

BAB I. INTRODUCTION

Video is one of the sources of information that can be used to add insight and increase the level of competition among athletes in the sports sector [1], [2]. In recent years, humans can easily access video information with widespread internet access. The availability of a vast repository, such as the YouTube platform, can be used as a source to find various samples of sports matches for analysis. The player's movement on the field is one of the data points that may be studied in sports. Players' tactics and game conditions may be determined by observing their movements on the court [3]. In addition, the outcomes of sports match analysis may also be used to adapt training plans, evaluate the strengths or weaknesses of teams and players, and create game statistics [4]. However, manual game observation requires a lot of time and high accuracy from coaches and sports observers. In order to automate the sports analyzing process, sensor-based techniques have been proposed in many research [5]–[7]. The information obtained through sensor-based analysis is comprehensive and precise. Nevertheless, an enormous expense will be required, and it will not be possible to research the opposition. Therefore, visually based analysis is a wise choice. The application of image processing has benefited humans in many ways. For example, it facilitates the process of analyzing and classifying plant types [8] and diseases in these plants [9], [10]. With the implementation of image processing in object detection, various match videos available on the internet can be utilized, and there is no need for the installation of any devices during the analysis process.

In previous studies, most sports analysis was aimed at football, basketball, baseball, and tennis matches [11]. Because of that, the authors of this research are interested in studying object detection in badminton games. Tracking objects is done to accomplish object recognition, extraction, and tracking or to offer information about the activity carried out [12]. Deep learning methods for object detection cases have been recognized for their ability to handle the transformation of scale, background switches, and occlusion [13]. In recent years, region proposal-based detectors such as R-CNN [14], Fast R-CNN [15], and Faster R-CNN [16] have been popular for object detection. The ability of Convolutional Neural Network (CNN) in conducting classification has been previously studied and can show satisfactory performance [17], [18]. From the object detection method in the CNN family, Faster R-CNN can show the best performance and compete with the previous method and other methods besides the CNN family [19].

The dataset training stage in deep learning methods requires a manual player labelling process which can take time if the number of datasets used is enormous. The MATLAB Image Labeler program has a feature called Automation Algorithm that speeds up the labelling process [20]. In the case of badminton player tracking, ACF People Detector can help to identify the people in each image frame. However, people's presence caught on video matches, such as officials, often be identified while applying this tool. Therefore, A new review is needed to eliminate the labels that this detector algorithm acquired. Moreover, for a full view of the player's position in badminton game videos, the camera angle needs to be aimed at one side of the player. The net area partially obscures the player on the opposing side due to the camera angle. The ability of the coach to monitor movement during badminton matches in court may be disturbed by a net. For this reason, the inpainting method is used to remove disturbances from the court area. The image inpainting method was successfully employed to eliminate the net area in earlier studies [21]. Applying the video inpainting approach will be more effective in the case of removing the region on the video. An example is research on video inpainting with non-local patch-based techniques studied by Newson et al. [22].

In this study, the video inpainting method will remove the possible disturbing object and net area from badminton video matches. Video inpainting is applied so that the automatic labeling feature from MATLAB is not in vain due to interference with the video source used. By

combining video inpainting with Faster R-CNN, the authors aim to create a badminton player recognition system that performs efficiently.