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Liverpool John Moores University

School of Computer Science and Mathematics

**6100COMP Project**

Final Year Dissertation

submitted by

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Title

**Determining the Impact of Turf Surfaces on Football Injuries: A Comprehensive Analysis on Injury Detection and Prediction.**

Supervised by

**Dr. Mark Evans**

Submitted on

**19 April 2024**

Abstract

An abstract of not more than 300 words or one page. Though it is placed at the beginning of the report, it is written after the main body of the report, which it summarises, has been completed. It gives the potential reader a framework showing the main features of each section of the report, including the problem, the solution, the results, and the main conclusions reached. It is therefore both self-contained and self-explanatory.

Acknowledgement

Here the student must make a full declaration of all contributions made by others to the project as, unless stated, the project is assumed to be entirely the student’s own work. This would typically include the emotional support and encouragement of family, friends, and academic staff.

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# Introduction

## Background Information

Football or Soccer as it is called in some parts of the world is often widely regarded as the world’s most popular sport [1]. The sport transcends geographical boundaries and cultural differences, captivating millions of enthusiasts globally. Due to the sport’s competitive nature that is intertwined with demands of a rigorous schedule places an increased risk of injury to professional football players. Among the myriad factors that influence a player's well-being, the nature of playing surface plays emerges as a topical determinant.

In the realm of professional football or soccer as it’s known in North America, the Major League Soccer (MLS) stands as a pinnacle of the best of football that America and Canada have to offer. The league showcased the region’s talent and contributed to the global football landscape. As the sport continues to evolve in terms of embracing the advancements of sports science, technology and facilities, one aspect that warrants meticulous examination is the choice of playing surface in terms of player welfare. Traditionally, natural grass has been the standard choice for football pitches but the emergence of astro turf and hybrid pitches have introduced a dynamic shift in playing conditions.

This dissertation seeks to delve into the intricate relationship between playing surfaces with a comparative analysis of injuries on astro turf versus natural grass in the context of the Major League Soccer as a case study. The significance of this study lies not only in advancing our understanding of injury patterns but also in providing actionable insights for player welfare, performance enhancement, and the overall development of the sport.

As the MLS landscape transforms, incorporating both tradition and innovation, it becomes imperative to scrutinise the impact of playing surfaces on the physical well-being of football players. By navigating through the intricacies of injuries on different surfaces, this research aims to contribute valuable knowledge that can inform not only MLS practices but also serve as a reference for football leagues globally.

The subsequent sections of this dissertation will uncover a comprehensive analysis, from literature reviews, comparative studies, and practical recommendations, with the ultimate goal of fostering a safer and more sustainable environment for football players.

The rise in technology has given rise to groundbreaking advancements in injury prediction with machine learning ML algorithms playing a pivotal role when identifying players that are risk of injury. These algorithms leverage the power of data analysis to mitigate potential risks. ML injury prediction models have the potential to revolutionise the football industry. They have potential provide actionable insight to help reduce the burden of injury to athletes.

## 

## Problems Statement

The introduction of artificial turf, or as more commonly referred to as astro turf, alongside natural grass pitches has prompted many discussions and debates regarding its potential influence on player injuries. It’s a topical subject at the minute in the Netherlands as they begin the phasing out of artificial pitches by 2030. The surface played a massive hazard for players welfare.

The primary problem revolves around the ambiguity surrounding the difference of playing surfaces contribute to injury patterns among football players. Technological advancements and an increasing awareness of sports science provide a comprehensive understanding of the impact of astro turf compared with natural grass on injury occurrence is notably lacking. This knowledge gap is a source of concern for players, coaches, league administrators, and the broader football community.

Player safety stands at the forefront of these concerns. The potential correlation between certain playing surfaces and higher injury rates or specific injury types raises critical questions about the immediate and long-term health implications for football players. The physical toll of injuries not only impacts individual players but has broader implications for team dynamics, overall competitiveness, and the attractiveness of football leagues to both players and fans.

The lack of a comprehensive analysis creates challenges in strategic decision-making for teams and the league. If specific playing surfaces are associated with distinct performance metrics, such as possession, goal-scoring, or match outcomes, teams may need to adjust their strategies based on the venue. This dynamic adds an additional layer of complexity to MLS matches.

The introduction of astro turf into MLS stadiums has also led to questions about equitable treatment. Variances in playing conditions between different stadiums may contribute to disparities in team performance and player morale. The MLS covers a vast geography where climate can have a massive impact on injury prevalence in terms of pitch surfaces.

In light of these challenges, there is an urgent need for rigorous and systematic research that addresses the impact of playing surfaces on injuries in football comprehensively. This research is essential not only for safeguarding the health and well-being of players but also for informing evidence-based decisions regarding facility standards, regulations, and the sport’s commitment to providing a fair, safe, and consistent playing environment for all participants.

This dissertation aims to fill this crucial knowledge gap by conducting a detailed analysis of injury rates, types, and player perspectives on astro turf and natural grass surfaces. By providing nuanced insights, this research seeks to contribute to the formulation of effective policies and the enhancement of player safety measures.

## Motivation

The motivation behind this dissertation is deeply rooted in the global context of football, transcending geographical boundaries and encompassing the broader football community. Several compelling factors drive the need to investigate the impact of playing surfaces on injuries, contributing to the larger body of knowledge within the sport:

Player Welfare in Global Football

Football represents a universal language that captivates millions of players and fans worldwide. The foremost motivation is a genuine concern for the welfare of football players globally. By delving into the relationship between playing surfaces and injuries, this research aims to uncover insights that can benefit players at all levels, from grassroots to professional, fostering a safer environment for participants in the beautiful game.

Advancement of Football Science

Football has seen a surge in the integration of sports science and analytics. The motivation here is to contribute to the evolving field of football science. Understanding how different playing surfaces impact injuries provides a foundation for evidence-based strategies not only for individual teams but also for football organizations, governing bodies, and researchers worldwide. This research aspires to be a catalyst for pushing the boundaries of football science.

Equity and Fairness Across Football Competitions

The introduction of various playing surfaces across different football competitions has created a landscape with inherent disparities. This dissertation is motivated by a commitment to promoting equity and fairness in football. By investigating how playing surfaces influence injuries, the aim is to contribute to a more level playing field, ensuring that all footballers, regardless of the league or venue, encounter similar challenges and opportunities.

Global Relevance and Cross-League Insights

Football is a global phenomenon with diverse playing conditions across various leagues. The motivation is to generate insights that transcend specific leagues and have applicability across different football ecosystems. The findings from this research have the potential to contribute not only to the understanding of playing surfaces in elite competitions but also to grassroots football, fostering a holistic approach to player safety and development. The MLS has many different climates from the warm humid subtropical climate of Texas to the temperate climate of Vancouver. I hope to gain insight into how surface and weather play a role in terms of injury risk.

Enhancing Competitiveness and Sustainability of Football

The competitiveness and long-term sustainability of football as a sport are contingent on various factors, and injuries play a pivotal role in terms of competitiveness. By unwinding the impact of playing surfaces on injuries, this research seeks to contribute to the creation of conditions that enhance the overall quality, competitiveness, and sustainability of football globally.

The use of Data Science in Injury Prediction

The motivation to harness the power of data science for injury prediction in football is driven by the pursuit of precision in terms of safeguarding player health. Traditional injury prevention strategies often rely on generalized protocols, lacking the granularity needed to address individual player risks. The hope is to use data-driven insights in order of revolutionising the way football clubs approach player welfare.

In conclusion, this dissertation is motivated by a profound passion for football and a commitment to enhancing the sport's global landscape. By exploring the intricate relationship between playing surfaces and injuries, the goal is to contribute meaningful insights that resonate across football communities worldwide, fostering a safer, fairer, and more competitive environment for all participants.

# Background Research and Domain Analysis

## Background Research

## Domain Analysis

# Requirement Analysis and Methodology

## Requirement Analysis

## Methodology

The report should have one or more chapters describing the design and development of the project solution/artefact. These may include formulation of scientific questions and the answers to them, appropriate theoretical background, technical problems considered, methods used to solve them (methodologies and tools employed e.g. case tools), discussion of issues arising in specifying, designing, and implementing the system (e.g. requirements analysis, user interface, system architecture, algorithms, major data structure, etc.) and evaluation of results (e.g. complexity, efficiency, user-friendliness, reliability, etc.).

# Design of Artefact

The report should have one or more chapters describing the design and development of the project solution/artefact. These may include formulation of scientific questions and the answers to them, appropriate theoretical background, technical problems considered, methods used to solve them (methodologies and tools employed e.g. case tools), discussion of issues arising in specifying, designing, and implementing the system (e.g. requirements analysis, user interface, system architecture, algorithms, major data structure, etc.) and evaluation of results (e.g. complexity, efficiency, user-friendliness, reliability, etc.).

# Development of Artefact

The report should have one or more chapters describing the design and development of the project solution/artefact. These may include formulation of scientific questions and the answers to them, appropriate theoretical background, technical problems considered, methods used to solve them (methodologies and tools employed e.g. case tools), discussion of issues arising in specifying, designing, and implementing the system (e.g. requirements analysis, user interface, system architecture, algorithms, major data structure, etc.) and evaluation of results (e.g. complexity, efficiency, user-friendliness, reliability, etc.).

# Testing and Evaluation of Artefact

# Project Evaluation

# Conclusion and Future Work

## Conclusion

## Future Work

The report should have a section to contain the Conclusions, this being a summary discussion/critique of the project’s goals, achievements, difficulties, lessons learnt, etc. Similarly, there should be a section on Further Work for the project, this being a discussion on how the work in the project could be further continued and directed. A dead-end project with no possibility for further development is probably not a good one. Suggestions for how future projects could develop the current theme would be a good way of describing further work.

# References

The project must be conducted in the context of related work, and so the report should contain a section for References to others’ work used within yours. Make sure that all of the references listed are actually referred to in the main text. Note that it is usually the work that others have or have not done which provides the motivation and justifies the project.

# Appendix

## Project Specification

## Signed Monthly Reports

The report should have an appendix section on Project Management. This section must contain at least the monthly reports but could include a range of other supporting documentation.