



Center for Data Modelling, Analytics and Visualization

Analyzing Playing Techniques and Personalized Training Recommendations in Racket Sports

Sport:	Badminton/Tennis
Leader:	Aryan Wadhwa(PES2UG21CS098)
Members:	Jay Shah(PES2UG21CS213) Aryan Wadhwa(PES2UG21CS098) Jawahar Balachandher(PES2UG21CS212)

Abstract

- The project focuses on creating a personalized badminton and tennis training platform that caters to families who may not have access to a dedicated coach. By leveraging cutting-edge technologies including deep learning, image processing, video processing, and machine learning, the platform aims to offer tailored training feedback and guidance.
- To achieve these goals, the project utilizes algorithms for pose estimation and object detection, such as YOLO and TrackNet, to

accurately analyze player and shuttle movements. Relevant features are extracted from the analyzed data to assess players' techniques and playing style. Machine learning models are implemented to provide personalized training based on body coordinates while executing specific shots. The analysis results are then used to provide actionable feedback and personalized training recommendations.

- Players of all skill levels, from beginners to professionals, can utilize the system to gain insights into their techniques, style, and areas for improvement. Coaches and trainers can also benefit from the system to assess players' performance, track progress, and tailor training programs accordingly.

Individual Contributions

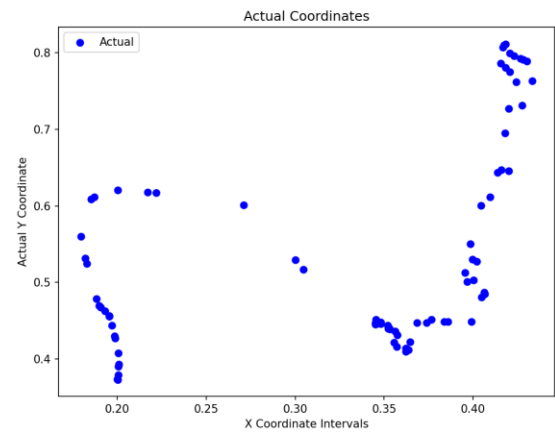
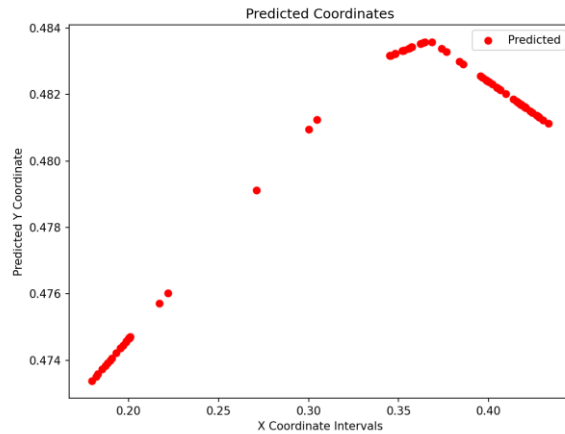
Team Member	Name	SRN	Tasks	Progress Status
1	Aryan Wadhwa	PES2UG21CS098	<ul style="list-style-type: none"> ● Python script using mediapipe cross platform library to obtain the coordinates of the player's body playing the specific shot. ● Dataset Collection (Smash - 17 videos). ● Implementation of Sequential Deep Feedforward neural network Model using Tensorflow and Keras to provide feedback on the body posture of the player playing a specific shot. ● Training the Deep Learning Model. 	1,2,3,4 are done. 5th is ongoing.

			<ul style="list-style-type: none"> Implementation of a CLI based Menu system. 	
2	Jay Shah	PES2UG21CS213	<ul style="list-style-type: none"> Research on YOLO software for object detection. Dataset Collection(Drop - 14 Videos). Player detection using YOLO and research on deepSort for tracking. Working on using YOLO and deepSort to track the time when the player is active and helping in tracking. Finding out on how to use the data generated by YOLO for player analysis. 	1,2,3 are done. 4th and 5th are ongoing
3	Jawahar Balachandher	PES2UG21CS212	<ul style="list-style-type: none"> Research on TrackNet software for the detection of high speed objects(shuttle). Dataset Collection(Serve - 11 videos) Player Analysis using TrackNet. 	1,2 are done. 3rd is ongoing.

Deliverables

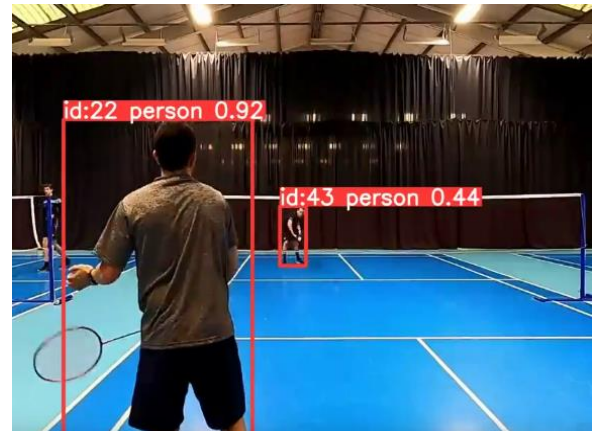
Sequential Deep Learning Model (feedforward neural network):

- This deep learning model will take a video of the player training for the specific shot as an input (mp4 format) and return the feedback based on the body posture of the player in the form of graphs and text on the command line.
- The body coordinates of the player training will be extracted using mediapipe, when the video is uploaded. Using these coordinates, the model will make predictions and the feedback will be provided.



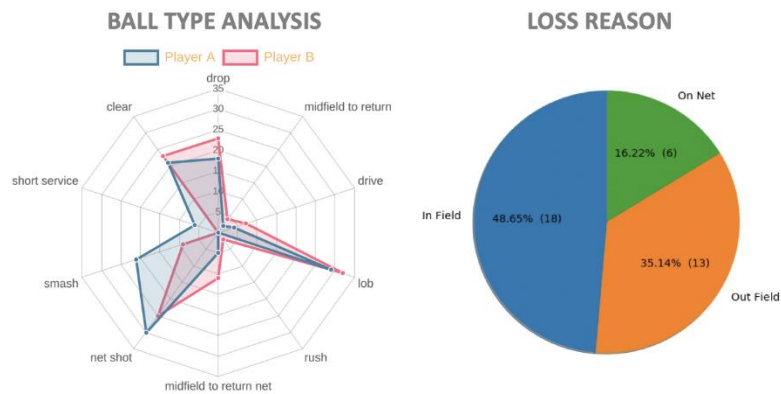
YOLO:

- YOLO (You Only Look Once) is an object detection algorithm that is used for real-time object detection in images and videos.
- Using this software we can provide analysis based on the position of the player in the badminton court.
- The latest versions of YOLO also comes with integration of pose estimation.
- Using this we will be able to detect the position of the person and find out the active time a player is in the court.



TrackNet:

- TrackNet is used to track the motion and trajectory of high speed objects across consecutive frames of a video sequence.
- Using this we can provide analysis on the speed and the direction of the shuttle/ball after playing a specific shot.



End Product:

- Upon the successful implementation of our software, our objective is to publish a **research paper**.
- The ultimate outcome of our software will be a **sophisticated command-line interface (CLI)-based** system. In this system, players will record their gameplay videos and upload them to our platform. Subsequently, our system will analyze the uploaded videos, providing **valuable feedback and comprehensive player analysis**.

Technology Used

1. **Mediapipe** – To extract coordinates of the player's body playing the specific shot.
2. **Deep Feedforward Neural Network** - To provide feedback on the player's body posture while playing the specific shot.
3. **YOLO** – It is used for object detection. We can determine how much time the player was in a section of the badminton court. Then analysis can be provided.
4. **TrackNet** – It is used to detect small and high speed objects (shuttle/ball). This can be used to track shuttle speed and provide feedback.
5. **Programming Language** – Python

Next Steps

- Train the Sequential FeedForward Neural Network Model using a larger dataset to improve the accuracy.
- Work on Advance Analysis of Players, Player Comparison and Performance Evaluation using YOLO and TrackNet.
- Publish a research paper

Future Tasks and Owners

Task or Deliverable	Task Owner
<ul style="list-style-type: none">• Training the Sequential FeedForward Neural Network Model using a larger dataset to improve the accuracy of the model.• Understand how research papers are written.	Aryan Wadhwa
<ul style="list-style-type: none">• Provide Analysis of Players and Player Comparison using YOLO. The analysis will be related to the position of the trainee• Using the YOLO and DeepSORT algorithm to find out the position,give an estimate on active time of player in the video frame and give a specific id to an individual.	Jay Shah
<ul style="list-style-type: none">• Provide Analysis of Players and Player Comparison using TrackNet.• The analysis will be related to the speed of shuttle.	Jawahar Balachandher

Faculty in Charge: Dr. Sandesh B J