Automating Basketball Referee

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Abstract :
Often basketball referees make controversial decisions in crucial games. Especially in the cases of travel detection and double dribbling. Using computer vision algorithms, we can achieve this task of detection.

Functional components of the project:
Using the cameras in the basketball game, detection in real time using CV can be done and signals of the foul detected can be sent.

Detection of one dribble :
When a ball travels downward and upward again(using ball tracking using its real time coordinates) , register this as a dribble.

Detection of travel :

What is travel?

In basketball, a "travel" or "traveling" violation occurs when a player holding the ball takes too many steps without dribbling.

For detection of travel,
If the step counter(which calculates the no. of steps the player took) is greater than 2 without a dribble being registered = travel detected

What is double dribble?
In basketball, a "double dribble" is a violation that occurs when a player dribbles the ball, comes to a stop (either by catching the ball or holding it), and then starts to dribble again. Essentially, it involves resuming dribbling after having already started dribbling.

There are two main scenarios where a double dribble is called:

Picking Up the Dribble and Restarting: If a player stops dribbling, holds the ball in their hands, and then begins to dribble again, it is considered a double dribble.

Dribbling with Both Hands: While a player is allowed to switch hands while dribbling (from right to left or vice versa), using both hands simultaneously or consecutively is considered a double dribble.

Functional Component to solve this problem :

Using CV and heatmaps, we can track the ball and the feet,hands and the posture of the player and when the player double dribbles the ball, a signal will pop off that the player has committed the foul. This signal can be a sound to the on field referee's earpiece so that he can call the foul on the field.
A player can be detected using Pose estimation.
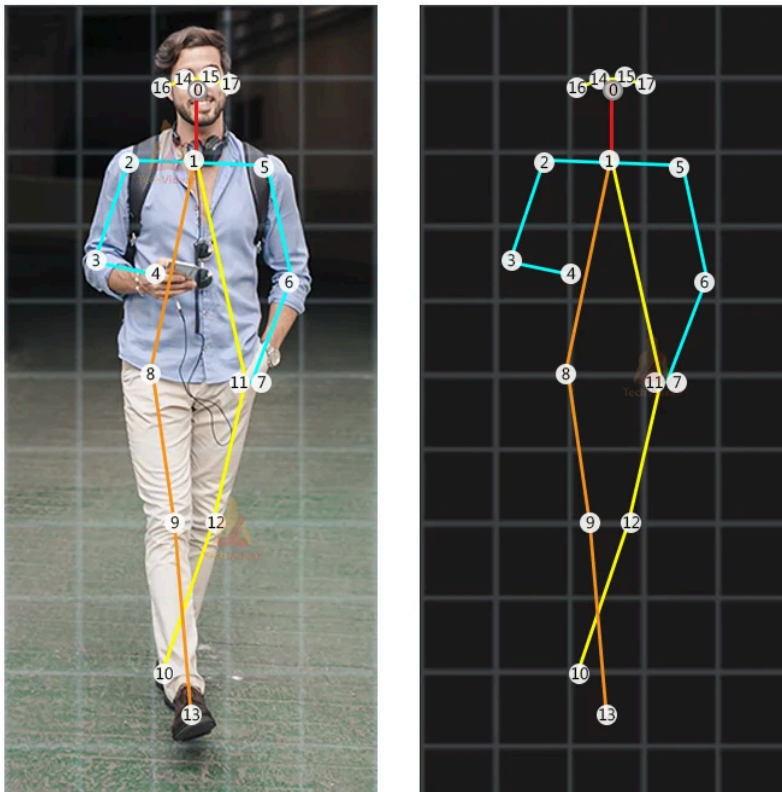
If the distance between either one of the wrists of a player and the ball is equal to 0 (Holding the ball) for more than 1 second(say), then register it as holding the ball.

Now, when he holds the ball and if a dribble is detected again, then it is a double dribble.