

Project Proposal:

Sports Management for Injury Prevention, Performance, and Athlete Management Using Machine Learning

Prepared for
CSIS4495 Applied Research Project
Section 002

Presented to
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Introduction

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I. Domain, Overview of Background, and Context of the Research

Sports injuries are inherently multifactorial, arising from interactions between modifiable factors (e.g., training load, strength) and non-modifiable factors (e.g., age, injury history) that fluctuate over time. Artificial intelligence (AI), including machine learning models, has shown potential in analyzing large, imbalanced datasets to predict injuries by accounting for these complex interactions and both risk factor types.

The application of Artificial Intelligence (AI) and Machine Learning (ML) in sports has grown significantly in recent years. AI has been instrumental in enhancing decision-making, performance forecasting, and injury prevention in various sports disciplines. Examples include optimizing training regimens, predicting game outcomes, and evaluating injury risks through wearable devices and advanced algorithms.

II. Framing the Problem

Here are some questions regarding the research:

1. How can ML improve injury prediction and performance optimization in sports?
2. What methods can provide personalized, data-driven insights for people?

Injuries significantly impact athletes' performance and team success. A reliable injury prediction system and performance tracker can mitigate risks, reduce downtime, and improve overall athlete outcomes.



III. Relevant Literature and Research

Injury prevention is essential for success in sports, with significant financial investments made to achieve it. Despite these efforts, millions of athletes still experience injuries each year, highlighting the need for improvement in injury prediction. Artificial intelligence (AI) presents a promising approach by addressing the complexity of sports injuries, considering their non-linear nature, and enhancing decision-making for practitioners.

ML models such as Support Vector Machines (SVM) and XGBoost have been used to predict injuries in basketball by analyzing factors like age, past injuries, and performance metrics. Wearable devices combined with ML algorithms have shown to effectively monitor real-time physiological data to evaluate training impacts. Existing studies focus on individual aspects like injury prediction or performance forecasting but lack integration into a holistic system. Many ML models require high-quality datasets that are often inaccessible or incomplete.



IV. Hypotheses, Assumptions, and Potential Benefit of Research

An integrated sports management portal powered by machine learning (ML) will significantly enhance the accuracy of injury prediction and provide actionable insights to optimize athlete performance. The portal will leverage advanced algorithms to analyze both modifiable (e.g., training load, strength) and non-modifiable factors (e.g., age, injury history), enabling people like coaches and athletes to make informed decisions.

Assumptions include the availability of high-quality datasets containing relevant variables such as athlete demographics, performance metrics, and injury histories. It is also assumed that the adoption of the portal by coaches and athletes will align with the growing reliance on data-driven approaches in sports.

The potential benefits of this research are multifaceted. Firstly, the system is expected to reduce athlete downtime by accurately predicting injury risks and recommending preventive measures tailored to individual needs. Secondly, the portal will improve training outcomes by enabling coaches to adjust regimens based on real-time performance data and risk assessments. Thirdly, the research will contribute to the development of a user-friendly and customizable platform, empowering athletes to track their progress and coaches to manage multiple profiles efficiently.

By addressing the gaps in current injury prevention and performance tracking tools, this research aims to advance sports management technology and contribute to safer and more efficient athletic practices. In the long term, the portal could serve as a model for broader adoption across various sports and training environments.



Proposed Research Project

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I. Research Design and Objectives

Design

Develop a web-based portal incorporating ML models for injury prediction, performance analytics, and training customization.

Objectives

- a. Create a database to store athlete profiles and performance metrics.
- b. Train an ML model to predict injury risks using historical data.
- c. Build interactive dashboards for visualizing performance trends.

II. Methodology

Data Collection

Sources include publicly available datasets from NBA and synthetic data. Possible features include age, previous injuries, physiological metrics.



Data Analysis

Use machine learning algorithms/models for injury prediction and trend analysis.

Justification

ML models have shown superior performance in similar studies, validating their use in this context.

III. Technologies

Operating System/Platform

Will use both MacOS and Windows 11

Programming Languages/Frameworks

For the backend, it will be Python (machine learning algorithms still to be decided)

For the frontend, it will be HMTL, CSS, and JavaScript

Database

For the database, will use a Database Management System (still deciding if MS SQL Server or MySQL)

IV. Expected Results

The expected results are:

1. Accurate injury risk predictions with recommendations for mitigation
2. Practical applications which people like athletes and coaches can use



Project

Planning and Timeline

Here is the proposed project plan and timeline which can change depending on the status of the project.



PHASE	DURATION	MILESTONES
RESEARCH AND PLANNING	2 weeks	Define scope, collect datasets, finalize tech stack
PROTOTYPE DEVELOPMENT	4 weeks	Build minimum viable product: athlete profiles and basic injury prediction
FEATURE EXPANSION	2 weeks	Look how to combine performance/training with the prototype
PROJECT MANAGEMENT	2 weeks	Launch portal, gather feedback, and refine

Project Contract

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January 24, 2025

Padmapriya Arasanipalai Kandhadai

Advisor

Douglas College
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New Westminster BC V3M 5Z5

Dear Ms. Kandhadai,

This letter serves as a formal agreement for the development and delivery of the Sports Management Portal for Injury Prevention and Performance Optimization Using Machine Learning. As outlined in the proposal, the scope includes creating a web-based platform that integrates machine learning models for injury prediction, performance analytics, and training customization.

The project will follow the timeline detailed in the proposal, with key deliverables including a functional prototype, expanded features, and a fully deployed portal by the designated milestones. All development, testing, and deployment responsibilities will be managed solely by me, and I will adhere to the agreed-upon scope and deadlines.

Weekly self-reviews will be conducted to ensure progress aligns with the proposed plan. Any adjustments to the timeline will be promptly communicated. This agreement reflects my commitment to delivering a high-quality, impactful solution.

Excited to work on this ambitious project!

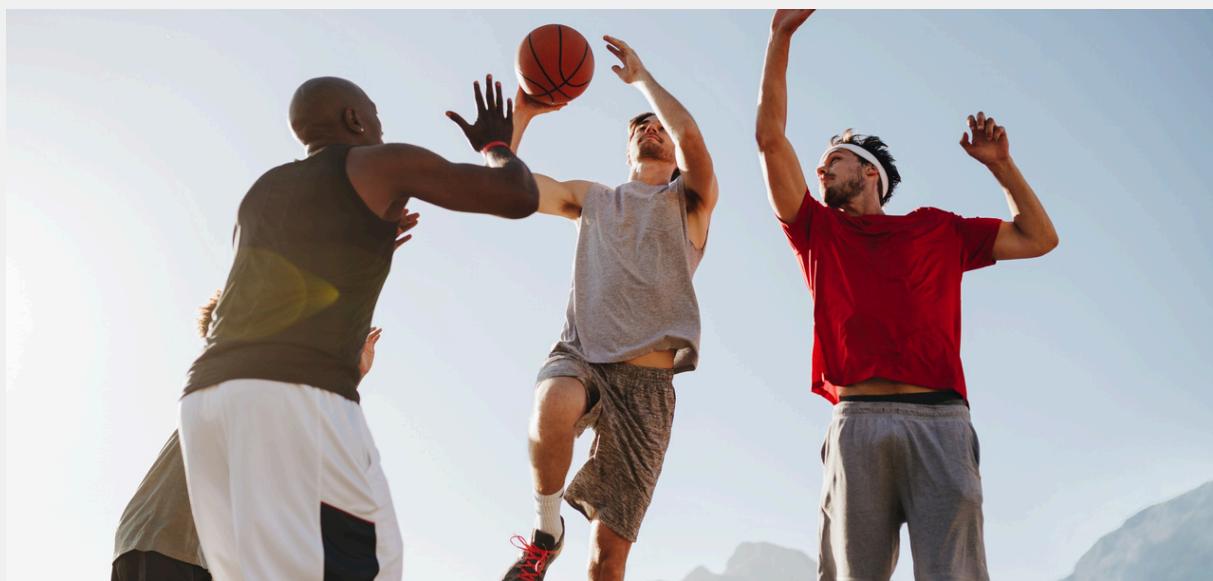
Sincerely yours,

Juan Carlos Katigbak
Juan Carlos Katigbak
300366535
Student

Work Date/ Hours Logged

Here is the table so far of the work date and hours logged for the project.

DATE	NUMBER OF HOURS	DESCRIPTION OF WORK DONE
JANUARY 17, 2025	2	Initial research on topic
JANUARY 22, 2025	4	Further research on topic
JANUARY 23, 2025	3	Created 1st draft of project proposal



Closing and References

In conclusion, the Sports Management Portal for Injury Prevention and Performance Optimization represents a significant opportunity to leverage machine learning for improving athlete outcomes. By integrating injury prediction, performance tracking, and training customization into a cohesive and user-friendly platform, this project aims to address critical gaps in current sports management tools. The proposed timeline, technologies, and methodologies ensure a structured approach to achieving the project's objectives.

I am committed to delivering a solution that combines cutting-edge technology with practical applications, ultimately contributing to advancements in sports management and athlete care.

Main reference which inspired me to do this project is this:

Owen, R., Owen, J. A., & Evans, S. (2024). Artificial intelligence for sport injury prediction. In C. Dindorf, E. Bartaguz, F. Gassmann, & M. Fröhlich (Eds.), Artificial intelligence in sports, movement, and health (pp. [page range if known]). Springer.

