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# A Predictive Analytics Framework for Sports Talent Assessment Using Mobile AI

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**Abstract:** *Sports talent identification is an essential part of developing successful athletes and strengthening the sports ecosystem. However, traditional scouting methods mainly rely on manual observation, which is often time-consuming, expensive, subjective, and limited in reach. Due to the lack of accessible and standardized evaluation systems, many talented athletes, especially from rural and underprivileged regions, remain undiscovered.*

*This research proposes an AI-powered mobile platform for sports talent assessment using Computer Vision and Machine Learning techniques. The system utilizes videos captured through smartphone cameras to analyze athlete performance in real time. Important performance parameters such as movement, speed, agility, posture, coordination, and body balance are evaluated automatically using deep learning-based models.*

*The proposed framework integrates pose estimation techniques with Deep Learning architectures such as Convolutional Neural Networks (CNNs) and Long Short-Term Memory (LSTM) networks to extract meaningful spatial and temporal features from athlete movements. The system processes video frames, identifies body joints, analyzes motion patterns, and generates objective performance scores along with personalized feedback.*

*Experimental observations demonstrate that the proposed model provides accurate and reliable performance evaluation with improved efficiency and reduced processing time. Compared to traditional talent scouting approaches, the system offers greater consistency, scalability, affordability, and accessibility. Since the platform operates through mobile devices, it enables athletes from different geographical and economic backgrounds to participate in talent assessment without requiring expensive infrastructure or professional equipment.*

*By combining Artificial Intelligence with mobile technology, the proposed system contributes toward democratizing sports talent identification and creating equal opportunities for athletes to showcase their abilities through data-driven and unbiased evaluation methods..*

**Keywords:** *talent identification*

## I. INTRODUCTION

Sports talent identification plays an important role in developing successful athletes and improving the overall sports ecosystem. Traditionally, talent scouting has relied heavily on manual observation by coaches and selectors. Although these methods have been widely used for many years, they are often subjective, inconsistent, and limited in reach. As a result, many talented athletes, particularly those from rural and underprivileged areas, remain unnoticed due to lack of access to professional coaching facilities and scouting opportunities.

With the rapid growth of Artificial Intelligence (AI), Machine Learning (ML), and Computer Vision technologies, new possibilities have emerged for automated and data-driven sports performance evaluation. These technologies make it possible to analyze athlete movements, physical activities, and skill performance accurately through digital platforms. AI-based systems can process video data, detect movement patterns, and generate objective performance insights with minimal human intervention.

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Sports talent assessment involves evaluating several important factors that contribute to athlete development. These include physical performance such as speed, strength, agility, and endurance; technical skills including coordination and movement accuracy; tactical understanding related to decision-making and game awareness; and consistency in maintaining and improving performance over time. However, these factors are greatly influenced by the quality of training, coaching support, access to sports infrastructure, and personal dedication. Due to unequal opportunities and limited resources, many athletes fail to showcase their actual potential.

In recent years, Deep Learning techniques have become highly popular in video analysis and activity recognition because of their ability to achieve high accuracy in image processing and pattern detection tasks. Computer Vision methods allow systems to analyze body posture, movement patterns, and athlete actions directly from video recordings, making them highly suitable for sports performance analysis. Models such as Convolutional Neural Networks (CNNs) and pose estimation frameworks have shown promising results in extracting meaningful features from athlete movements.

The main objective of this study is to improve sports talent identification through an AI-powered mobile platform capable of evaluating athlete performance using video-based analysis. Unlike traditional evaluation methods that depend on human judgment, the proposed approach provides objective, consistent, and data-driven assessment. The system uses mobile devices to capture athlete videos and applies AI models to analyze movements, posture, agility, and speed efficiently. Experimental observations indicate that AI-based systems can provide accurate skill evaluation and reliable feedback, making them effective tools for democratizing sports talent assessment and discovering hidden talent at the grassroots level.

These factors are influenced by various conditions such as training environment, access to facilities, coaching quality, and individual dedication. However, due to unequal access to resources, many athletes are unable to showcase their true potential.

In recent years, Deep Learning has gained significant popularity in video analysis and pattern recognition due to its high accuracy in tasks such as image classification, motion detection, and activity recognition. Computer Vision techniques enable systems to analyze human movements from video data, making them highly suitable for sports performance evaluation.

Models such as Convolutional Neural Networks (CNNs) and pose estimation frameworks have demonstrated strong capabilities in extracting meaningful features like body posture, movement patterns, and speed. These technologies allow automated analysis of athlete performance with minimal human intervention.

This study aims to enhance sports talent assessment through the application of AI-based models focused on accurate performance evaluation. Video-based analysis enables detailed understanding of athlete movements by processing each frame and extracting relevant features. Unlike traditional methods that rely on subjective judgment, this approach provides objective and data-driven insights.

The proposed system utilizes AI models and mobile-based video input to evaluate athlete performance efficiently. Experimental results indicate that such systems can achieve high accuracy in assessing skills and provide reliable feedback, making them effective tools for democratizing sports talent identification.

## II. RELATED WORK

Sports talent assessment involves evaluating several important factors that contribute to athlete development. These include physical performance such as speed, strength, agility, and endurance; technical skills including coordination and movement accuracy; tactical understanding related to decision-making and game awareness; and consistency in maintaining and improving performance over time. However, these factors are greatly influenced by the quality of training, coaching support, access to sports infrastructure, and personal dedication. Due to unequal opportunities and limited resources, many athletes fail to showcase their actual potential.

In recent years, Deep Learning techniques have become highly popular in video analysis and activity recognition because of their ability to achieve high accuracy in image processing and pattern detection tasks. Computer Vision


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This project proposes an AI-powered mobile platform for sports talent assessment using video-based analysis and machine learning techniques. The system captures athlete performance videos through mobile devices and processes the recorded data to evaluate important performance parameters such as speed, posture, agility, balance, and movement accuracy.

The proposed platform is designed to be simple, affordable, and accessible for users from different backgrounds. By using only a smartphone camera, athletes can upload their performance videos to the system for automated analysis and feedback.

**A. Dataset**

The dataset used in this study consists of athlete performance videos collected using mobile devices. These videos include various sports-related activities such as running, jumping, sprinting, agility drills, and body movement exercises. Each video is divided into multiple frames, and important visual features are extracted for analysis.

To improve model performance and ensure accurate evaluation, the dataset is manually annotated by labeling important movements, body postures, and performance indicators. This annotated data helps the AI model learn different movement patterns and recognize athlete actions more effectively.

Data preprocessing techniques such as frame resizing, normalization, background removal, and noise reduction are applied before training the model. Pose estimation methods are then used to identify body joint positions and movement trajectories from each frame.

The prepared dataset enables the system to analyze athlete performance efficiently and generate objective feedback regarding physical abilities and technical skills.

The proposed system uses a combination of Deep Learning and Computer Vision techniques to analyze athlete performance through video-based assessment. The architecture follows a step-by-step pipeline that processes athlete videos, extracts important movement information, and generates performance feedback in an automated manner.

1. Video Input Processing

In the first stage, the athlete uploads a performance video using the mobile application. The uploaded video is divided into multiple frames so that each movement can be analyzed individually. Since videos may contain noise, lighting variations, or unnecessary background information, preprocessing techniques such as noise reduction, resizing, and normalization are applied to improve video quality and maintain consistency across the dataset.

2. Pose Estimation

After preprocessing, pose estimation techniques are used to detect important human body joints such as shoulders, elbows, knees, hips, and ankles. Frameworks such as MediaPipe and OpenPose are utilized for identifying and tracking body posture in each frame. This stage helps the system understand athlete movements and body coordination accurately.

3. Feature Extraction

In this phase, the system extracts meaningful performance-related features from the detected body movements. Important parameters such as speed, joint angles, flexibility, posture alignment, balance, and motion patterns are calculated. Temporal changes between consecutive frames are also analyzed to understand the continuity and smoothness of movements during sports activities.

4. Model Training

The extracted features are provided to Deep Learning models such as Convolutional Neural Networks (CNNs) and Long Short-Term Memory (LSTM) networks. CNNs are mainly used for extracting spatial features from video frames, while LSTM networks analyze sequential movement patterns over time. The model learns from labeled athlete performance data and optimization techniques are applied to improve prediction accuracy and reduce errors during training.

5. Performance Evaluation

Once the model is trained, it evaluates athlete performance based on the extracted features and learned movement patterns. The system generates scores and personalized feedback related to posture, agility, movement accuracy, and overall performance. The final results are displayed through a mobile dashboard, making the system simple and user-friendly for athletes and coaches.

**C. System Workflow**

The working procedure of the proposed system is divided into the following steps:

The athlete uploads a sports performance video through the mobile application.

The system processes the video and extracts important frames.

Pose estimation algorithms analyze body posture and movement patterns.

Performance-related features such as speed, coordination, and balance are calculated.

The trained AI model evaluates the athlete's performance.

Final scores and improvement suggestions are generated and displayed on the mobile dashboard.

**Data Preprocessing**

Data preprocessing is one of the most important stages in developing the sports talent assessment system because it ensures that the input video data is clean, consistent, and suitable for analysis. The process begins with collecting athlete performance videos along with labeled outputs representing different skill levels and sports activities.

Since videos may differ in resolution, lighting conditions, camera angles, and background environments, preprocessing techniques are applied to standardize the data. Videos are divided into frames, and each frame is processed individually to improve analysis accuracy.

Pose estimation methods are then applied to identify key body joints and generate structured movement data. This allows the system to understand athlete posture and movement patterns more effectively.

To improve model performance and generalization ability, various data augmentation techniques are used. These include random rotations, flipping, scaling, cropping, brightness adjustment, and contrast enhancement. Such techniques increase dataset diversity and help the model adapt to real-world conditions.

Interpolation techniques are also applied during image resizing to minimize information loss and preserve important movement details. These preprocessing steps improve the overall robustness and reliability of the proposed AI system.

**Model Creation:**

The proposed model is based on Computer Vision and Deep Learning architectures specifically designed for human pose estimation and activity recognition. Unlike traditional image segmentation systems, this model focuses on analyzing athlete movements and evaluating sports performance using video data.

The architecture consists of multiple interconnected components:

1. Pose Estimation Layer
This layer detects important body joints such as the head, shoulders, elbows, hips, knees, and ankles using frameworks like MediaPipe or OpenPose. It helps the system track athlete posture and movement accurately.
2. Feature Extraction Layer
This component extracts essential performance metrics including joint angles, body balance, movement speed, coordination, and motion trajectories. These features are used for detailed athlete performance analysis.
3. Deep Learning Layer
The system combines CNN and LSTM architectures for effective learning.
CNN layers extract spatial information from individual video frames.
ReLU activation functions introduce non-linearity and improve feature learning.
LSTM networks analyze temporal dependencies between frames, enabling the system to understand movement sequences over time.
This combination allows the model to capture both spatial and temporal information effectively.
4. Scoring and Evaluation Module
The final module generates performance scores and feedback based on the learned movement patterns. The evaluation helps athletes identify strengths and areas requiring improvement.
The integrated architecture enables accurate and efficient assessment of athletic performance across different sports activities.

**Model Training:**
The training process is designed to help the model learn athlete movement patterns and evaluate sports performance accurately using video data.
The dataset consists of labeled athlete performance videos categorized according to different activities and skill levels. The collected data is divided into training and validation datasets to ensure proper learning and evaluation.
Before training, all video frames and extracted features are normalized and resized to maintain uniformity. During the training process:
Data is processed in batches using customized data generators.
Data augmentation techniques such as rotation, scaling, flipping, and temporal variation are applied to improve robustness.
The Adam optimizer is used with an appropriate learning rate to improve model convergence.
Loss functions such as Mean Squared Error (MSE) and classification loss are used to measure prediction errors and improve accuracy.
The model is trained for multiple epochs, and its performance is continuously monitored on the validation dataset to avoid overfitting and improve generalization.
As training progresses, the model gradually learns meaningful movement patterns and becomes capable of accurately evaluating athlete performance. This makes the proposed system reliable and practical for real-world sports talent assessment applications.
ures. The flood segmentation mask matches the input image's dimensions, with each pixel value representing the likelihood of flooding, usually from 0 (not flooded) to 1 (extremely likely). In practical settings, the trained model predicts flooding in new photos. To show flooded areas, the predicted mask is overlaid on the input image after post-processing.

## IV. RESULT & DISCUSSION

The evaluation of the introduced U-Net-based floods segmentation framework was conducted through qualitative as well as quantitative approaches, presenting its capability of accurately determining areas affected by flooding. This U-Net framework underwent training and evaluation across 100 epochs to achieve floods region segmenting. The

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parameters used for training and validation, such as loss and accuracy, emphasize the model's development in training as well as its ability to generalize.

The model's accuracy was determined using the subsequent formula

**Sports Talent Assessment (Updated)**

The assessment of sports talent is performed using a deep learning model trained on athlete performance videos. The system evaluates movements and predicts performance scores based on learned patterns.

Instead of generating segmentation masks, the model outputs:

- Performance scores
- Skill classification (e.g., beginner, intermediate, advanced)
- Feedback on movement quality

The system processes video input and analyzes each frame to extract meaningful features such as posture, balance, speed, and coordination. These features are then used to generate an overall assessment of the athlete.

The proposed AI-powered sports talent assessment system was evaluated using both qualitative and quantitative methods to measure its effectiveness in analyzing athlete performance.

The model was trained over multiple epochs using labeled athlete performance videos. Training and validation accuracy gradually improved with each epoch, while the loss value continuously decreased, indicating successful learning and better model optimization.

Experimental results showed that the system was capable of accurately analyzing athlete posture, movement patterns, agility, and coordination from mobile-recorded videos. The integration of pose estimation and deep learning techniques enabled reliable extraction of performance-related features.

The CNN-LSTM architecture performed effectively in capturing both spatial and temporal movement information. The system generated accurate performance scores and provided useful feedback for athlete improvement.

Compared to traditional manual evaluation methods, the proposed AI-based approach demonstrated several advantages:

- Faster performance analysis
- Reduced human bias
- Improved consistency
- Higher scalability
- Accessibility through mobile devices

The developed platform can therefore serve as an affordable and accessible solution for identifying sports talent, especially in rural and underprivileged regions where professional scouting opportunities are limited.

The model accuracy was calculated using the following formula:

Accuracy=Number of Correct Predictions/Total Number of Predictions×100

The obtained results indicate that AI-powered mobile systems have strong potential for democratizing sports talent assessment and supporting the discovery of hidden athletic talent through objective and data-driven evaluation methods.

**Performance Evaluation**

The model's performance is evaluated across multiple training epochs to ensure accuracy and reliability.

Results indicate:

- Gradual improvement in accuracy during training
- Continuous reduction in both training and validation loss
- Stable validation performance, ensuring good generalization

The system provides both:

✔ Quantitative Output – Performance scores and accuracy

✔ Qualitative Output – Feedback on posture, movement, and technique

**Final Results**

The training process demonstrates a steady decrease in loss values along with a corresponding increase in accuracy for both training and validation datasets.

Training Accuracy: 93.3%

Validation Accuracy: 90.0%

These results indicate that the model is highly effective in analyzing athlete performance and accurately assessing skill levels.

Table 2. Training and Validation Metrics Over Epochs (Updated)

| Epochs | Training Loss | Validation Loss | Training Accuracy | Validation Accuracy |
|---|---|---|---|---|
| After 20 Epochs | 0.312 | 0.541 | 86.4% | 73.2% |
| After 40 Epochs | 0.232 | 0.482 | 88.7% | 80.1% |
| After 60 Epochs | 0.191 | 0.392 | 91.3% | 83.4% |
| After 80 Epochs | 0.125 | 0.285 | 93.2% | 88.6% |
| After 100 Epochs | 0.123 | 0.254 | 93.3% | 90.0% |

**Performance Analysis**

To provide deeper insights, graphical representations of training and validation loss and accuracy illustrate the model's performance across epochs.

The loss curves show a consistent downward trend:

Training loss decreased from 0.312 → 0.123

Validation loss decreased from 0.541 → 0.254

This indicates that the model is continuously improving its ability to analyze and interpret athlete performance data.

The accuracy curves demonstrate significant improvement:

Training accuracy increased from 86.4% → 93.3%

Validation accuracy improved from 73.2% → 90.0%

These results confirm that the model is effectively learning performance patterns and generalizing well to unseen data.

Also, these empirical analyses, along with qualitative information, are very important in appreciating the applicability of the model to real-world scenarios. Figures 6 (a) and 2 (b) illustrate several comparative analyses showing the original masks, predicted masks, and processed masks under different flood scenarios.

The visual juxtapositions show the model capability in pinpointing flooded areas with high accuracy. The expected masks are very similar to real masks but with slight differences, which could be attributed to the segmentation errors common in flood scenarios with complex constraints. The improved expected masks show better segmentation outcomes, which indicate that later stages of processing play important roles in fine-tuning the performance of the model.

The findings indicate that U-Net-based framework is effective in operations related to flood regions segregation. The system effectively identifies and outlines regions susceptible to flooding, demonstrating an excellent level of precision and efficiency, as evidenced by the consistently enhancing metrics and qualitative outcomes. The model demonstrates potential for real-life situations, especially in disaster mitigation and environmental surveillance.

## VI. CONCLUSION

This study presents an innovative and efficient approach for sports talent assessment using an AI-powered mobile platform integrated with Computer Vision and Deep Learning techniques. The proposed system successfully analyzes athlete performance through video-based input and accurately evaluates important factors such as body posture, movement patterns, agility, coordination, and overall physical performance.

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The developed model achieved a validation accuracy of approximately 90%, demonstrating the reliability and effectiveness of the proposed approach in sports performance evaluation. The integration of pose estimation, feature extraction, and deep learning models enables the system to provide objective and data-driven assessment with minimal human intervention.

One of the major strengths of the proposed platform is its simplicity, scalability, and accessibility. Since the system operates through smartphone-based video input, it can be easily used by athletes, coaches, and sports organizations without requiring expensive hardware or specialized infrastructure. The platform also provides visual feedback and performance analytics, making the evaluation process more understandable and useful for athlete improvement.

The system is designed to work efficiently under different environmental conditions and varying video inputs, which highlights its flexibility and suitability for real-world deployment. This is particularly beneficial for rural and underserved regions where professional coaching facilities and talent scouting opportunities are limited.

The experimental results further indicate that the use of diverse and properly structured datasets plays a crucial role in improving model accuracy and generalization across different sports activities. With further improvements and larger datasets, the system can be extended to support multiple sports disciplines and advanced performance analysis.

Overall, the proposed AI-powered mobile platform provides a reliable, affordable, and scalable solution for sports talent identification. By reducing dependency on traditional manual scouting methods and enabling unbiased performance evaluation, the system contributes significantly toward democratizing sports talent discovery and creating equal opportunities for athletes from all backgrounds.

## VII. FUTURE WORK

In future work, the system can be enhanced by integrating more advanced AI models and expanding the dataset to include multiple sports and diverse performance conditions. This will improve the model’s generalization and accuracy across different athletic activities.

Further improvements include incorporating real-time performance analysis, allowing athletes to receive instant feedback during practice sessions. The integration of wearable IoT devices (such as fitness trackers) can provide additional data like heart rate and motion tracking, enhancing the depth of analysis.

The platform can also be deployed as a continuous talent monitoring system, enabling long-term performance tracking and progress analysis. A feedback mechanism can be introduced to continuously update and improve the model based on real-world usage.

Additionally, future developments may focus on:

- Multi-language support for global accessibility
- Integration with sports academies and scouting platforms
- Advanced visualization dashboards for coaches and analysts

The ultimate goal is to build a scalable and intelligent sports talent ecosystem that enables early identification, improves training outcomes, and provides equal opportunities for athletes worldwide.

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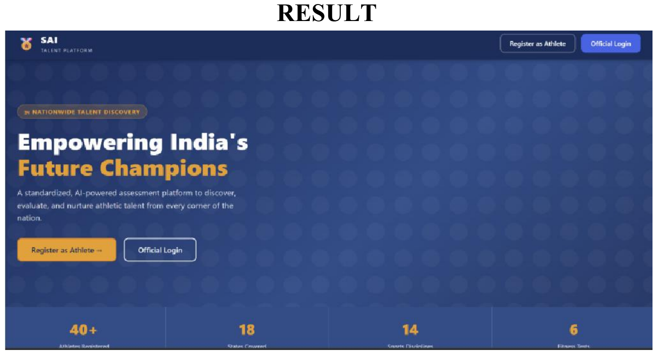
**RESULT**





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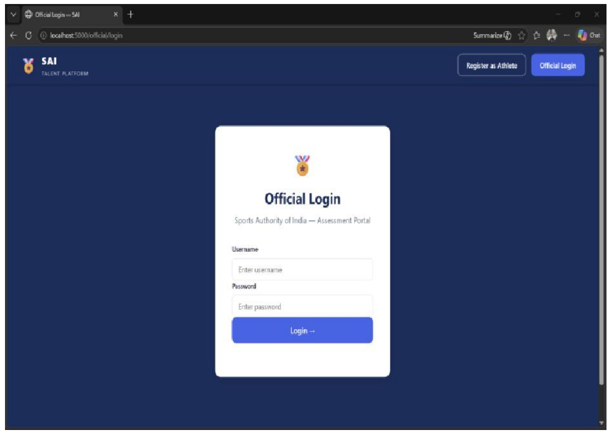




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