project will focus on proposing an AI algorithm to help coaches make more informed decisions on monitoring player performance and strategizing game calls, all while prioritizing security and privacy measures to safeguard player data. My STS project will examine how sports organizations are currently using AI models, and the privacy and ethical concerns that arise from its use. My research question will investigate how AI can be applied ethically and responsibly to create a fairer and safer environment in sports - a space that unites millions together and should

protect the rights of its players. As AI technology becomes increasingly integrated into sports, it is critical to ensure it is being used to enhance rather than compromise athletes' performance, rights, and well-being, making it essential to explore the ethical implications of AI's role in sports analytics.

Technical Project

Developing an AI model that is unbiased and efficient in analyzing game data is vital for coaches to make more informed on-the-field decisions that directly impact player performance and safety on the field. My technical project aims to develop an AI algorithmic model that can quickly parse through game data, providing easily interpretable and accurate results to coaches in time-sensitive environments. To help combat existing problems and ethical concerns with AI technology, this model will prioritize security and privacy protections, ensuring that the data used for training is reflective of a broad range of demographics, including race, gender, and age, to mitigate biases and ensure fair outcomes for all athletes.

The foundation for my model is grounded in findings from existing AI systems, which highlight how AI can significantly enhance sports prediction with a fast execution speed, allowing for more effective game-time decisions (Tan, 2023). This is why I plan to design my model with a high execution speed, enabling it to generate faster predictions in real time to support rapid adjustments during games. This execution speed is essential in high-stake environments like Formula 1 racing, where team coaches need to make split-second decisions that can affect the safety of their athletes. I plan to propose a model that can dynamically respond to changing conditions on the field, providing insights that allow coaches to optimize player performance based on real-time data.

Additionally, findings from an AI system that analyzed a collegiate women's basketball team highlighted the importance of integrating data from various performance measures to provide valuable insights for coaches (Taber et al., 2024). For my model, I plan to incorporate the ability to analyze a variety of performance metrics, such as player weight and number of injuries. By analyzing these performance metrics, my model can output predictive statistics on how well an athlete is likely to perform in an upcoming match and assess the injury risk associated with each player, promoting their overall wellbeing. These insights will allow coaches to adjust the starting lineup to prioritize athletes who have a higher performance condition and lower risk of injury. Along with performance metrics, my model will be able to analyze game feeds from prior matches, offering an analytic assessment of opponents' performance patterns and statistics. This analysis will enable coaches to train their athletes and prepare them for upcoming matches, familiarizing players with their opponents' tendencies and strengths.

My AI model will also be designed for live, on-the-field use and be connected to cameras that track and record athlete movements. Research emphasizes the benefit of using AI to analyze motion data in real time, allowing coaches to make better decisions during games (Nauck et al., 2022). By analyzing game data in real time, my model can output predictive statistics and injury assessments for each player, providing coaches with actionable insights during the game. This will allow coaches to make timely and accurate decisions on which players need to be substituted out based on injury risk, providing coaches with insights that can improve team performance and player safety.

An important component of my model will be the ethical framework it incorporates to address privacy and security concerns. Scholarly authors emphasize the importance of ensuring AI tools have robust ethical frameworks to ensure AI is being utilized with care (Dubber et al.,

2020). To protect athlete privacy, my model will securely store athlete data by anonymizing names and assigning each athlete with a unique number identifier instead. Only authorized people, like senior coaches and managers, will have access to the mapping between the names and unique identifiers. This framework helps minimize the risk of unauthorized access and addresses security concerns. Additionally, I plan for the predictive statistics outputted by my model to be viewed by the same authorized people, further reducing the risk of rival competitors accessing this sensitive data.

In summary, my final product will be able to analyze various types of data - player health, opponent performance, and real-time game data - to provide meaningful recommendations for coaches before, during, and after a game. This model can potentially benefit any sports team across organizations by offering a tool for strategic decision-making, injury prevention, and optimized performance for players. Due to the sensitive nature of the data involved, this model will require strong security and privacy protections to ensure it is being utilized responsibly and fairly. It is critical to ensure this model doesn't end up in the wrong hands, such as rival athletes and teams, as the goal of my model is to enhance team performance, not to compromise privacy and integrity of any players involved. After creating my model, I plan to ensure my model securely handles athlete data by anonymizing sensitive data and following authorization protocols so only authenticated users can view athlete data.

STS Project

AI is transforming the sports industry, and its incorporation into this field can help revolutionize how coaches are utilizing this technology to better their strategies and monitor player performance. For instance, the Philadelphia Eagles and San Francisco 49ers utilize AI to

analyze large amounts of game data to better understand opponents' strategies and predict future plays (Sahota, 2024). Coaches are able to make more informed decisions, such as more effective play-calling and drafting defensive and offensive line formations. Additionally, the NFL created the Digital Athlete Initiative, a tool that uses AI, earlier this year to allow teams to understand what players need to stay healthy and perform at their best. A new kickoff rule was implemented, taking after predictive analysis, that includes capturing player data through chips in players' shoulder pads (Yohannes, 2024). This analysis helps identify plays and body positions that most likely lead to injuries, allowing coaches to make smarter play calls that prevent athletes from being injured.

AI is also being harnessed to develop customized training programs for athletes. Through real-time monitoring, AI can help track athlete progress and offer targeted feedback to address each player's specific needs. Many coaches now use AI to monitor player health and predict which players are susceptible to being injured. For instance, the Seattle Seahawks are using AI models to spot players at potential risk of injuries (Peranzo, 2024). AI also enhances real-time decision-making, especially in high-stakes environments like Formula 1 racing, where coaches need to make quick decisions to ensure player safety. By utilizing AI, coaches can dynamically respond to changing conditions, allowing them to optimize performance (Brady et al., 2022). Thus, this technology allows coaches to analyze the results of personalized training for athletes and real-time data to make more informed, data-driven decisions that contribute to team success.

While AI offers significant benefits in sports analytics, it also raises privacy and ethical issues due to the sensitive nature of player data and accuracy issues in algorithm development. My research question seeks to investigate these unanswered ethical challenges surrounding AI use in sports analytics and what issues arise from coaches using this tool. Coaches can make

poor decisions about players or the game strategy if the statistics provided by the AI models are misinterpreted. Models are trained using historical data, which could favor certain players over others based on race and gender, leading to bias in technology and coaches again making misinformed decisions (Dubber et al., 2020). Privacy concerns also emerge from the collection of personal data on athletes, especially health sensitive data like their heart rate and injury histories, to evaluate their performance. This collection of data can be ethically concerning, and the data ownership and security of this data should be questioned (Sharma, 2024). To help combat these problems with AI technology, I will research how a more robust algorithmic model that implements privacy protection measures, while ensuring that the data used for training of the model is reflective of a broad range of demographics, can be utilized by coaches. Through my research, I will focus on the limitations with current AI tools and why they exist. I aim to identify areas for improvement to ensure AI is being used ethically within the field of sports.

To help answer my research question, I plan to use a mix of STS methods. First, I will perform a content analysis to analyze how AI is being used among different sports organizations. I will collect data from looking at news stories of how AI is being used and analyze what policies are put in place regarding its usage. Next, I will do a discourse analysis to read through secondary materials, such as articles posted by news reporters and post-game interviews found on YouTube from the past two years, to explore how coaches feel about using AI to make data-driven decisions. I will focus on what their thoughts are to see if coaches believe the benefits of AI outweigh its limitations. Lastly, I will conduct a meta-review of analyzing AI systems developed by researchers. I will review AI systems discussed in academic journals from the University of Virginia Library over the past five years to evaluate their effectiveness in assisting coaches with monitoring player performance and making game decisions. I will use these

findings as supporting evidence for why AI tools are beneficial and why they should be improved to reduce ethical concerns.

Conclusion

Through my research on the ethical concerns that exist with current AI models, I will address the concerns of AI usage in sports analytics by proposing a new AI model and suggesting areas for improvement. By examining existing AI models and their limitations, I hope to emphasize the need for a more robust and secure model that can mitigate bias and protect athlete data. AI is a rapidly growing tool that can transform sports, enabling coaches to make better data-driven decisions to boost player performance. However, by adopting this new technology, it is critical to be aware of the added responsibility of ensuring the data processed by this tool is safeguarded from misuse by bad attackers, like rival teams and players.

A securely designed AI model should be accurate, precise, non-discriminatory, and accessible to all teams and sports organizations to ensure fair play. The model I propose will safeguard athlete privacy, provide coaches with valuable predictive insights, and contribute to a more ethical use of AI in sports. By developing models that take ethics and privacy into account, an environment that emphasizes the values of fair play and respects the rights of athletes can be created, ultimately enhancing the game for players and fans alike.

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