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# WEB PENGHITUNG CACAH TBS MENGGUNAKAN ALGORITMA YOLOv8

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Abstract

Oil palm (Elaeis guineensis) has become one of the most important crops and commodities in the world. As a primary source of vegetable oil, oil palm is known as the most productive plant for producing oil. Fresh Fruit Bunches (FFB) are oil palm fruits typically harvested when the fruit begins to detach from the bunch. You Only Look Once (YOLO) is an algorithm based on CNN (Convolutional Neural Networks) that uses a single neural network approach to detect objects in images. This study aims to count oil palm fruits at collection points using photos or videos with a web-based YOLOv8 training module and tested through the System Development Life Cycle (SDLC). Confidence level testing uses a Confusion Matrix, which shows how confident the system is that the detected object is truly an oil palm fruit or detached fruit. This web-based YOLOv8 system was developed to facilitate the counting of oil palm fruits (FFB) at collection points, where the previous system was still manual. The results of the study show that the system successfully identified detached oil palm fruits with a fairly high confidence level, above 0.85, indicating that the developed system is accurate.

**Keywords** : Oil Palm, FFB, SDLC (System Development Life Cycle), YOLOv8 System, Confusion Matrix

## 1. INTRODUCTION

Oil palm (Elaeis guineensis) has become one of the most important crops and commodities in the world. As a primary source of vegetable oil, oil palm is known as the most productive plant for producing oil. Fresh Fruit Bunches (FFB) are oil palm fruits typically harvested when the fruit starts to detach from the bunch. In the early stages of growth, oil palm can grow 20–30 fronds each year, but this number decreases as the plant ages, averaging about 1.5 fronds per month. As a result, oil palm produces a large amount of biomass, reaching over 6 tons per hectare per year (Nugroho, 2019).

You Only Look Once (YOLO) is an algorithm based on CNN and uses a single neural network approach to detect objects in images (Muhlashin & Stefanie, 2023).

SDLC, or System Development Life Cycle, is a cycle used in the creation or development of information systems to solve problems effectively. SDLC provides a framework that includes the necessary steps for developing software. This system includes a comprehensive plan for the development, maintenance, and replacement of specific software (Rizal et al., 2022).

This study aims to count oil palm fruits at collection points using photos or videos through a web-based YOLOv8 training module, tested with the System Development Life Cycle (SDLC) method and evaluated using the Technology Acceptance Model (TAM). The web-based YOLOv8 system was developed to facilitate the counting of oil palm fruits (FFB) at collection points, where previously the system used was manual. After development and testing were completed, the system was uploaded to hosting so it can be accessed via the internet.

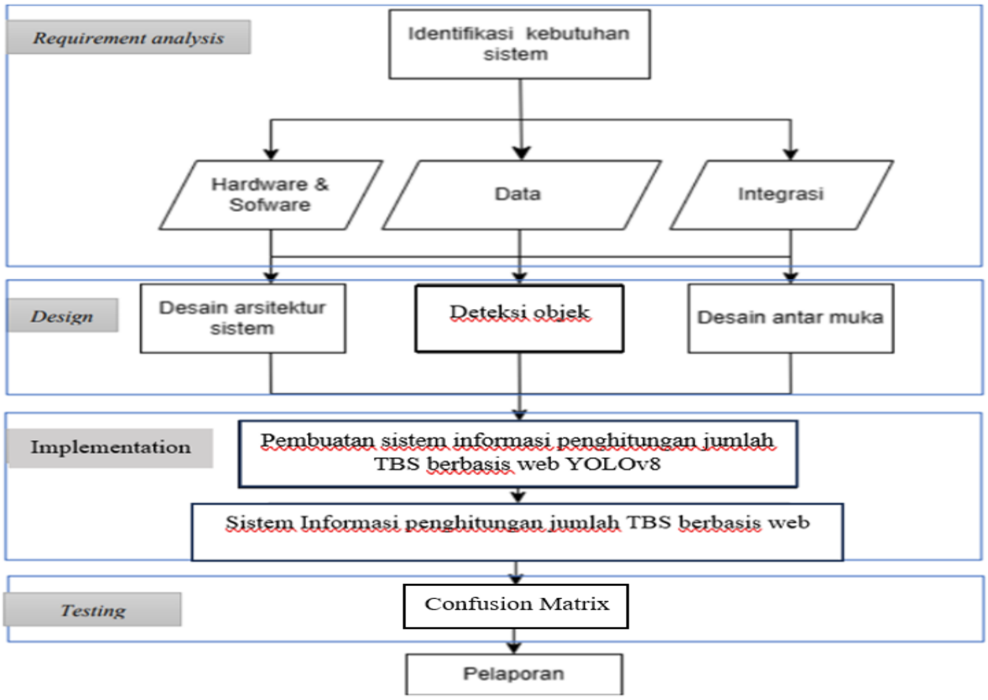
The results of the study show that the system successfully identified detached oil palm fruits with a fairly high confidence level, above 0.85, indicating that the developed system is accurate.

## 2. PRELIMINARIES

This research was conducted at PT.xxxxx in the Jambi area. The research started in May 2024 and continued until July 2024.

In its implementation, the research used HP brand laptops. The model was HP Laptop 14s-dq2xxx with Visual Studio Code 1.92.2 software, utilizing the YOLOv8 algorithm. The materials used in this research included data in the form of photos of FFB and attributes of oil palm (counting the number on the oil palm bunch).

The methodology used is SDLC, or System Development Life Cycle, with the YOLOv8 algorithm. The stages of SDLC consist of **Requreiment gathering, Design, Implementation, Testing** The stages of SDLC can be seen in the following image **:**




"Figure 1. System Development Life Cycle (SDLC) Flow"

The following describes the stages of system development using the SDLC method with YOLOv8 algorithm on image 1:

During the Requirement Analysis phase, documentation of Fresh Fruit Bunches (FFB) at the Collection Point (CP) will be collected. The photos of the FFB will then be processed using the YOLOv8 algorithm. At this stage, system requirements are identified. There are three parts of the system observed:

a. Hardware & Software

1. Hardware (Client-Server Hosting): Uses a client-server architecture model for hosting the system. The server hardware can run web applications such as e-commerce platforms and content management systems, and can use hosting to securely store data that can be accessed from anywhere.

2. Software is a set of instructions or programs used to operate computers and other devices. This software can include operating systems that manage hardware resources, applications that allow users to perform specific tasks, or other tools that support the

development and maintenance of computer systems. Examples include word processors, graphic design programs, and database management software.

b. The data used consists of 100 high-quality photos of Fresh Fruit Bunches (FFB) documentation at the Collection Point (CP).The data used consists of 100 photos of Fresh Fruit Bunches (FFB) documentation at the Collection Point (CP) with high-quality images. Documentation of Fresh Fruit Bunches (FFB) at the Collection Point (CP) in the form of photos is a modern method for collecting and monitoring palm oil harvest data. These photos are taken at the CP location and serve as a visual data source that documents the quantity and condition of the harvested fresh fruit bunches. This method utilizes image processing technology and artificial intelligence to automatically detect, count, and classify FFB.

After the requirements analysis stage, the next step is to develop the system design, including user interface (UI) design and database design. At this stage, the writer converts the results of the problem identification into a system blueprint, which encompasses data structures, system architecture, and coding procedures to be implemented. The programming language used is Python. At this stage, the writer converts the results of the problem identification into a system blueprint, which includes data structures, system architecture, and coding procedures to be implemented. The programming language used is Python.

1. Architecture Model

This system design utilizes a client-server architecture model. On the server side, the web is implemented using Fraks as the back-end, which provides web services and communicates with the database.

2. Object Detection

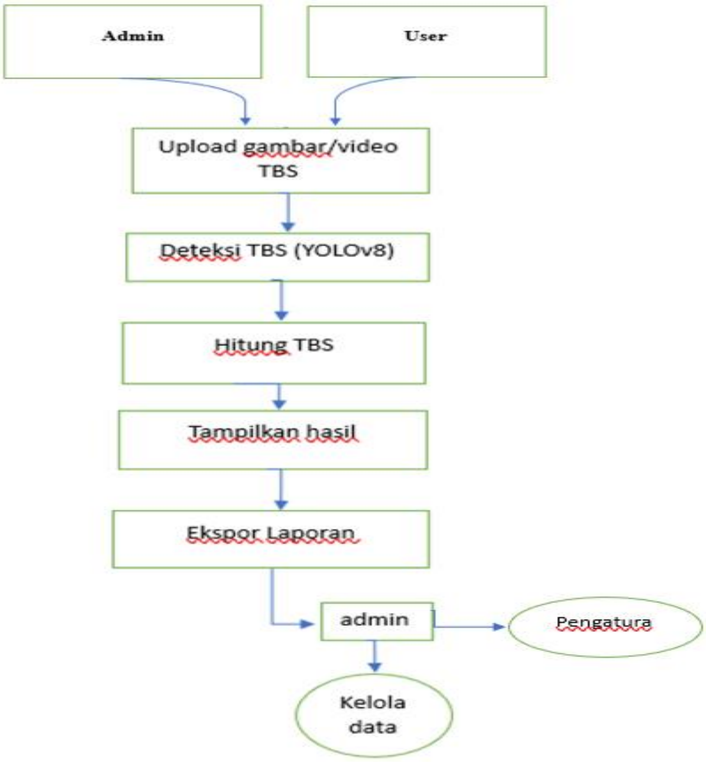
For object detection, you need to ensure that all required libraries are installed. You can use YOLOv8 via pip, labelimg, or ultralytics. You can then load a pre-trained YOLOv8 model or train the model you desire using Anaconda.

A confusion matrix is an important evaluation metric in machine learning, especially for classification tasks. This matrix provides a clear visualization of model performance by breaking down predictions into four main categories: True Positives (TP), True Negatives (TN), False Positives (FP), and False Negatives (FN).

In the context of YOLOv8 (You Only Look Once version 8), an advanced object detection model, the confusion matrix helps assess how well the model distinguishes between different object classes. Here, the confusion matrix is used to evaluate how well the predictions align with the ground truth data, which helps refine the model by identifying which object classes may be misclassified. This tool is crucial for improving the precision and recall of the model in object detection tasks, ultimately resulting in more accurate real-world applications such as autonomous vehicles or surveillance systems.

## 3. Results and Discussion

In the Requirement Analysis stage, the results show the efficiency of access and management of the palm oil counting web, enabling more effective monitoring of palm oil. Two (2) key pieces of information at the plantation (TPH) have been identified: palm fruit and bunches. The research titled "Palm Fruit Counting Using YOLOv8 Algorithm" can be explained through several system interactions in the form of a use case diagram.

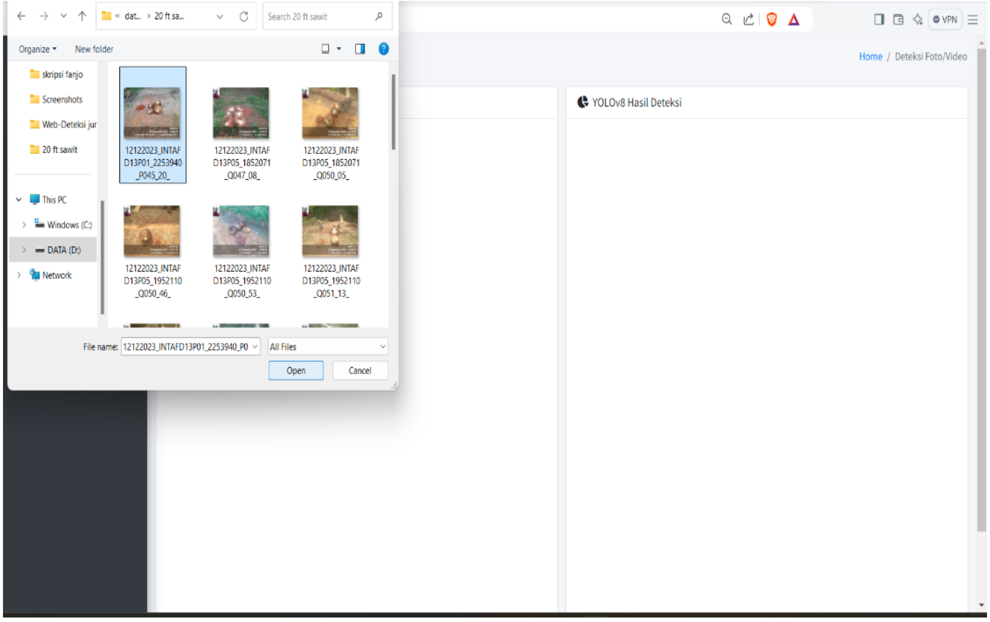



Picture 2. Use Case Diagram

In the use case diagram, the user has the ability to upload images or videos of fresh fruit bunches (FFB). After that, the system will perform FFB detection using the YOLOv8 algorithm, which automatically detects and counts the number of FFBs in the image or video. Once the detection process is complete, the system will display the FFB count results to the user.

The user can then export the detection results in the form of a report, either in PDF or Excel format. Additionally, the admin has special privileges to manage data within the system, such as deleting old data or updating user and system information. The system will also maintain an activity log to record every action taken by both users and admins.

In the implementation phase, the initial screen and dashboard file are obtained.




"Figure 3. Initial Screen (Dashboard)"

This image displays the dashboard view that is likely used to manage and organize image data. The dashboard shows several folders containing groups of images, marked with file names. These folders are well-organized within a clear directory structure, making it easy for users to find the desired images. A search feature is also available to help expedite the search process. In the testing phase, confidence levels are evaluated using confusion matrix, which shows how certain the system is that the detected object is indeed an oil palm fruit or a bunchlet.

Figure 4. Confusion matrix

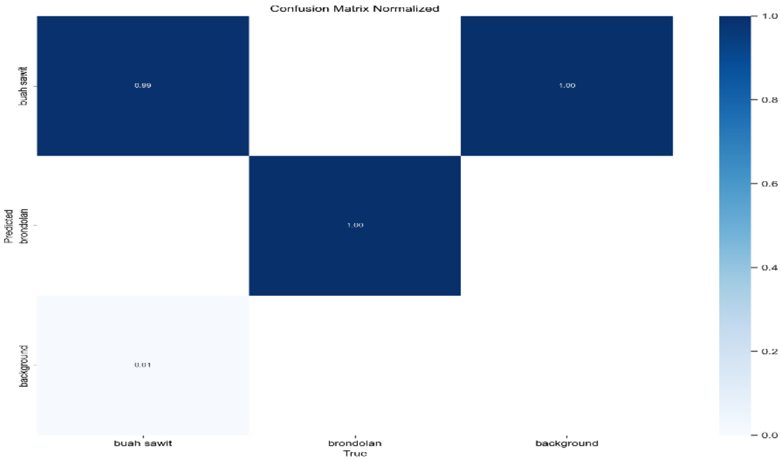



Figure 4. Confusion matrix

Axes:

- X-axis (horizontal): Represents the actual classes (true labels) of the data. In this case, the actual classes are "oil palm fruit," "bunchlet," and "background."
- Y-axis (vertical): Represents the classes predicted by the model. The predicted classes are the same as the actual classes.

Cell Values: Each number in a cell represents the quantity (or proportion) of data that should belong to a specific class (X-axis) but was predicted by the model to belong to another class (Y-axis).

Color: The colors used in this heat map indicate the model's confidence in its predictions. Dark blue represents high confidence, while white represents low confidence.

In the final implementation, the image detection results show that the system has successfully identified several objects, namely oil palm fruits and bunchlets. These objects are marked with blue bounding boxes, accompanied by labels and confidence scores.


Figure 5. Detection Results Generated from the Web

In this image, the confidence level for most of the oil palm fruit detections is quite high, above 0.85, indicating that the system is very confident in its detection results.

## CONCLUSIONS AND SUGGESTIONS

### A. CONCLUSIONS

1. YOLOv8 Model Layout: Train this model with an image dataset  High quality TBS to obtain high detection accuracy Good. Then install a framework such as Flask or Django to build web applications. Then install the Frontend Library: Use a library like python to create user views interactive interface.

2. Web-based YOLOv8 implementation process for calculations  The number of FFBs in TPH in brief is: YOLOv8 model drilled with the TBS image dataset, then integrated into a web application (e.g. using Flask or Django). Application This website will receive input in the form of real-time video from the camera installed on TPH. This video is then processed by the YOLOv8 model to detect TBS on each frame. Detection results, namely the number Detected TBS will be displayed in real-time on web interface.

3. The steps to calculate TBS are as follows:

   1) Training YOLOv8 model: Train the model with image dataset High quality TBS to ensure accuracy good detection.

   2) Apply the model to the video: Once the model is trained, apply the model to real-time video from the camera installed on the TPH.

   3) Object detection: The model will detect each TBS object video frames.

   4) Calculate the number of detections: The number of bounding boxes generated by the model in each frame will represent the number of TBS detected

### B. SUGGESTIONS

1. Integration of Additional Sensors Combining the YOLOv8 application with weight sensors or RFID in TPH to increase counting accuracy, so that it is not only based on visual detection, but also calculates the number and weight of palm fruit automatically.

2. Detection Optimization in Low Light Conditions Add a lighting optimization feature or image processing algorithm to increase the accuracy of palm fruit detection in low light conditions or at night.

3. Added a menu to show the number of an object (Palm)

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