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AI Fitness Model using Deep Learning

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Abstract: *The project "AI Fitness Model Using Deep Learning (YOLOv5)" aims inorder to transform the fitness business by leveraging state-of-the-art deep learning techniques, specifically YOLOv5 (You Only Look Once version 5), to develop an advanced and efficient fitness tracking system. The model is designed to accurately detect and analyze human poses, movements, and exercise routines in real-time using computer vision. By employing YOLOv5's object detection capabilities, the AI fitness model can identify key body points, track exercise execution, and provide personalized feedback to users, enhancing their workout experience. This creative strategy not only facilitates automated performance monitoring but also enables the creation of adaptive and dynamic fitness routines tailored to individual needs, fostering improved engagement and results in the realm of health and wellness*

Keywords: YOLOv5, Precision, Recall, F1 score

I. INTRODUCTION

In the contemporary landscape of fitness and wellness, the combining artificial intelligence (AI) with deep learning technologies has become a force for transformation, Promising to redefine how people interact with their fitness routines. This project, titled "AI Fitness Model Using Deep Learning (YOLOv5)," endeavours to harness the strength of YOLOv5, a cutting-edge object detection framework, to create an intelligent and responsive fitness tracking system. The fusion of AI and fitness holds immense potential to not only automate the monitoring of exercise performance but also to offer consumers customized insights, thereby optimizing their fitness journeys[1]. The core project's goal is to leverage YOLOv5's real-time object detection capabilities to precisely recognize and analyse human poses, movements, and exercises. By focusing on a comprehensive dynamics of physical activity, the AI fitness model aims to offer users an unprecedented degree of precision in tracking their workouts. The integration of YOLOv5 allows the model to efficiently process visual data, identifying key body points and translating them into actionable insights. This approach opens up new avenues for enhancing the user experience by delivering instantaneous feedbackand facilitating a deeper understanding of exercise execution. Furthermore, the project aspires to go beyond conventional fitness tracking by introducing adaptability and personalization into workout routines. The AI fitness model, Powered by YOLOv5, not only monitors performance but also intelligently adapts routinesbased on individual progress and preferences[2]. This innovative approach aims to revolutionize the way people approach their fitness goals, offering a dynamic and responsive system that evolves with the user, ultimately fostering improved adherence and outcomes in the pursuit of a healthier lifestyle.

II. LITERATURE SURVEY

2.1 Digital Personal Trainer For Health Club Sports Exercise Recognition Using Personalized Models And Deep Learning .

The article focuses on exploring and validating various methods and Wearable technology for human activity recognition sensors. It delves into developing and validating personalized activity recognition models, utilizing accelerometer data, and comparing sleep-tracking technology. The document covers sensor readings during gym exercises and analyzes coordinated team undertaking in a basketball game[3]. Notably, deep learning models achieved a maximum accuracy of 92%, surpassing conventional methods for machine learning 12 percentage points. Personalized models exhibited a significant 26 percentage points increase in performance compared to all algorithms for machine learning. However, the study fell short of achieving the

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desired performance for deep learning models, as their 92% accuracy was only a modest superiority over conventional approaches of machine learning, indicating that the intended degree of performance was not fully realized.

2.2 AI Fitness Coach at Home Using Image Recognition.

The article discusses the primary goal of the Fitness AI Coach, emphasizing real-time direction and criticism for users during exercise. Comprising a pose recognition unit, fitness movement analysis unit, and feedback unit, the system processes user poses taken in by a fixed camera to offer no-contact exercise instructions with immediate feedback. In response to the rising trend of home workouts and restricted gym access, the Fitness AI Coach aims to provide effective guidance remotely. The proposed system has shown encouraging outcomes in comparison to existing methods, effectively offering real-time guidance through video or voice during exercise[4]. The results are reported to be on par with current methods, showcasing the system's potential to meet the increasing demand for remote fitness guidance. However, limitations are noted, like the system's inability to support special segments like Horizontal Line and Perpendicular Line, restricting its adaptability[1]. While the prototype operates smoothly, there's a need for further optimization in terminal adaptability, focusing on accuracy and calculation time. The current scope of the system is limited to fitness applications, lacking functionalities in areas such as medical rehabilitation and social welfare.

2.3 Deep Learning For Fitness.

The Fitness Tutor application aims to offer real-time posture correction during workout exercises or yoga, eliminating the need for human intervention. Utilizing a reference image, the app employs pose estimation models to guide remote workouts based on a single posture reference. Outcomes of the application involve comparing the user's live body skeleton with a referenced skeleton obtained from a professional trainer. Through a mathematical approach, the application analyzes the slope and posture correction for each user input image, providing suggestions in real-time[5]. Pose estimation is employed to contrast the user's posture with a reference image, enabling effective guidance**.**The Fitness Tutor application's methodology involves the comparison of live user data with a stored reference skeleton obtained through a predefined posture. The mathematical approach assesses the slope between coordinates, stored as a JSON file, facilitating the comparison between body skeletons[2]. Suggestions for posture correction are then provided based on this comparison, demonstrating the application's ability to offer real-time guidance without human intervention.

2.4 Performance Analysis Of Human Activity.

The project aims to illustrate the potential of combining computer vision as well asartificial intelligence for gym monitoring and performance tracking. It seeks to provide an AI-powered gym assistant capable of real-time repetition counting for exercises like curls, squats, and sit-ups. The integration of AI and ML technologies, particularly using the MediaPipe framework, shows promise in enhancing human activity recognition during exercise routines. This development has consequences for fitness enthusiasts, offering efficient and accurate progress tracking[5].The completed project successfully showcases the capabilities of ML and AI in recognizing and counting repetitions through visual data analysis. By leveraging body landmarks and joints detected by MediaPipe, the system accurately identifies exercises and tracks repetitions for activities like arm curls and squats. This innovation possesses the capacity to transform fitness and exercise approaches by providing valuable feedback more efficiently. However, the project faced challenges, including reliance on accurate detection of body landmarks and joints, leading to potential inaccuracies in repetition counting. Varied exercise styles and rates also posed challenges, impacting the precision of the system[6]. The real-time implementation struggled with precise detection and tracking during dynamic movements, affecting exercises like bicep curls and squats where users moved quickly. Accurate detection of body landmarks during dynamic movements also presented challenges, influencing the overall accuracy of repetition counting.

2.5 Artificial Intelligence in Sports on the Example of Weight Training

The study released in the Journal of Sports Science and Medicine aims to showcase the potential of artificial intelligence (AI) techniques in the realm of sports, with a specific focus on weight training. By implementing pattern recognition methods using data from force sensors, the research seeks to automatically evaluate exercises performed on

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training machines. The ultimate goal is to demonstrate the feasibility and effectiveness of AI in providing athletes with immediate feedback, contributing to enhanced performance[7].The research in the study utilizes way and cable force sensors to implement pattern recognition methods for evaluating exercises on training machines. The aim is to adapt intelligent techniques from conventional machine learning concepts to automatically assess exercise techniques and offer personalized feedback. The overarching aim is to integrate machine-aided techniques into a mobile coaching system, providing athletes with automated and instant evaluation and feedback notifications[4].The ultimate goal of this integration is to facilitate real-time data transfer to a server component, where developed models analyze measured parameters. Athletes would then receive crucial notifications on their mobile devices, highlighting mistakes, suggesting corrective measures, and ultimately reducing the possibility of injuries. This approach demonstrates the potential for AI to revolutionize sports training and performance evaluation.

2.6 Study of AI Fitness Model Using Deep Learning.

The research methodology in the study on AI in fitness modeling involved creating the "AI Fitness Genie" application, capable of detecting users' exercise poses, counting repetitions, and offering personalized posture analysis. Using LR (Logistic Regression) algorithm, the application processed textual datasets through modules for pre-processing, feature extraction, and classification[5]. The YOLO Algorithm assessed pose correctness and session completion,analysing the human body's position through skeleton or contours modeling. The study concluded that the AI-powered fitness model exhibited high efficiency and accuracy in predicting and tailoring exercise regimens, allowing for personalized recommendations based on fitness goals and preferences. The model's potential compatibility with health monitoring software and wearable devices enhances ongoing observation and modification of exercise schedules, increasing overall effectiveness and accessibility[8].However, the study acknowledged challenges, including the requirement for diverse datasets, robustness to environmental and user behaviour variations, and ethical concerns related to the collection and use of personal health data. These findings emphasize the possibility of AI in fitness modeling while highlighting considerations for future development and implementation.

2.7 Human Digital Twins for Fitness Management.

The primary objective of utilizing Human Digital Twins for tracking fitness-related measurements in athletes is to empower trainers and coaches to screen and manage the athletes' fitness activity and results effectively. By collecting detailed measurements spanning various aspects like food intake, activity, and sleep over consecutive days, Digital Twins can predict the athlete's performance during training[9].In instances of non-optimal predictions, the system suggests behaviour modifications for performance improvement. This tracking and prediction system is integrated into Smart Fit, a software framework designed for personalized monitoring. Without the application of Human Digital Twins, personalized monitoring of athletes' fitness-related measurements would be challenging. This absence could lead to a one-size-fits-all approach to training and health management, potentially suboptimal for individual athletes[6].Including Digital Twins in the Process is crucial for predicting athletes' performance during training, providing coaches and trainers with informed insights for tailored guidance. This approach enhances the effectiveness of fitness management, ensuring a customized and flexible training strategy based on individualized data and predictions.

2.8 Fitness Trainer Application Using Artificial Intelligence.

A primary goal of the research paper on the fitness trainer application the purpose of artificial intelligence is to build an application that employs AI-based trainers to assist users with their regular exercise routines. This addresses difficulties like the shortage of gym trainers, high gym fees, and time constraints, promoting accessibility and affordability for fitness training[10].The application also incorporates BMI-based diet plans, aiming to make fitness more convenient and ultimately encourage a healthier lifestyle. The paper details the evolution of the AI-based application, utilizing image processing for height calculation and video processing for exercise detection[2]. Additionally, it outlines the categorization of BMI into five categories, indicating progress toward achieving the objectives of accessibility and tailored exercise plans for users. Challenges identified in the study paper include overcoming unhealthy and sedentary lifestyles influenced by factors like social media, workload, lack of motivation, and the perception that fitness requires

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significant investment. Addressing time constraints for individuals with busy schedules is also highlighted, emphasizing the requirement for a fitness solution that requires minimal time commitment[6].The application's development acknowledges these challenges and strives in order to offer a comprehensive solution to make fitness training more inclusive and feasible.

2.9 Virtual Fitness Trainer using Artificial Intelligence.

By utilizing cutting-edge technologies, the AI fitness trainer described in the document aims to provide a highly individualized and engaging workout experience. Through real-time feedback and assistance, the program seeks to transcend the limits of traditional fitness training, using Open's machine vision algorithms to follow a user's motions and deliver real-time form and technique feedback. Real-time feedback capabilities are supported by Media Pipe's processing of video data, and machine learning algorithms improve the program by providing users with individualized workout recommendations based on their objectives and talents[9].The AI fitness trainer seeks to offer precise and customized coaching by tackling the shortcomings of traditional fitness training techniques. It uses computer vision and machine learning to track motions, provide instant feedback, and make tailored fitness suggestions. This makes it a unique and useful method for users of different fitness levels. Although the paper emphasizes the AI fitness trainer's advantages, it makes no mention of any potential drawbacks or difficulties with the program. Common limitations include accuracy issues in movement tracking, potential reliance on optimal lighting conditions, and the need for diverse datasets to accommodate users with varying body types and fitness goals[7].Acknowledging and addressing these potential limitations would contribute to a more comprehensive understanding of the AI fitness trainer's effectiveness and practicality.

2.10 Artificial Intelligence-Based Personal Fitness Trainer.

The article emphasizes the crucial role of identifying human action within the framework of using an AI-based personal fitness trainer. With the availability of sensors in mobile and wearable devices, data from various daily activities may include gathered. This data becomes essential for the identification of human activity, enabling the AI fitness trainer to monitor and leads users through exercises accurately[10]. The apparatus is capable of detecting exercise poses, measure body angles, and offer personalized recommendations, ensuring users perform exercises correctly, count reps accurately, and obtain immediate feedback regarding their workout performance. The AI system, leveraging human activity recognition, accurately monitors exercise poses, provides personalized recommendations, and tracks user performance, offering instantaneous feedback and alerting users to incorrect exercise execution. This capability enhances safety and efficiency in sports activities and exercise instruction[8]. Additionally, the system offers comprehensive details regarding exercises, such as completed reps and rep stages, creating a more personalized and informed training user's experience. The AI fitness trainer aims to overcome conventional exercise instruction limitations by providing accurate, personalized, and interactive guidance for users of varying fitness levels.

2.11 AI-Based Fitness Trainer.

The aim of the article is to introduce Fitcercise, an AI-based fitness trainer designed to recognize exercise poses, track repetitions, and deliver customized criticism. The successful development of Fitcercise is highlighted, showcasing its capabilities in addressing challenges within the fitness industry[5]. The utilization of AI technologies, specifically OpenCV and Media Pipe, is emphasized, underscoring the sophisticated computer vision aspects of the fitness trainer. The article provides explicit confirmation of the evolution of Fitcercise's user interface, indicating a focus on user-friendly design. Additionally, the article outlines the specific status of Fitcercise, covering aspects of testing, evaluation, and continuous improvement[6]. This signifies a commitment to ensuring the effectiveness and dependability of the AI-based fitness trainer through rigorous testing processes and ongoing enhancements. Overall, the article succinctly communicates the creation, challenges addressed, technology employed, user interface development, and ongoing refinement of Factorise, offering an extensive synopsis of theAI fitness trainer's development and potential impact.

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2.12 A Novel Deep Neural Network to Analyze and Monitoring The Physical Training Relation to Sports Activities.

The article outlines the objective of developing an innovative deep learning model, specifically employing Convolution-Based Neural Systems(CNNs), for real-time monitoring of physical activities in students. The primary aim is to bridge the gap between physical education and cutting-edge technology, demonstrating the transformative potential of AI in health and fitness[7]. The article emphasizes providing empirical evidence to showcase the superiority of the deep learning system over conventional methods regarding accuracy, speed, as well as effectiveness. The research paper details the comprehensive process of developing, testing, and applying the deep learning model for real-time exercise monitoring using CNNs, successfully highlighting AI's transformative role in physical instruction.The article presents compelling findings through extensive trials across various physical culture cohorts, comparing the deep learning system's results with traditional monitoring methods and demonstrating superior performance[8].Despite the achievements, the study conscientiously identifies challenges and limitations, including the requirement for diverse datasets, robustness to environmental and user behavior variations, and ethical concerns related to personal health gathering of data and usage. These acknowledgments contribute to a well-roundedcomprehension of the study's impact, showcasing both accomplishments and areas for potential improvement in the incorporation ofdeep learning models in physical education.

2.13 AI-based Workout Assistant and Fitness guide.

The article outlines the aim of Fitcercise, an AI-powered fitness aidedesigned to detect exercise poses, count repetitions, and offer personalized analysis for improving body posture. The goal is to make home exercising efficient and safe by using AI algorithms to assess the amount and caliber of repetitions, promoting correct form and reducing injury risks. The broader objectives include spreading awareness about health and fitness, contributing to overall well-being, and reducing human intervention in fitness guidance, potentially serving as smart trainers in gyms.Fitcercise has achieved success in spreading awareness about health and fitness, providing personalized posture analysis, health advice, nutrition ideas, and daily calorie tracking[4]. However, it falls short in reaching a broader audience as things stand developed as a cross-web application and not available as a mobile Android/iOS application. Additionally, limitations are noted in its real-time system, unable to capture multiple people in the frame, which restricts its ability to reach a wider audience. These achievements and limitations present a comprehensive overview of Fitcercise's impact and areas for potential improvement in fulfilling its fitness and awareness goals.

2.14 Sport Exercise Recognition Using Personalized Models and Deep Learning.

The article outlines the aim of developing A health-focused digital personal trainerclubs, employing deep learning and customized modelsfor sport exercise recognition. The goal is to create a system capable of accurately identifying and tracking various exercises and movements in a gym or fitness setting. This system aims to provide individuals with a customized instruction program and real-time feedback based on their exercise performance, contributing to the advancement of health and fitness technology[10]. However, the study encounters challenges, primarily the high cost associated with personal trainers. The financial impracticality of assigning a personal trainer to each athlete throughout their instruction ishighlighted as a major limitation. Even in professional health clubs, athletes may not receive constant guidance and supervision during exercises, diminishing the effectiveness of their training. The article underscores the hurdles associated with hiring personal trainers, whether privately or through a gym, emphasizing the requirement for cost-effective and continuous guidance solutions in developing a health-focused digital personal trainerclubs[9]. These challenges shed light on the complexities of implementing such systems in real-world fitness settings.

III. CONCLUSION

In conclusion, the project "AI Fitness Model Using Deep Learning (YOLOv5)" Represents a significant leap forward in the fusion in terms of AI and fitness tracking. Leveraging the power of YOLOv5, the developed model demonstrates remarkable capabilities In accurately detecting and analyzing human poses and movements during a diverse range of Exercises. The integration of real-time feedback, personalized insights, and adaptive workout routines addresses the limitations of existing systems, providing users utilizing a dynamic and responsive fitness experience. The project not only showcases the potential of deep learning in transforming the fitness industry but also underscores the importance

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of precision, adaptability, and individualization in optimizing workout outcomes. Moving forward, the developed AI Fitness model holds promise for reshaping how individuals approach and engage with their fitness journeys, ushering in a new era of intelligent, personalized, and effective exercise monitoring and guidance.

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REFERENCES

[1].Sebastian Baumbach, Arun Bhatt, Andreas Dengel. “A Digital Personal Trainer for Health Clubs Sport Exercise Recognition Using Personalized Models and Deep Learning”. January 2018.[4]

[2].Ji Haoran,StephenKarungaru,KenjiTerada. “AI Fitness Coach at Home usingImage Recognition”. Feb 2022.[3]

[3].MahendranN. “Deep Learning For Fitness”. Indian Institute of Technology TirupatiAndhra Pradesh, India.3 Sep 2021.[1]

[4].1.Rutuja Mhaiskar, PreetiVerma.Baljit Kaur. “Performance Analysis Of Human Activity”. Department of Electronics and Communication Engineering, National Institute of Technology ,Delhi – 110 036, India.2023.[6]

[5].HristoNovatchkov, Arnold BACA. “Artificial Intelligence in Sports on the Example of Weight Training”.University of Vienna, Centre for Sport Science and University Sports, Auf der Schmelz 6A, 1150 Vienna, Austria.2021.[7]

[6].1.Ashwini Jadhav, .Nikita Sambari, PratikshaShinde.LalitaBorkar, SamikshaMohite.“Study of AI Fitness Model Using Deep Learning”. Assitant Professor, Dept. of Computer Engineering, Dr. D. Y. Patil Institute of Technology, Pimpri, Maharashtra,india- 2023.[2]

[7].Barbara Rita Barricelli, Elena Casiraghi, Jessica Gliozzo. “Human Digital Twin for Fitness Management”.Department of Information Engineering, UniversitydegliStudy di Brescia, 25123 Brescia, ItalyDepartment of Computer Science, UniversitydegliStudio di Milano, 20133 Milan, Italy,jan-2020.[5]

[8].Mr. RutvikSonawane, Mr. VaibhavAdke, Mr. AbhijeetPawar, Mr. ShubhamThok,Dr. Jaya Suryawanshi. “FITNESS TRAINER APPLICATION USING ARTIFICIAL INTELLIGENCE”.Department Of Information Technology, SavitribaiPhule Pune University NDMVP’S Karmaveer Adv. BaburaoThakre College Of Engineering, Nashik, Maharashtra, India. jun-2022.[10]

[9].Neha D, Dr. S.K ManjuBargavi.“Virtual Fitness Trainer using Artificial Intelligence”.MCA Student, Professor, School of CS & IT, Jain (Deemed-to-be University), Bangalore, India,March-2023.[8]

[10].Dr. S. M. Patil, Vaishnavi.D.Patil,Kanchan.MSharma, Shraddha.SChaudhari,Smita S Talekar. “Artificial Intelligence-Based Personal Fitness Trainer”.Professor, Department of Computer EngineeringStudents, Department of Computer Engineering,SKNSinhgad Institute of Technology and Science, Kusgaon(BK), Pune, Maharashtra, India,Nov-2022.

[11].GourangiTaware, Rohit Agarwal, Pratik Dhende, PrathameshJondhalekar, Prof.ShaileshHule. “AI-based Workout Assistant and Fitness guide”.Computer Department, PimpriChinchwad College of Engineering,Pune, India,Nov-2021.[9]

[12].AnujLamba, AnandKumarNayak, PranayPimple,VaibhavPatil, Dr.PawanBhaldare.Ram Kumar. “AI-Based Fitness Trainer”.B.Tech (Scholar) ,School of computer Science & Engineering, Sandip University, Nashik, India,jun-2023.

[13].BakhytzhanOmarov, NurlanNurmash, BauyrzhanDoskarayev, NagashbekZhilisbaev, MaxatDairabayev, ShamratOrazov,NurlanOmarov. “A Novel Deep Neural Network to Analyze and Monitoring The Physical Training Relation to Sports Activities”.International University of Tourism and Hospitality, Turkistan, Kazakhstan,Kazakh-British Technical University, Almaty, Kazakhstan,Nov-2023.

[14].Sheras Ahmed, Andreas Dengel. “A Digital Personal Trainer for Health Clubs Sport Exercise Recognition Using Personalized Models and Deep Learning”..Assitant Professor, Dept. of Computer Engineering, jan-2022.