Original Article

International Journal of Convergence in Healthcare

Published by
IJCIH & Pratyaksh Medicare LLP
www.ijcih.com

Machine Learning-Based Model for Injury-Free Sports Training

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Abstract

An outdoor sport like basketball requires a lot of practice and physical endurance of the player. A small gesture error may also result in injury and loss in the game. The proposed machine learning-based gesture recognition and recommender model shall activate an injury-free sports training environment. The arenas with this implementation shall provide real-time feedback to the sportsperson under training. It would look in detail at the locomotive controls, dribble maneuvers, sharp turns, and gestures used and generate a simulation for better response by the trainee of basketball.

Keywords: *Machine Learning, Gesture Recognition, Real-time Simulations, Gaming Matrix.*

Introduction

Machine learning-based models for injury-free sports training are a valuable tool that can help athletes of all levels reduce the risk of injuries while improving their performance. By leveraging data collected from sensors, motion tracking, and other sources, these models can provide personalized feedback to athletes on how to adjust their technique or form to minimize the chance of injury. Additionally, machine learning algorithms enable coaches and trainers to quickly analyze large amounts of data to identify patterns that could indicate an increased risk for injury.

Machine learning uses statistical techniques such as regression analysis or clustering algorithms to make predictions based on existing data sets. In this context, it can be used by coaches and trainers alike when creating individualized programs designed specifically for each athlete's needs, taking into account factors such as age group level ability, etc., so that appropriate exercises are chosen which will not only improve performance but also reduce the likelihood of injury occurring during practice sessions or competitions. Machine Learning also enables coaches/trainers to access real-time analytics regarding an athlete's progress over time which helps them determine if any adjustments need to be made accordingly - ultimately leading towards better results both physically & mentally!

Real-time gesture recognition and suggestive image processing model for basketball players is an innovative technology that has the potential to revolutionize the game of basketball. This technology uses computer vision algorithms to detect subtle body movements, such as hand gestures or facial expressions, which can be used for various purposes. For example, it can provide feedback on player performance in real-time by recognizing when they are making mistakes and offering corrective advice accordingly. It can also be used as part of a predictive analytics system to suggest better offensive or defensive plays based on what it sees happening in front of it. Finally, this technology could help coaches identify individual weaknesses within their team, so they know where best to focus their training efforts to improve overall team performance.

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The implementation begins with capturing images from multiple cameras placed around the court during practice sessions and games using advanced image processing techniques such as deep learning models and convolutional neural networks (CNNs). These images are then fed into an artificial intelligence (AI) system, which is trained on thousands upon thousands of examples from previous games to learn how different body motions correlate with successful outcomes like shots made or turnovers caused by defenders, respectively. The AI then makes predictions about future actions based on these correlations before sending them back out along with visual cues highlighting areas where improvement needs attention most urgently.

Overall, the real-time gesture recognition & suggestive image processing model for Basketball Players offers tremendous potential benefits both inside & outside the court. With its ability not only to recognize mistakes but also offer corrective advice quickly, coaches will have more opportunities than ever before maximize each player's full capabilities while minimizing costly errors at the same time. Additionally, AI-powered predictive analytics systems allow teams to develop strategies explicitly tailored toward opponents' strengths & weaknesses – all without sacrificing precious practice hours doing tedious scouting reports manually! All these possibilities make this exciting new tech one to watch out upcoming years.

In conclusion, then it would appear clear that utilizing Machine Learning-based model systems within Sports Training environments provides a great deal more insight than traditional methods alone ever could – allowing Coaches/Trainers greater control over how best they approach each situation whilst simultaneously reducing risks associated with Injury occurrence amongst Athletes at all levels!

Review of Literature

Use of an attention mechanism and Recurrent Neural Network(RNN) on EHR data has been discussed, for predicting heart failure of patients and providing insight into the key diagnoses that have led to the prediction (Khedkar et. al., 2019)[1]. To identify specific aspects of explainability that may catalyze building trust in ML models (Tonekaboni et. al., 2019)[2] survey clinicians from two distinct acute care specialties (Intenstive Care Unit and Emergency Department). (Gade et. al., 2019)[3] present an overview of model interpretability and explainability in AI, key regulations/laws, and techniques/tools for providing explainability as part of AI/ML systems. (Chakraborty et. al., 2020)[4] present the problem of explainability as it pertains to various personas involved in healthcare viz.

The challenges for the research community include: (i) achieving consensus on the right notion of model explainability (ii) identifying and formalizing explainability tasks from the perspectives of various stakeholders, and (iii) designing measures for evaluating explainability techniques (Gade et. al., 2020)[5]. As a consequence, AI researchers and practitioners have focused their attention on explainable AI to help them better trust and understand models at scale[14, 15, 25].

The challenges for the research community include:

(i) defining model explainability (ii) formulating explainability tasks for understanding model behavior and developing solutions for these tasks, and finally (iii) designing measures for evaluating the performance of models in explainability tasks (Gade et. al., 2020)[5]. Explainability has been a goal for Artificial Intelligence (AI) systems since their conception. The need for explainability is growing as more complex AI models are increasingly used in critical, high-stakes settings such as healthcare (Chari et. al., 2020)[8]. (Jiang et. al., 2021)[9] propose a solution that integrates domain knowledge, in the form of a hierarchical taxonomy defined for disease codes, into the learning framework to advance state-of-the-art in readmission prediction. Three sources of uncertainties in categorical attributes are recognised (Sachan et. al., 2021)[10]. Other influential work includes (Arya et. al., 2020)[11]. (Cao et. al., 2005) present an evaluation of a hybrid gesture interface framework that combines on-line adaptive gesture recognition with a command predictor. (Han et. al., 2006)[12] attempt to address the skin segmentation problem for gesture recognition. The toolkit also provides support for the data collection and the training process. (Lyons et. al., 2007)[13] present GART and its machine learning abstractions. (Hoffman et. al., 2010)[14] present a systematic study on the recognition of 3D gestures using spatially convenient input devices. These data sets directly impact the accuracy and performance of the gesture recognition system and should ideally contain all natural variations of the movements associated with a gesture. (Fothergill et. al., 2012)[15] address the problem of collecting such gesture datasets. (Kiliboz et. al., 2015)[16] propose an approach to recognize trajectory-based dynamic hand gestures in real time for human–computer interaction (HCI). (Liu et. al., 2017)[17] recorded signals of eight kinds of hand movements into computer using wearable wireless device with nine-axis sensor (including accelerometer, gyroscope and magnetometer sensors) worn on the wrist, then recognized gestures with machine learning classification process. (Sargano et. al., 2017)[18] present a novel method for human action recognition based on a pre-trained deep CNN model for feature extraction & representation followed by a hybrid Support Vector Machine (SVM) and K-Nearest Neighbor (KNN) classifier for action recognition. The recognition framework proposed can enhance the generalization ability of HCI in the long term use and it also simplifies the data collection stage before training the device ready for daily use, which is of great significance to improve the time generalization performance of an HCI system (Qi et. al., 2019)[19]. In order to effectively identify the basketball player's sports posture and improve the athlete's training effect (Ji, 2020)[20] propose a basketball shooting gesture recognition method based on image feature extraction and machine learning.

Proposed Model

The proposed model explained in Figure 1 is designed to induce sports suggestive amongst sportspersons to enhance the performance of the sports person, as the visual perspective trains the entity to look to their respective errors while displaying their gestures in the game. Once they are able to look to the errors in their performance and system enables with Generative Pre-trained Transformer (GPT-3) shall, errors leading towards injury and lagged performance in the game. The NLP-based solution would be helpful amongst the players while understanding a foreign language and the experience shared by the simulation platform with a different language in Injury Safe Sports Environment (ISSE) as suggested by Starke et al. 2020[21].

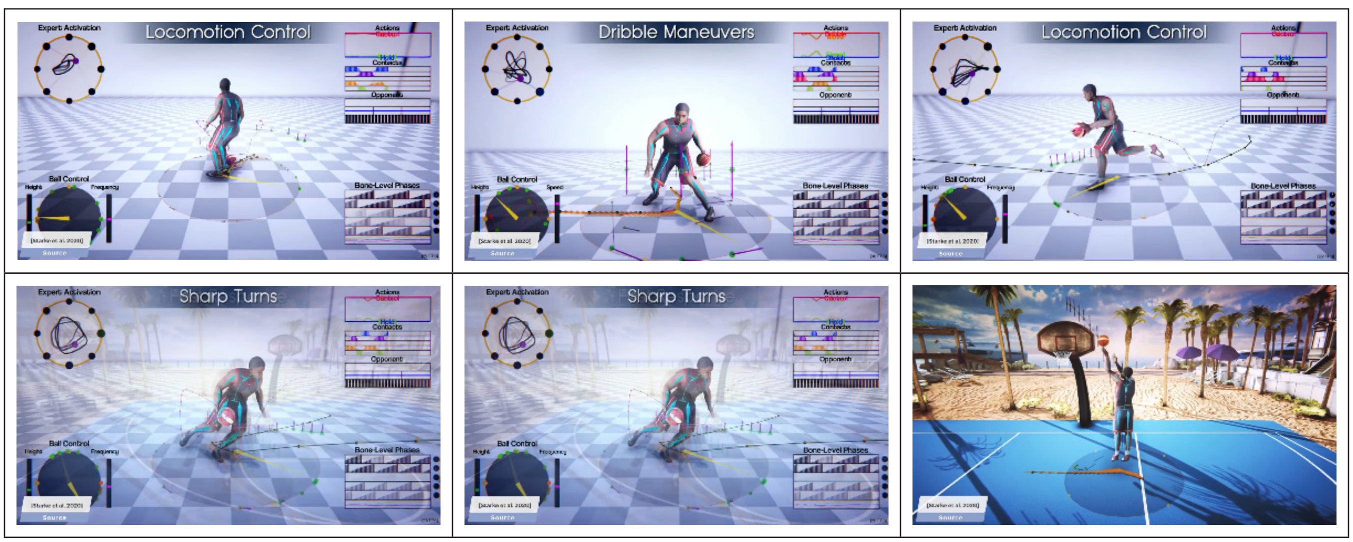

Figure 1: Injury-Safe Sports Environment (ISSE)

Conclusion

This research work has modeled the congruency amongst different dimensions of the physical perspectives during the training phase of the sportsperson. It has created a cognizance of various different techniques for suggesting a better and stress-free environment for the players who would like to excel in the domain and set a precedence for their fellow sports persons.

Future Scope

This research work can be further propagated to design the model for creating a better and injury-safe environment using different image processing techniques for implementation.

Ethical Clearance: Taken

Conflict of Interest: Nil

Source of Funding: Self

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