"Revolutionizing Sports: An In-depth Analysis of Artificial Intelligence in Sports"

Tanya Gandhi[1] Punam Pradhan[2],Divyam Patidar[3],Rahul Kushwah[4] Harmanpreet Kaur[5]

[1]Department of Physical Education, Lovely Professional University, Phagwara, Punjab, India
tanyagandhi1025@gmail.com

[2]Department of Physical Education and Sports Sciences, Faculty of Inter-disciplinary and Applied Sciences, University of Delhi, India
punampradhan746@gmail.com

[3]Department Of Exercise Physiology, Lakshmibai National Institute of Physical Education, Gwalior, India
divyampatidar4@gmail.com

[4]PhD Scholar, Department of Exercise Physiology, Lakshmibai National Institute of Physical Education, Gwalior, India
kushwahrsk1997@gmail.com

[5]Department of Physical Education, Lovely Professional University, Phagwara, Punjab, India
harmanpreet.kaur@lpu.co.in

Background: *Artificial Intelligence techniques like neural networks, decision tree classifiers, and support vector machines are utilized in sports to predict sports performance. AI in sports involves gathering data during sports events and extracting valuable insights using algorithms. The application of AI in sports is considered to be in its early stages, prompting a need for increased research investment in the field*

Method: *Systematic searches through the Sci space, connected Papers and Web of Science onlinedatabases were conducted for articles reporting AI techniques or methods applied to sportspersons.*

Result: *The predictive models built using machine learning techniques showed promising results in the application of AI in sports, particularly in predicting sporting outcomes, has shown high accuracy rates in sportspersons performance prediction. The study highlighted the potential of AIin generating well-formulated training plans, game strategies, and score feedbacks based on pastsporting events and predicting within-year and between-year sports injuries in elite sportspersons.*

Conclusion*: The use of AI approaches in team sports has the potential to expand predictive performance techniques/methods. AI in sports can generate training plans, game strategies, and score feedback based on historical data. Challenges exist in analyzing rich datasets in elite sportsdue to time constraints and data quantity.*

Keywords*: Artificial Intelligence, Sports Analysis, Machine Learning, Performance Evaluation,Computer Vision, Wearable Sensors, Coaching Strategies, Tactical Decision-making*
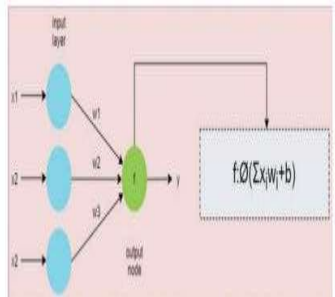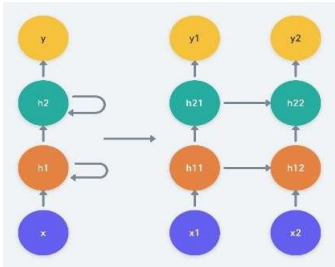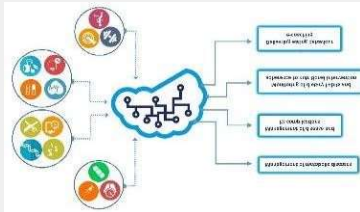
Key points

- *At the moment, artificial neural networks, decision tree classifiers, Markov processes,and support vector machines are being used in sports to predict athletic performance.*
- *Given the field's ongoing growth and the use of evaluation research in sports practiceto determine the predictive performance of any particular technique/method, the use of AI approaches in team sports has the potential to expand.*

1. Introduction

AI combines artificial intelligence and machine learning in sports to gather data during sports events. This data comprises a wide range of information regarding player statistics, game dynamics, and external factors like weather.AI uses algorithms to extract valuable insights frommassive amounts of data that wouldn't be possible through traditional analysis methods. It helps coaches, athletes, analysts, and fans understand the game better and make informed decisions. These methods give insights into each player's sports performance. It reveals patterns that help coaches identify strengths and weaknesses in their team. AI comprehends the tendencies of opponents and generates performance data for teams. In order to suggest optimalgame plans and in-game adjustments to enhance the chances of success. Hence, artificial intelligence is indeed an important factor in sports performance analysis.

In sports, scores and dedication of the team matter to their fans, and coaches are always lookingfor ways to improve sports performance analysis. However, traditional data collection and analysis methods can be time-consuming and subjective Therefore, algorithms that track and measure sports outcomes are used to examine vast amounts of data gathered from video footage, wearables, and sensors. It eliminates human bias and provides objective insights into player performance. This enables coaches to make data-driven decisions for their teams Moreover, with athletic training AI, it becomes easy to identify potential injuries of players and prevent them from happening. It records athlete's health data and movement patterns. Not onlythat, it can detect any abnormalities to alert the medical team before a serious injury occurs. The integration of AI in sports performance analysis addresses fundamental needs in the field.Eventually, it leads to a revolution in how athletes train and compete.
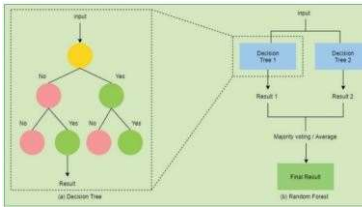
2. AI Method Described

AI	DESCRIPTION	GRAPH
ARTIFICIL NEURAL NETWORK	Based on the architecture and operationsof biological neural networks, an artificial neural network (ANN) is a computational model. Since a neural network adapts—or, in a sense, learns—based on inputs and outputs, information flowing through the network has an impact on the ANN's structure. ANNs are regarded as nonlinear. Using statistical data modelling techniques, itis possible to identify patterns or simulate the intricate interactions between inputs and outcomes.	FIG 1. (Arun Bhavsar et al., 2021)
RECURRET NEURAL NETWORK	A recurrent neural network (RNN) is a type of artificial neural network designed to handle sequential data byretaining memory of past inputs. It processes data in sequences, allowing for context awareness and suitable for tasks like language modeling and time series prediction.	FIG 2 (Arun Bhavsar et al., 2021)
MACHINE LEARNING	Machine learning decision tree classifiers are predictive models that use a tree-like structure to make decisions based on input data, effectively categorizing or classifyinginstances into different groups or classes.	FIG 3 (Arun Bhavsar et al., 2021)

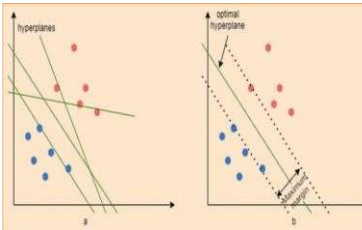| DECISION TREE CLASSIFIERS	Decision tree classifiers are a type of supervised learning algorithm that recursively splits the data into subsets based on features, creating a tree-like structure of decisions to classify instances.	FIG 3 (Arun Bhavsar et al., 2021)
SUPPORT VECTOR MACHINES	SVM is a supervised learning algorithmused for classification tasks. It finds the optimal hyperplane that best separates data into different classes by maximizing the margin between classes, making it effective for both linear and non-linear classification problems.	FIG 4 (Arun Bhavsar et al., 2021)

3. Related Work

3.1 Discussion and Future Research Directions

This study is done to access the contribution of AI in predicting sports performance. A comprehensive review of research papers in this study provides an overview the use of AI approaches in team sports has the potential to expand predictive performance techniques/methods. The articles considered for review in this study are distributed in three Parameter.

Table 1: The distribution of Application of AI in Sports

Sno.	Author	Methodology/Technique	Output	Application	Remark
1.	João Claudino, Daniel De Oliveira Capanema, Thiago Viei raDe Souza Julio Serrã o, Adriano	AI techniques: artificialneural networks, decision tree classifier, support vector machine AI techniques for performance prediction: decision tree classifier, Markov process	AI techniques: neural networks, decision tree, support vector machine, Markov process Team sports: soccer, basketball, handball, volleyball	AI used for injury risk assessment and performance prediction insports. Various AI techniques appliedin team sports for	AI techniques used: artificial neural networks, decision tree classifier, support vector machine, Markov process Team sports with

				analysis.	most AI applications: soccer, basketball, handball, volleyball
2.	(Oliver et al.,2020)	A prospective study assessed 355 elite male youth football players, using pre-season neuromuscular screening and supervised machine	The study aimed to enhance injury risk identification in elite male youth football players using machine learning. Logistic regression showed	This study aims to enhance injury risk assessment in elite youth football players. Comparing	The study investigated whether machine learning enhanced neuromuscular screening's efficacy in identifying injury
		learning algorithms, comparing traditional regression analyses to identify injury risk factors.	low sensitivity, while decision trees improved sensitivity, highlighting multiple contributing factor	Traditional regression to machine learning, the latter showed improved sensitivity and identified multiple risk factors.	risks in elite youth footballers. While logistic regression highlighted one predictor, machine learning improved sensitivity, identifying multiple risk factors

| 3. | (Chmait & Westerbeek, 2021) | The methodology involves providing a non-technical overview of AI and ML in sports analytics, summarizing relevant literature, and presenting hypothetical scenarios of AI/ML's future impact on sports. | In the past two decades, AI has revolutionized sports analysis, enhancing decision-making and forecasting. Despite its growing importance, understanding AI's role in sports remains unclear for many. This paper aims to bridge that gap, offering a non-technical overview of AI and ML's potential in sports analytics, supported by relevant research and hypothetical scenarios. | In this perspective paper, we offer a concise, non-technical overview of AI's impact on sports analytics. We summarize relevant research and explore potential future scenarios, bridging the gap for non-experts. | he paragraph discusses the significant impact of AI on sports analytics, noting its expanding role in decision-making and forecasting. However, it highlights a common lack of understanding among non-experts regarding AI's connection to sports. |

| 4. | (Zhang et al.,n.d.) | Utilizing computer vision, we employ an RGB camera and deep learning models to develop a sports analysis system. The RGB image undergoes sequential processing by two subsystems: Human detection and Performance analysis. The system achieves over 99% accuracy in human detection andprovides real-time feedback with inmilliseconds. | This essay presents a sport detection and analysis system utilizing computer vision with an RGB camera and deep learning models. It accurately recognizes posture, evaluates performance, and provides real-time feedback. | This essay presents a computer vision-based sports analysis system, utilizing an RGB camera and deep learning models for real-time posture recognition and performance evaluation in activities like golf driving. | The system described utilizes computer vision technology with an RGB camera and deep learning models for sport analysis, achieving high accuracy, real-time feedback, and minimal delay across various actions, exemplified through golf driving. |
| 5. | ROMMERS etal., 2020 | 734 elite youth footballplayers underwent preseason anthropometric measurements and physical performance tests. Football exposure and injuries were monitored throughout the season. XGBoost algorithms were | A machine learningmodel accurately predicts injury risk in elite youth football players based on preseason assessments, distinguishing between overuse and acute injuries with high precision." | A machine learning model accurately predicts injury risk in elite youth football players based on preseason assessments, distinguishing between overuse and | The study utilized machine learning to predict injury risk and differentiate between overuse and acute injuries in elite youth football players with high precision and accuracy, offering promising injury management strategies. |

		employed to predict andclassify injuries, achieving high accuracy.		acute injuries with high precision."	

Table 2: Predictive Models in Sports:

Sno.	Author/year	Methodology/Technique	Output	Application	Remark
1.	Bijukumar ,2019	Mathematical and statistical models are used in this, which is verified by a domain expert. Classification approach and Neural. Network Approach are being explored in this article which are considered to be the most accurate prediction models in sports performance	Classification approach and Neural. Network Approach are beingexplored in this article which are considered to be the most accurate prediction models in sports performance.	This application employs AI to predict sports outcomes using historical data. Utilizing mathematical and statistical models, validated by experts, it explores classification and neural network approaches for accurate predictions	The article discusses using AI for sports outcome prediction, utilizing historical data and mathematical models. It explores classification and neural network approaches, validated by domain experts. Beneficial for various

www.healthinformaticsjournal.com

Open Access

					stakeholders.
3.	(Bunker & Thabtah, 2019)	A critical analysis of literature focusing on the application of Artificial Neural Network (ANN) to sport results prediction	. It discusses learning methodologies, data sources, model evaluation, and challenges associated with predicting sport results	To leverage ML techniques to analyze various factors involved in sports matches, such as historical match results, player performance indicators, and opposition information.	The authors provide a comprehensive analysis of the application of Machine Learning (ML), particularly Artificial Neural Networks (ANN), in sport results prediction

| 3 | (Yang et al.,2021) | It utilizes Recurrent Neural Network (RNN), Long Short-Term Memory (LSTM), and Gate Recursive Unit (GRU) models to predict race completion within scheduled times. The study compares these models' predictive accuracy using running records data, finding GRU to be the most accurate. | Research integrates AI for intelligent running analysis and posture prediction. A proposed system utilizes AI to analyse and predict sports postures. Using running data from smartwatches, RNN, LSTM, and GRU neural networks predict race completion within time limits. GRU exhibits superior accuracy compared to LSTM and RNN. | Our application utilizes AI technology for intelligent analysis of running training, enhancing sports performance. Employing RNN, LSTM, and GRU models, it predicts race completion within scheduled time, analyzing heart rate, pace, and running technique. Utilizing data from smart sportswatches, it optimizes training efficiency. Results Favor GRU for accuracy. | The study compares three neural network models, finding GRU to have the highest predictive accuracy, followed by LSTM and RNN. |

Open Access

4.	(Sun, 2022)	This study utilizes adaptive federated deep learning for analysing and simulating college sports performance, integrating motor skill assessment and personalized federated learning algorithms to predict student performance accurately with a 91.7% average accuracy rate	Widespread use of intelligent teaching yields abundant student performance data. Advances in AI, leveraging big data, enhance predictions. This paper proposes fusion of adaptive federated deep learning for college sports performance analysis, achieving 91.7% accuracy	This paper introduces an adaptive federated deep learning algorithm for college sports performance prediction, addressing issues in existing methods. It achieves 91.7% accuracy, providing valuable insights for student improvement.	The paper proposes an innovative approach using adaptive federated deep learning to predict college students' sports performance, addressing existing limitations in prediction accuracy. Impressive results indicate significant advancement in
					performance prediction
5.	(Jauhiainen et al., 2020)	The study utilized 3D motion analysis and physical data from 314 young basketball and floorball players. Predictive models (L1-regularized logistic regression, random forest) identified injury risk factors and were validated using permutation tests	This article explores using predictive machine learning to identify sport injury risk factors. Data from 314 young basketball and floorball	This article demonstrates the application of predictive machine learning in identifying sport	The article demonstrates the application of predictive machine learning for identifying

		(p<0.01).	players were analyzed, revealing consistent predictors for knee and ankle injuries.	injury risk factors. Using data from 314 young athletes, both linear and non-linear methods were employed, revealing consistent predictors.	sports injury risk factors, utilizing data from young basketball and floorball players. Despite modest predictive power, consistent risk factors were identified.

Table 3:

Evaluation of AI Methods in Sports:

Sno	Author/Year	Methodology/Technique	Output	Application	Remark
1.	(Lapham & Bartlett, 1995)	This paper explores the evolving role of computers in sports biomechanics, advocating for AI integration in decision-making. It reviews parallels in medical informatics, focusing on gait analysis, and discusses potential advancements through expert systems	Computers bolster sports biomechanics via data handling, modelling, and simulation. Advocates AI integration for decision-making. Draws parallels with medical informatics, focusing on gait analysis. Proposes expert systems for sports technique advancement.	This paper explores the pivotal role of computers in sports biomechanics, advocating for their integration into decision-making processes through artificial intelligence. It draws parallels withmedical informatics, emphasizing potential advancements	Computers pivotal in sports biomechanics, aiding data processing, modeling, and simulation. Suggests AI integration for decision-making. Draws

					parallels with medical informatics, explores expert systems and neural networks' potential. Expert system development advocated.
2.	Bin & Xinyang,2021)	The methodology involved conducting a literature review to comprehensively analyze AI's application in basketball. Focus areas included team and player performance analysis, competition result prediction, shooting analysis, coaching systems, training machines, and injury	Basketball's global popularity fuels economic growth. Recent AI integration in the sport enhances player training, strategy formulation, injury prevention, and game enjoyment. Research investment is crucial for	AI technology in basketball has garnered attention, enhancing player training, strategy formulation, injury prevention, and game enjoyment. Research indicates untapped potential. We urge increased investment for basketball advancement.	The comprehensive review highlights the growing influence of AI in basketball, focusing on team and player performance analysis, competition result prediction, coaching systems, and injury prevention.

		prevention.	advancement.		Despite progress, further research investment is crucial for advancement.
.	(Pavit t t et al ., 2021)	Utilizing AI techniques, particularly Natural Language Processing and Conversational Interfaces, to aid sports experts in analyzing rich datasets. Demonstrating accessibility and benefits across elite and grassroots sports, exemplified by	Elite sports present rich datasets across multiple threads of the business, yet analyzing them faces challenges due to time constraints and data quantity. AI, like NLP and conversational interfaces, aids experts in gaining insights efficiently.	In elite sports, leveraging AI aids in analyzing vast datasets efficiently. Natural Language Processing and Conversational Interfaces offer intuitive tools for sports experts to	This paragraph highlights the potential of AI in elite sports analytics, acknowledging challenges such as time constraints and AI expertise. It suggests leveraging

www.healthinformaticsjournal.com

Open Access

				gain insights, democratizing analytics from elite to grassroots levels.	AI services like NLP and conversational interfaces to assist sports experts efficiently.
4.	(Novatchkov &Baca, 2013)	This study showcases AI's potential in sports, specifically weight training, using pattern recognition to evaluate exercises on machines. Sensors collect data for intelligent analysis, aiding technique assessment and optimization.	The study demonstrates AI's potential in sports, using weight training as an example. It employs pattern recognition to evaluate exercises, using sensor data to analyze displacement, force, and other parameters. AI aids in technique assessment, optimizing training, and injury prevention,	This study demonstrates AI's potential in sports, focusing on weight training. By analyzing sensor data, it develops intelligent methods for technique assessment, aiding athletes and coaches for optimized training and injury prevention.	The study demonstrates AI's potential in sports, particularly weight training, through pattern recognition methods on exercise machines. Results suggest effective assessment and feedback, beneficial for athletes,

			showing promising results with inexperienced participants.		coaches, and injury prevention.
5.	(Pouli os et al ., 2021)	This study aims to identify AI methods used in sports performance and injury risk prediction. Analysis focuses on AI techniques applied in various sports contexts	AI application in sports offers insights into injury risk and team performance. This study by Poulios et al. (2021) identifies AI techniques used to analyze sports performance and mitigate injury risk.	his study explores AI's role in predicting injury risk and enhancing team sports performance, aiming to identify AI techniques applied in sports performance and injury risk	The study aims to explore AI's role in predicting injury risk and enhancing team sports performance. Understanding AI techniques and their application in sports is crucial for further research.

				analysis (Poulios et al., 2021).	

4. Conclusion

The comprehensive review underscores the increasing role of artificial intelligence (AI) in sports, particularly in predictive analytics. Current utilization includes neural networks, decision tree classifiers, Markov processes, and support vector machines to predict sportsperson performance. These approaches exhibit promising accuracy rates, offering valuable insights for sports performance evaluation and injury risk assessment. The review emphasizes the potential expansion of AI techniques in team sports, facilitatingthe development of tailored training plans, game strategies, and injury prevention measures. Challenges remain, particularly in analyzing rich datasets within elite sports due to time constraints and data volume. Nevertheless, AI's integration in sports analysis revolutionizes decision-making processes, providing objective insights into player performance and enhancing overall team strategies. AI technologies, including machine learning and computer vision, facilitate real-time analysis, posture recognition, and

References

- Arun Bhavsar, K., Abugabah, A., Singla, J., Ali AlZubi, A., Kashif Bashir, A., & Nikita. (2021). A Comprehensive Review on Medical Diagnosis Using Machine Learning. *Computers, Materials & Continua*, *67*(2), 1997–2014. https://doi.org/10.32604/cmc.2021.014943

- Bijukumar, K. (2019a). Artificial intelligence to predict sports performance. ~ *238* ~ *International Journal of Physical Education, Sports and Health*, *6*(3).

- Bin, L., & Xinyang, X. (2021). The journal has had 5 points in Ministry of Science and Higher Education parametric evaluation. *Journal of Education, Health and Sport*, *11*(7), 2391–8306. https://doi.org/10.12775/JEHS.2021.11.07.005

- Bu, X. (2023). Exploration of Intelligent Coaching Systems: The Application of Artificial Intelligence in Basketball Training. *Saudi Journal of Humanities and Social Sciences*, *8*(09), 290–295. https://doi.org/10.36348/sjhss.2023.v08i09.007

- Bunker, R. P., & Thabtah, F. (2019). A machine learning framework for sport result prediction.

o *Applied Computing and Informatics*, *15*(1), 27–33. https://doi.org/10.1016/j.aci.2017.09.005Chen, S., Liya Guo, Xiao, R., Ran, Li, H., & Reynoso, L. (n.d.). *Establishing a cognitive evaluation*

- *model for injury risk assessment in athletes using RBF neural networks*. https://doi.org/10.1007/s00500-023-08789-3(

www.healthinformaticsjournal.com

2024; Vol 13: Issue 3

Open Access

- Chmait, N., & Westerbeek, H. (2021). Artificial Intelligence and Machine Learning in Sport Research: An Introduction for Non-data Scientists. *Frontiers in Sports and Active Living*, *3*. https://doi.org/10.3389/fspor.2021.682287

- Claudino, J. G., Capanema, D. de O., de Souza, T. V., Serrão, J. C., Machado Pereira, A. C., & Nassis, G. P. (2019). Current Approaches to the Use of Artificial Intelligence for Injury RiskAssessment and Performance Prediction in Team Sports: a Systematic Review. *Sports Medicine - Open*, *5*(1). https://doi.org/10.1186/s40798-019-0202-3

- Efe, A. (n.d.). *An Assessment Over the Impact of Artificial Intelligence on Sports Activities and the Sports Industry The International Federation of Red Cross and Red Crescent Societies*.

- Hassan, A., Schrapf, N., & Tilp, M. (2017). The prediction of action positions in team handball by non-linear hybrid neural networks. *International Journal of Performance Analysis in Sport*,*17*(3), 293–302. https://doi.org/10.1080/24748668.2017.1336688

- \Jauhiainen, S., Kauppi, J.-P., Leppänen, M., Pasanen, K., Parkkari, J., Vasankari, T., Kannus, P., & Äyrämö, S. (2020). New Machine Learning Approach for Detection of Injury Risk Factors inYoung Team Sport Athletes. *International Journal of Sports Medicine*, *42*(02), 175–182. https://doi.org/10.1055/a-1231-5304

- Kumar, G. S., Kumar, M. D., Reddy, S. V. R., Kumari, B. V. S., & Reddy, Ch. R. (2023). Injury Prediction in Sports using Artificial Intelligence Applications: A Brief Review. *Journal ofRobotics and Control (JRC)*, *5*(1), 16–26. https://doi.org/10.18196/jrc.v5i1.20814

- Lapham, A. C., & Bartlett, R. M. (1995). The use of artificial intelligence in the analysis of sports performance: A review of applications in human gait analysis and future directions for sports biomechanics. *Journal of Sports Sciences*, *13*(3), 229–237. https://doi.org/10.1080/02640419508732232

- Li, L. (2023). Summary of the Research Status of Artificial Intelligence in Sports PerformanceAnalysis of Athletes. *OALib*, *10*(08), 1–7. https://doi.org/10.4236/oalib.1110539

- Li, S., & Zhang, W. (2022). Evaluation Method of Basketball Teaching and Training Effect Basedon Wearable Device. *Frontiers in Physics*, *10*. https://doi.org/10.3389/fphy.2022.900169

- Novatchkov, H., & Baca, A. (2013). Artificial Intelligence in Sports on the Example of Weight Training. ©*Journal of Sports Science and Medicine*, *12*, 27–37.Oliver, J. L., Ayala, F., De Ste Croix, M. B. A., Lloyd, R. S., Myer, G. D., & Read, P. J. (2020). Using machine learning to improve our understanding of injury risk and prediction in elitemale youth football players. *Journal of Science and Medicine in Sport*, *23*(11), 1044–1048.https://doi.org/10.1016/j.jsams.2020.04.021

- Park, Y. J., Kim, H. S., Kim, D., Lee, H., Kim, S. B., & Kang, P. (2017). A deep learning-based sports player evaluation model based on game statistics and news articles. *Knowledge-BasedSystems*, *138*, 15–26. https://doi.org/10.1016/j.knosys.2017.09.028

- Pavitt, J., Braines, D., & Tomsett, R. (2021). Cognitive analysis in sports: Supporting match analysis and scouting through artificial intelligence. *Applied AI Letters*, *2*(1). https://doi.org/10.1002/ail2.21

- Poulios, P., Serlis, A., Groumpos, P. P., & Gliatis, I. (2021). Artificial intelligence and data processing in injury diagnosis and prevention in competitive sports: A literature review. *MOJOrthopedics & Rheumatology*, *13*(2), 34–37. https://doi.org/10.15406/mojor.2021.13.00544

- ROMMERS, N., RÖSSLER, R., VERHAGEN, E., VANDECASTEELE, F., VERSTOCKT, S., VAEYENS, R., LENOIR, M., D'HONDT, E., & WITVROUW, E. (2020). A Machine

- Learning Approach to Assess Injury Risk in Elite Youth Football Players. *Medicine & Science in Sports & Exercise*, *52*(8), 1745–1751. https://doi.org/10.1249/mss.0000000000002305

- RUDDY, J. D., SHIELD, A. J., MANIAR, N., WILLIAMS, M. D., DUHIG, S., TIMMINS, R. G.,

- HICKEY, J., BOURNE, M. N., & OPAR, D. A. (2018). Predictive Modeling of HamstringStrain Injuries in Elite Australian Footballers. *Medicine & Science in Sports & Exercise*, *50*(5), 906–914. https://doi.org/10.1249/mss.0000000000001527

- Schrapf, N., Alsaied, S., & Tilp, M. (2017). Tactical interaction of offensive and defensive teams in team handball analysed by artificial neural networks. *Mathematical and Computer Modelling of Dynamical Systems*, *23*(4), 363–371. https://doi.org/10.1080/13873954.2017.1336733

- Sun, W. (2022). Predictive Analysis and Simulation of College Sports Performance Fused with Adaptive Federated Deep Learning Algorithm. *Journal of Sensors*, *2022*, 1–11. https://doi.org/10.1155/2022/1205622

- Van Eetvelde, H., Mendonça, L. D., Ley, C., Seil, R., & Tischer, T. (2021). Machine learningmethods in sport injury prediction and prevention: a systematic review. *Journal of Experimental Orthopaedics*, *8*(1). https://doi.org/10.1186/s40634-021-00346-x

- Wenninger, S., Link, D., & Lames, M. (2020). Performance of machine learning models in application to beach volleyball data. *International Journal of Computer Science in Sport*, *19*(1), 24–36. https://doi.org/10.2478/ijcss-2020-0002

- Yang, C., Liu, Y., & Zhang, X. (2021). Research on intelligent analysis of running sports training performance based on artificial intelligence. *Research Square (Research Square)*. https://doi.org/10.21203/rs.3.rs-734803/v1

- Yang, H., & Luo, C. (2022). Accuracy Analysis of Sports Performance Prediction Based on BP Neural Network Intelligent Algorithm. *Security and Communication Networks*, *2022*, 1–11. https://doi.org/10.1155/2022/4198920

- Zhang, B., Chen, C., Chan, L., & Fok, W. (n.d.). *Intelligent Sports performance Scoring andAnalysis system Based on Deep Learning Network*.