

OELP –2022

END-TERM REPORT PRESENTATION

VIDEO ANALYTICS

SUBMITTED BY:-

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Introduction



- Computer vision is a field of artificial intelligence (AI) that enables computers and systems to derive meaningful information and to do actions by looking at digital images, videos and other visual inputs.
- Video content analysis is one new technology which uses computer vision.
- Implementing different algorithms and training models using computer vision techniques to analyze video contents.

Aim and Motivation



The goal is to solve a real-world problem.



Provide feedback and suggestions to the player so that he can improve his game skills.



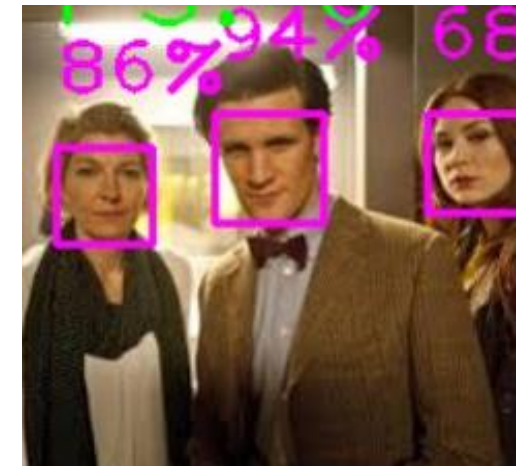
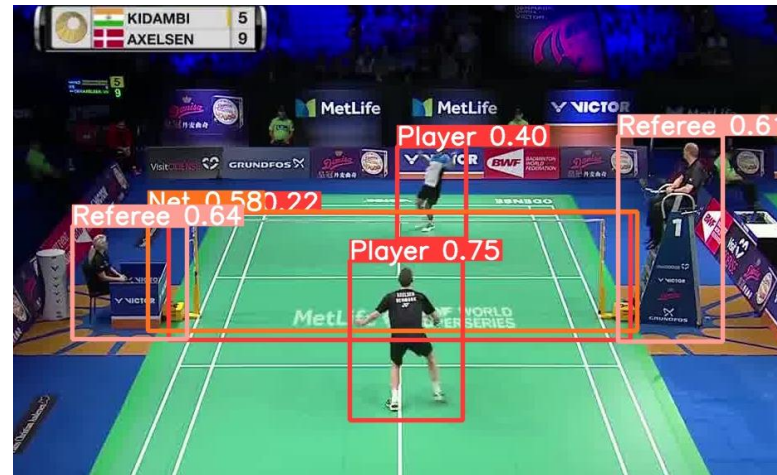
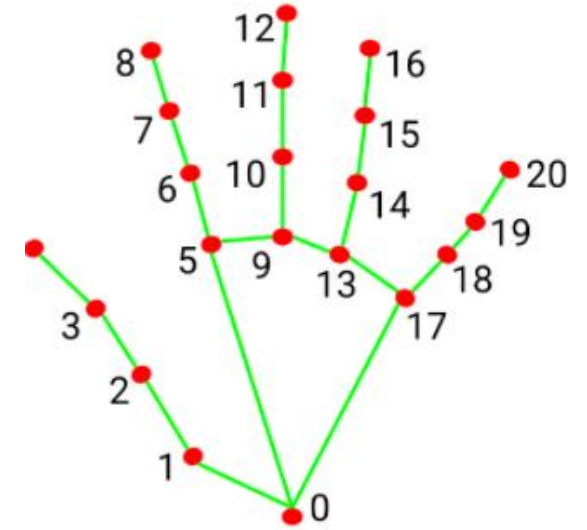
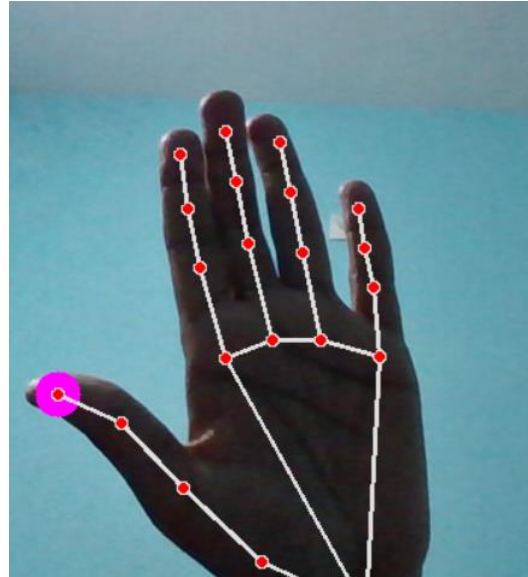
To assist athletes in identifying and correcting their frequent errors, as well as to modify their techniques, if necessary.

Summary

Mini projects to understand CV and mediapipe - Finger counting, Face detection

To understand the different rules and tactics of the game, we reviewed some Coach Manuals and research papers.

YOLOv5s for object detection. Different players, equipment, shots and net detected.



Pose detection using Mediapipe

- Motivation: Pose detection very useful for analyzing movements of a player, their position in the court and various shots they play.
- Initially we analyzed using Posenet and Movenet model for multi pose detection with 17 different landmarks.
- Framework developed recently by Google and can detect 32 different landmarks of human body.
- Capable of detecting only one player even if there are multiple players in a single frame.
 - Initial idea was to use a sliding window technique where a window slides through the image and the image within this window passed to the mediapipe module
 - Very poor performance.

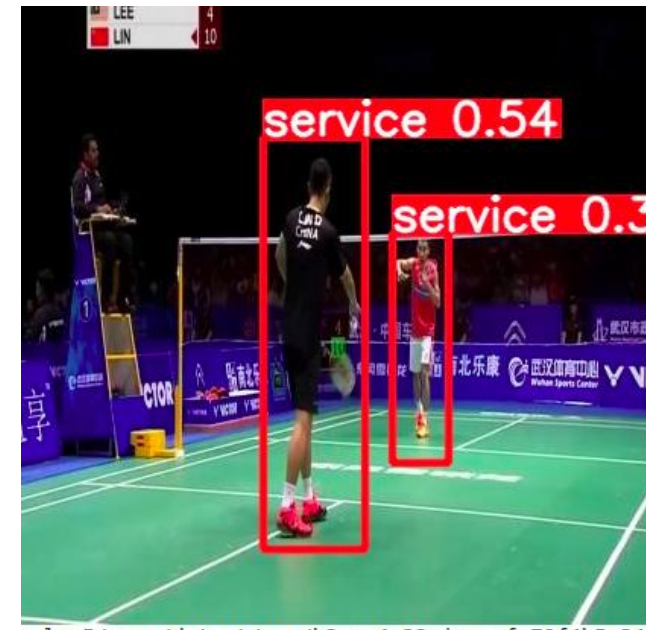
- Bounding box of different objects were already found(object detection using YOLOv5).
 - With the help of bounding box coordinates of each player, bounding boxes were cropped out from the original image and fed to the mediapipe module.
- Pose coordinates returned are with respect to the cropped image
- Need to rescale them back to original frame.
 - $(w1, h1)$ is the size of the entire frame (original)
 - $(w2, h2)$ is the size of the cropped image
 - Rescaled coordinates are (x_{new}, y_{new})
 - $x_{new} = (x1 * w2 + x_{min} * w1) / w1$
 $y_{new} = (y1 * w2 + y_{min} * w1) / w1$
 $(x1, y1)$ are the pose coordinates with respect to cropped image
 (x_{min}, y_{min}) are the top left corner coordinates of the original frame.



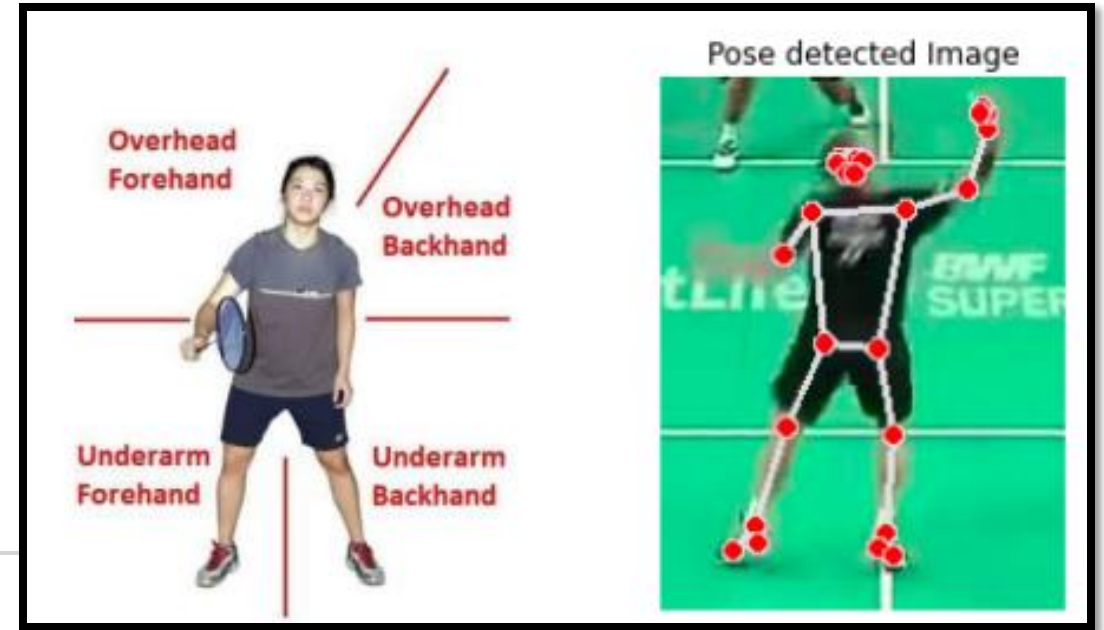
Training serve shots

Motivation: Detecting serve shots useful for finding when does one player score point and further analyze the position of players in long and short serve shots.

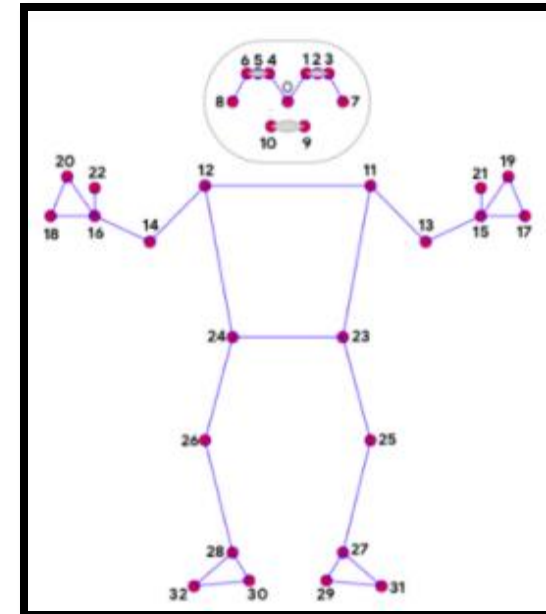
- Extracted out appropriate images from different YouTube videos , trimmed and annotated them using Roboflow.
- Annotated images trained using YOLOv5.



Forehand and Backhand shots

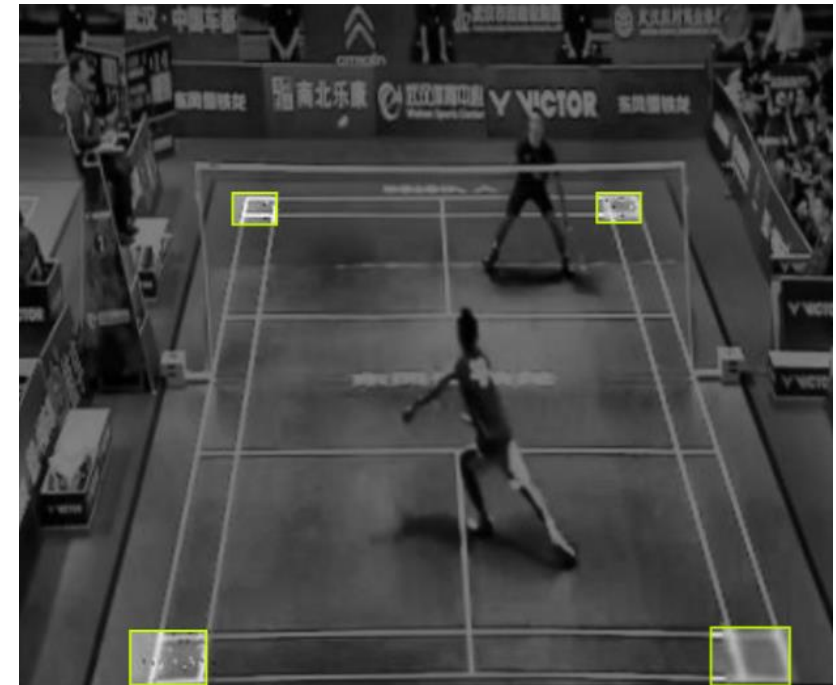
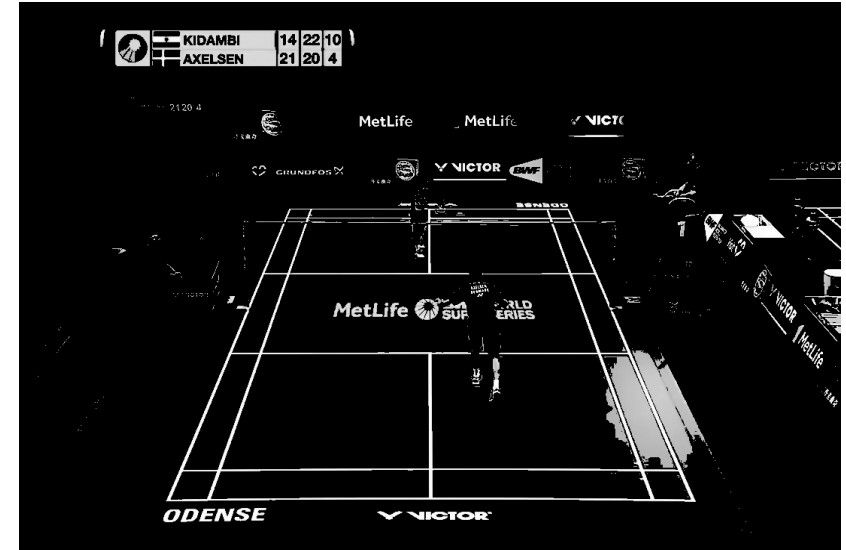


- Class Player – Associating different shots and distinguishing forehand and backhand shots with the help of mediapipe.
- Identifying different players based on the net's y-coordinate



Court Detection

- We can detect exact position of the player in the if we have coordinates of the court.
- Difficult task - Extracting white pixels, changing the threshold, canny edge detection and contour plotting.
- Created dataset, annotated and augmented the dataset. Trained with YOLOv5s model.



- Using this model, four corners of the court were detected.
- Transforming the image and coordinates using perspective analysis for getting a top view of the court.



The ratios are taken the same as the original court

Scope and future work

- It can expanded different games such as tennis, table tennis etc.
- Need to improve the accuracy of serve shot detection
 - Better dataset using higher camera resolution and different angles
- Implementing some complex algorithm for detecting shots including forehand and backhand by considering different angles of elbows as well.
- Implementing this as a product as web project or app project.

THANK YOU

