Athletic Runner Injury Prediction System

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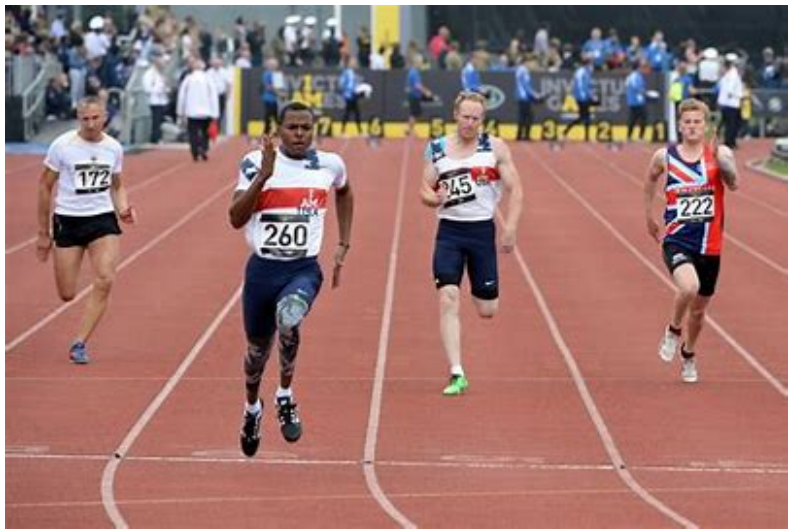
Contents

Overview

- By leveraging advanced machine learning techniques, we empower athletes to proactively manage their well-being, optimize performance, and contribute to the broader goals of health, innovation, and sustainability in sports and society.



Problem Statement

- Running is one of the most popular sports in the world.
- 60 million people participated in jogging, running, or trail running in America alone in 2017. But it is reported that 50 percent of runners get injured every year.

Objectives

Model Development

- Performing feature extraction and identifying the feature importance for Injury Prediction For Athletic Runners.
- Building model for injury prediction for athletic runners using machine learning techniques.

Literature Survey

S.no	Title	Objective	Methods	Description	Performance	Author, Year and Conference/Journal
1.	Just How Confident Can We Be in Predicting Sports Injuries?	To evaluate the methodological conduct and completeness of reporting of musculoskeletal injury prediction models in sport.	Regression, Machine Learning, and regression	Thirty studies were conducted where 204 models were included which used regression, machine learning Techniques.	Poorly developed and has high risk of bias	Garrett S. Bullock, 2022, Sports medicine 52.10.

Literature Survey

S.no	Title	Objective	Methods	Description	Performance	Author, Year and Conference/Journal
2.	Investigating Individual- and Group-Level Model Adaptation for Self-Reported Runner Exertion Prediction	To recognize the runner's exertion as soon as possible and take possible precautions.	Feature Selection, FFNN, Baseline model, individual-level adaption, group-level adaption	System consists of a feature selection and three model training components.	Mean Absolute Error (MAE) is less for the group-level adaption.	Alexander Kathan, 2022, Shahin Amiriparian E-Health and Bioengineering Conference.

Literature Survey

S.no	Title	Objective	Methods	Description	Performance	Author, Year and Conference/Journal
3.	Ultra marathon Result and Injury Prediction using PyTorch.	To develop and assess multilayer neural network models using PyTorch to predict ultramarathon runner performance and injury occurrence based on training, competition, and weather data.	Implementing multilayer neural network models with PyTorch for regression and classification tasks	Two Predictions based on MLNN are implemented using PyTorch framework for Python.	Up to a 2% relative error for the regression model and a 70% correct classification for injury prediction.	Valentina Nejkovic, 2021, 15th International Conference on Advanced Technologies

Literature Survey

S.no	Title	Objective	Methods	Description	Performance	Author, Year and Conference/Journal
4.	Data monitoring and sports injury prediction model based on embedded systems	To develop an Artificial Neural Network-based system for early prediction of injuries in sports by analysing player health, exercise load, and emotional status. Through a hierarchical machine learning approach.	PCA, Decision tree, ANN	A layered machine that makes accurate predictions of player damage.	PCA- 86% Decision tree- 89% ANN - 95%	Chen Huang, 2021, Microprocessors and Microsystems 81.

Literature Survey

S.no	Title	Objective	Methods	Description	Performance	Author, Year and Conference/Journal
5.	Prediction method of Running fatigue based on depth image.	To prevent over-fatigue exercises that may occur during running and accurately capture every small posture change of runners	Convolutional Neural Network, SVM.	Depth image human running fatigue prediction method.	Accuracy-87.692%	Bin Wang, 2021, 2020 International Symposium on Wearable Computers.

Literature Survey

S.no	Title	Objective	Methods	Description	Performance	Author, Year and Conference/Journal
6.	Machine learning methods in sport injury prediction and prevention	To improve injury prediction and allow proper approaches to injury prevention.	Tree based Ensembled Methods, SVM, ANN.	Eleven out of 249 studies met inclusion/exclusion criteria	performance ranged from poor (Accuracy = 52%,) to strong (Accuracy=85%).	Hans Van E, 2021, Journal of experimental orthopaedics

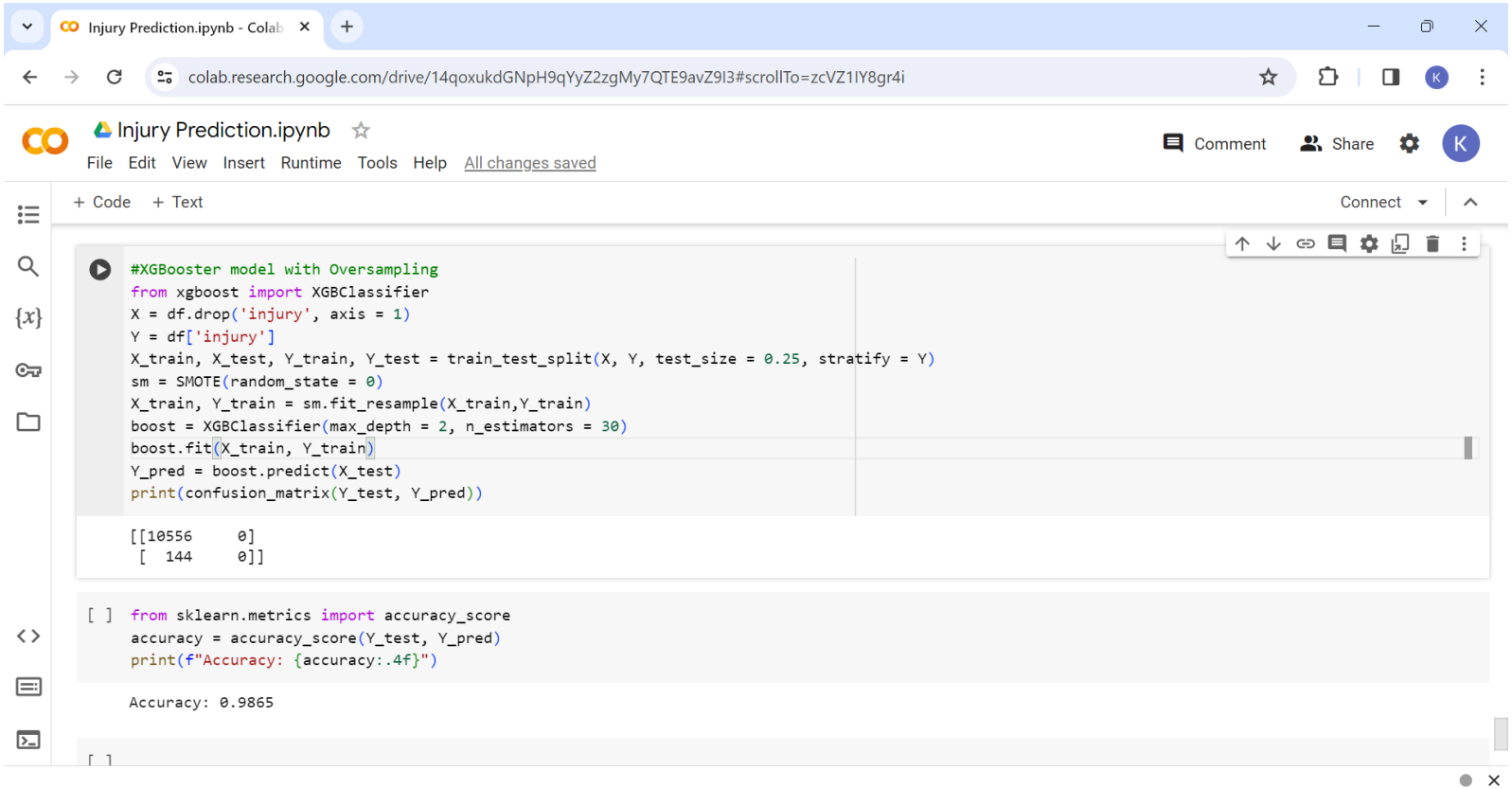
Methodology

- DataSet : https://www.kaggle.com/datasets/shashwatwork/injury-prediction-for-competitive-runners
- Algorithms :
  Support Vector Machine
  XGBooster
  Bagging

Tools and Technologies

- Tools : Google Colab
- Technologies :
  Python
  Python Libraries

Implementation



Results and Discussion

Algorithms Used	**Accuracy**
SVM	60%
Bagging	98%
XgBooster	98%

Progress

SNo	Title
1	Identified the data set
2	Literature Survey completed
3	Understanding the features of data
4	Started implementation

References

- Bullock, Garrett S., et al. "Just how confident can we be in predicting sports injuries? A systematic review of the methodological conduct and performance of existing musculoskeletal injury prediction models in sport." Sports medicine 52.10 (2022): 2469-2482.
- Kathan, Alexander, et al. "Investigating Individual-and Group-Level Model Adaptation for Self-Reported Runner Exertion Prediction from Biomechanics." 2022 E-Health and Bioengineering Conference (EHB). IEEE, 2022.
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- Van Eetvelde, Hans, et al. "Machine learning methods in sport injury prediction and prevention: a systematic review." Journal of experimental orthopaedics 8 (2021): 1-15.
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- Bai Y, Guan Y, Ng W F. Fatigue assessment using ECG and actigraphy sensors[C]//Proceedings of the 2020 International Symposium on Wearable Computers. 2020: 12-16.

Thank you