Automatic Oil Palm Unstripped Bunch (USB) Counting System based on Faster RCNN and Object Tracking

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Abstract— **USB Palm Oil Counting (Unstripped Bunch) is important in oil palm processing mills. Information on the number of USBs is essential because it shows the level of efficiency of the palm oil processing plant. Due to its complexity, palm oil mills rely solely on manual calculations, which is inefficient workforce waste. Challenging aspects such as partial occlusion, overlap, and even different perspectives limit the use of traditional computer vision techniques. In recent years, deep learning has become increasingly popular for computer vision applications due to its superior performance over conventional methods. This paper proposes a deep learning solution to solve USB computing problems in palm oil mills. Our proposed automated USB counter system consists of an object detector built on the RCNN Faster architecture and an object tracker made in the euclidean distance. Our proposed system identifies and counts USBs with an average accuracy of 71.5% in testing.**

Keywords—automatic, unstripped bunch, counting, faster r-cnn, object, tracker

I. INTRODUCTION

The processing of oil palm fruit into CPO is a complex process. Because the oil palm production process is complicated, there will be losses. Losses in oil palm mills include losses caused by the poor implementation of the sterilization process and the extraction of oil palm fruit from bunches[1].

Improper sterilization and seeding process of oil palm fruit bunch will result in empty bunches containing oil palm fruit. This bunch is called Unstripped Bunch or USB. In Malaysia, loss in USB, estimated reaches an average of 0.05% / TBS[2]. In one case study, in Indonesia (another major CPO producer), loss caused by USB is a bit bigger, 2.2%[3]. In some cases where the bunches are not treated properly, USB loss could reach 40% / TBS[4].

Based on this, we can conclude, the performance of the oil palm mills can be seen based on small USB losses; in other words, the performance measurement of oil palm mills can be seen based on USB loss; unfortunately, no method can automatically count the USB. So far, the USB surveillance has been done manually and is neglected in some cases[5].

Object counting is a major task in computer vision and has been widely applied to crowd monitoring[6] [7] [8] [9] [10] [11] [12] [13], blood cell counting[14] [15] [16] , and fruits detection[17] [18] [19]. Initially, the counting task was carried out through object detection. However, later mainstream methods involved density map regression. Although object counting is still a challenge because images have various appearances, scale changes, and object distributions are not homogeneous, because of its extensive application, automatic object counter remains an area that attracts researchers to develop its application or method.

In the production process of an industry, it is often necessary to calculate objects that are run on conveyors. This problem is usually solved using sensors or electronic transducers such as photo or laser sensors instead of computer vision[20]. However, along with the development of computer vision technology and driven by unique conditions, several researchers have tried to develop counting objects on a conveyor using image processing[21].

The counting of a USB on a running conveyor requires a different solution. Attempts to count objects on a conveyor belt as carried out by Vanijjirattikhan et al. cannot be carried out for this USB counting. The redundancy count and line camera methods do not detect objects of more than one class on the conveyor. In this case, there are two objects, namely EFB and USB, and these two objects must be distinguished. Another problem faced by the direct counting method is the occurrence of double-counting, where the same object is counted twice. The researcher solves this problem by calculating lines that form the calculated area. This research project will use an object tracking approach to solve this problem.

This research aims to develop a UB counting system by utilizing faster R-CNN as an object detector and a tracking method based on Euclidean distance to reduce double counting.

II. RESEARCH PROGRESS

A. USB (Unstripped Bunch)

USB (Unstripped Bunch) loose definition is an empty bunch with fruitlets still attached. Fig. 1 shows a sample of fruitlets on a USB.

Fig. 1. A USB with fruitlets (red box) attached to it