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# Vehicle Object Detection and Classification Using Machine Learning Algorithm in Tangerang City

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**Abstract:** Vehicles are tools that almost all humans use to move or move from far or near places. There are various types of vehicles such as two-wheeled vehicles (motorcycles) and four-wheeled vehicles (cars, trucks and buses). Advances in transportation technology have an impact on the development of road traffic and transportation, resulting in changes to road infrastructure, transportation facilities and other traffic equipment. Research on artificial intelligence such as detection and classification of vehicle objects can make it easier for researchers to recognize objects and calculate passing vehicles contained in a video recording. In this study, the author uses the YOLO object detection algorithm to detect and classify vehicles. This study uses a dataset of four classes, namely cars, motorcycles, trucks and buses. The results of the testing program using the YOLO object detection method were able to distinguish motorcycles with 4 wheels or more marked by the detection of a green box on the vehicle in the video frame. based on the YOLO object detection method, it has succeeded in calculating the number of vehicles that pass through the detection sensor with an accuracy value of 79%.

***Keywords:*** *machine learning, vehicle detection, vehicle classification, you only look once,*

## 1. Introduction

Vehicles are tools that are used by almost all humans for mobility or move from place Which Far or near [1]. There is various type vehicle (bicycle motorcycle) And wheeled four (car, truck, And buses) [2]. Progress Transportation technology has an impact on the development of traffic and transportation road, so that happen change on infrastructure road, means transport, And other traffic devices. Another factor is economic growth which causes road users to increase and become more congested on the road highway. Indonesia is one of the countries with a high level of vehicle purchases the motor tall [3].

In Indonesia, billboard advertising is currently booming. We will often encounter this type of advertisement in big cities such as Jakarta, Bali, Surabaya and Medan [4]. It's no wonder that along the streets of these cities are full of billboards or billboards of various sizes. Even though it is quite expensive, entrepreneurs still use billboard installation techniques as promotional media. Because the impact of advertising like this is very effective and extraordinary. If entrepreneurs or business people want to introduce products in the community, renting billboards is the best solution. The impact of placing billboards is far more effective than conventional types of advertising. However, placing outdoor advertisements is more complicated than advertising on various social media. There are many reasons people put up billboards as advertising media. But the thing to note is to choose the right location. Billboard is one of the advertising media in the form of a large poster, usually installed in the city center or crowd. The purpose of installing this advertising medium is so that many people see it. Then strategic installations are generally in public places and protocol roads, so that many people pass through them [5].

As technology develops, billboard designs are increasingly attractive with digital assistance such as computers or PCs, making it more time and cost efficient. It's no wonder that the best advertising media solution is to use billboard rentals. In the following, we provide reasons for using billboards for promotion or advertising. The most important thing to consider when installing a billboard is its location. Billboard rentals usually offer a variety of strategic locations. the more people walking around, the more strategic it becomes to advertise with a board. because placing billboards in strategic locations will provide great opportunities to attract potential consumers. Therefore, the existence of a billboard requires a wide and easily visible outdoor area. The cross-section of the advertising media that is quite large is a distinct advantage, which is easy to see. So it must be installed on the edge of a busy road.

To obtain relevant data, the researcher counted the vehicles passing through the research area and recorded the data in blanks with predetermined criteria. The data that has been recorded will later be in count to obtain the number of passing vehicles, Calculation vehicular movement by an observer allows the occurrence errors or human errors that are influenced by environmental conditions or internal condition. Errors in recording data resulted in less the

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accuracy of the calculation process carried out by the researcher. Calculation of data carried out so far certainly requires a high cost not a little so that it is felt to be less efficient, this underlies the research with the results of the vehicle counting program by utilizing video traffic conditions as data that will be processed by the method background subtraction by separating the background and foreground to determine the position of the centroid in the frame then count how many points centroid that passes through the specified line in the designed program,

Following a number of summary about study earlier Which Once done previously used data and methods Which has used.

Study about "Detection Vehicle Kindly Real Time Use Method Android-Based YOLO" [6] On study This do detection vehicle Which enter to track Which No intended for that vehicle. The analysis was carried out using the number of datasets as much 200, 4 class, 10 batch, And 200 epochs. Process training done until 4,000 step, and storing checkpoints in the form of a protobuf file is done at steps 800, 1,000, 1,200, 1,400, 1,600, 1,800, 2,000, 3,000, And 4,000. bound box succeed detect and classify object in a manner appropriate. Testing This done use device smartphones Xiaomi redmi 4X with resolution videos sized 764x432 pixels.

Study about "System Introduction Plate Number Automatic Use YOLOV3 with the Keras Framework" [7] This research did automatic vehicle number plate detection using the YOLO algorithm with the framework darknet. In the detection stage, it starts from the localization of the vehicle number plate then next with reading character on plate number. Results from study This produces an accuracy rate of 98.52% with an average reading time 3.03 seconds and for the OCR results with the Tesseract Software we get a detection result of 20%, p This show system has succeeded recognize whole character on plate car Which form Alphanumeric as much 6-7 characters.

Research on "Moving Vehicle License Plate Detection Based on the You Method Only Look once (YOLO)" [8]. Study This do detection plate number vehicle. detection started from inputs videos, acquisition, inputs ROI, process YOLO, tracking, choose confidence highest and cropping. Results Which obtained on Means Average Precision (folder%) 87, 89% And location detection plate number seen in a manner empirical own flat- flat accuracy of 85.81%.

Research on "Vehicle Type Classification System Through Image Processing Techniques Digital" [9]. Study This aim for detect motorcyclists who commit lane violations on the island toll road Bali. System can classify vehicle motorized Which can have used for warn motorists who drive improperly. The results of this study, the system is able to detect and classify the type of vehicle with a high level of accuracy different for a certain distance.

Study about "System Intelligent Monitoring Current So Cross with YOLO (You Only Look Once v3)" [10]. This system is designed for detect vehicles on the highway. Using dataset sourced from CCTV ATCS Medan City Transportation Agency. The system can detect cars, motorcycles, buses, trucks, and bicycles person. YOLOv3 is able to classify vehicles by mAP (mean Average Precision) on CCTV Fixed Which highest that is 97% whereas on CCTV PTZ as big 99%.

Research on "Visual Object Detection and Tracking using YOLO and SORT" [11]. This study aims to analyze tracking object with approach detection use YOLO and tracking use algorithm SORT. Uses video input to recognize vehicles and to recognize pedestrian's analysis Then cross. Datasets Which used as much 800 picture with 6 class. accuracy and precision can be detected by training the system using more epochs. Performance SORT for tracking depends on detector performance.

Study about "Detection and classification of vehicles for traffic videos analytics" [12]. Study This aim for analyze system Then cross based computers Vision. Statistics This covers calculation vehicle, classification vehicle type, estimated vehicle speed, and monitoring lane usage. The essence of system This is detect and classify vehicle in videos Then cross. Using 2 different traffic datasets. First, the Indonesian Toll Road dataset is dataset owned by they Which taken through Toll Jagorawi and Toll Kapok. Second, use MIT traffic datasets. The results of this study say that Faster R-CNN is superior in detect vehicle move compared to with model MoG background Subtraction.

Study about "Design get up counter and identifier vehicle using Multiple Object Tracking" [13]. This research implements a vehicle counter and identification system in toll roads using multiple object tracking. The system uses the Gaussian algorithm mixture model and Kalman filter to detect and track position, speed, direction of motion and size vehicle from time to time on each frames image. Results from study state when the morning produces the best results, and in the evening the worst results. accuracy on Morning big day 94%, Afternoon day 90%, afternoon day 85%, And Evening day 59%.

Based on the research that has been mentioned, with several different methods, as well as input and dataset Which different also. Is known that study about detection vehicle use algorithm you Only Look once (YOLO) can produce mark the accuracy tall. By Because That, on study This will done detection and classification vehicle use algorithm you Only Look once (YOLO). [14-15]

Based on these problems, the authors are interested in building Video-based vehicle calculation program as an

alternative solution for Simplify the process of calculating vehicles based on vehicle classification specifically by using the You Only Look Once (YOLO) method. The You Only Look Once (YOLO) method is a fast and accurate method in object detection. This method is capable of detecting up to 2 objects time more fast than algorithm Which other. On study This, writer use method YOLOv3 [16-18] because it has several improvements in detecting objects and accuracy values Which taller than version previously. With use method YOLO, expected study This can give results Which Good for detect and classify vehicles through traffic video recordings obtained in the city of Tangerang.

## 2. Research Methods

The research method is a scientific method that is useful for obtaining and collecting data with a specific function and purpose. In the process of compiling this thesis report, the author uses a type of research that is more directed to descriptive qualitative, namely by conducting research directly, by collecting and describing data regarding research objects related to the process of detecting and classifying vehicle objects to obtain relevant and accurate data.

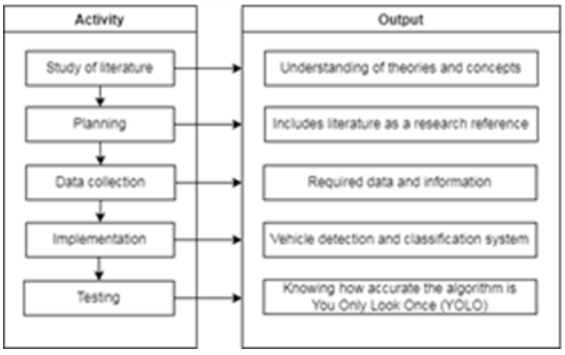


**Fig 1** Research Stages

Based on the description of the research stages above, each research stage can be described as follows:

### 2.1 Literature Study

The initial stage in this research is a literature study. Literature study was conducted for search problem, look for source related with study and base theory as reference for do study. Studies literature done with do review literature Which deals with the detection and classification of vehicles using algorithms YOLO, with input data in the form of images or videos. A literature search process was carried out with use *Google Scholars* and *ResearchGate* with enter say key Which in accordance. The main keywords searched for are divided into five sections, namely: a) "vehicle *detection"*, b) "classification *vehicle"*, c) "image *based"*, d) "video *based"*, e) "You *Only Look once* (YOLO)". Things Which become criteria in choose literature as following:

1. Literature is publication scientific.
2. Literature discuss about detection and classification vehicle.
3. Literature originate from publication scientific speak Indonesia and Language English.
4. Literature use *image* approach *based* or *videos based.*

2.1.1 Method of collecting data

A. Library Method (Library *Research)*

Literature research can be regarded as a research method in which the process of searching, collecting and analyzing data sources to be processed and presented in the form of library research methods including data sources, data collection, and data analysis. Mardalis The meaning of library research is research that aims to collect data and information through the help of various materials found in the library room.

This method is very important and strategic, because this method contains discussions and sources from books, journal literature, articles and documents related to the problem of this research report and is used as a theoretical basis for research.

B. Direct *Observation*

Method observation is method in collection data Which This can be done by visiting the research site directly get information Which needed for research. In this step, the necessary data, tools, and materials are collected in study. Data recorded live from highway section. The data is in the form of video recordings of traffic flow on the MH highway. Thamrin City of Tangerang. Data recorded from 1 day and location Which different with duration Which Different Also.

C. System Analysis Method

This final project research method is the implementation of the YOLO algorithm *object detection* on vehicle Which used For count vehicle Which is on a road. The vehicle detection is carried out by a video recording where the data is taken and the data is in the form of images will be processed by matlab. Vehicle counter program block diagram .

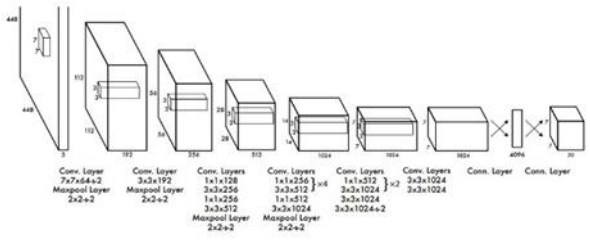

**Fig 2** Block Diagram

The block diagram above, obtained from the visuals that have been taken from the video recording will processed by *image processing* on matlab use method YOLO *object detection* to count how many vehicles are there on Wrong One segment road. Program YOLO *detection object* only will count vehicle If vehicle pass line Which function count which vehicle past .

You Only Look Once (YOLO) is an approach for real-time object detection based on a Convolutional Neural Network. YOLO uses a single neural network approach to perform object detection in an image. This network uses the features of all images to predict each bounding box which can make predictions on bounding boxes and probabilities directly in one evaluation, the YOLO detection network has 24 convolutional layers followed by 2 fully connected layers. connected layers). Some convolutional layers use a 1x1 reduction layer as an alternative in reducing the depth of feature maps followed by a 3x3 convolutional layer.

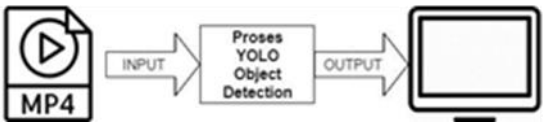


**Fig 3** YOLO Architecture

There is three step in detect object use YOLO Which illustrated on Figure 4 as follows:

a. Change size input picture to be 448x448

b. Operate network nerves single (Single neural networks) on picture

c. Do threshold on results detection based on mark confidence

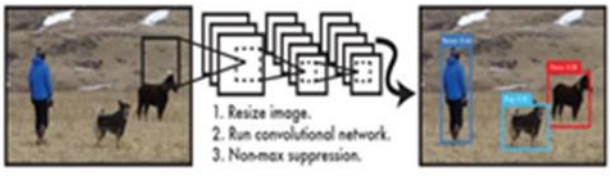


**Fig 4** YOLO detection system

YOLO share picture inputs become *grids* SxS. If center something object fall to in *grid* cell, then the *grid cell* is responsible for detecting that object. each *grid cell* predicts box barrier (bounding *boxes)* B and mark belief (confidence *scores)* For box, as well as the probability of conditional class C. This *confidence score* describes how much accurate box the according to estimate. YOLO define *confidence* as Pr $(Object)$. $IoU^{truth}$. If No There is object Which detected on cell, mark belief will worth zero. If No, system want to mark belief The same with *Intersections Over Union* (IoU) between box prediction and *ground truth.*

Every box barrier B consists from 5 component x, y, w, h, Figure 3.5, And *confidence.* Coordinate values (x, y) represent the center of the grid, *relative* to the *grid box boundaries.* Mark coordinate Then normalized for fall in between 0 And 1. Width (w) And tall (h) *relatively* to whole picture, and normalized Also. Mark belief (confidence *score)* specifies how confident the model is, that bounding box B contains an object and how much accurate he thought box Which He prediction. By Because That, prediction YOLO has an output *vector* $S, S, .5 + C$.

The determining factor for obtaining the final prediction is *the class confidence score,* based on class conditional probabilities and *box confidence scores. Class confidence score* measure the value of trust in the classification and localization of objects. *Class confidence score* give mark trust class Specific for every box, which encode possibility class that appears in the box and how well the predicted box matches the object. Equality on *class confidence scores* for every box prediction showed on Equation.

### 2.2 Planning

In conducting this study, planning encompasses the utilization of literature as a research reference, the selection of software to be employed, and the designation of hardware as outlined below:

**Table 1** Hardware and Software specifications table

| | |
|---|---|
| I. hardware | - RAM 16GB<br>- Intel Core i5<br>- SSD |
| II. Software | - OS Windows 10 64 Bit<br>- Pythons<br>- Spyder IDE<br>- OpenCV Libraries |

### 2.3 System Design Method

The vehicle counter program is designed for a variety of environmental conditions light and status Then cross changed. In system Which used, system accept Then cross from video recordings to do detection is needed in the form of image data, therefore the video needs to be converted into image form so that Can have processed to The next step. Then give box counter on road highway for detection of objects moving through it. The system will be described as following.

#### A. System Pre-Processing

Stages moment process classify object picture in a manner manuals using *software.* User can classify all objects and save results picture along with *.txt* to folders data

#### B. Learning

The stage when the user duplicates the darknet after installing the repo. Then re- *training* using an existing image model. After process *training* is complete, you

will get a model file that will be used for detect objects.

**C. Detector**

If the program detects a vehicle that is passing by the box, then the program will add *a counter* +1 which functions to count vehicle that passed on One video duration.

### 2.4 Data Collection

At this stage the author collects data using the library and observation method to carry out observations and analyzes of the vehicle object detection and classification system so as to obtain data and information needed by researchers. On in this step, the necessary data, tools and materials are collected in study. Data recorded straight from highway section. The data is in the form of video recordings of traffic flow on the MH highway. Thamrin, Tangerang City . Data recorded from 1 day and location Which different with duration Which Different Also.

**Table 2** Dataset Distribution

| Date/Time | Duration | Frame Size | Frame Rate |
|---|---|---|---|
| July 10, 2022 / 13:00 | 30 seconds | 1920x1080 | 30 fps |
| July 10, 2022 / 13:30 | 30 seconds | 1920x1080 | 30 fps |

Input data in this study is in the form of video in .mp4 format. to do detection is needed in the form of image data, therefore the video needs to be converted into image form so that Can process to The next step.

**Fig 5** Recording at 13:00

**Fig 6** Recording at 13:30

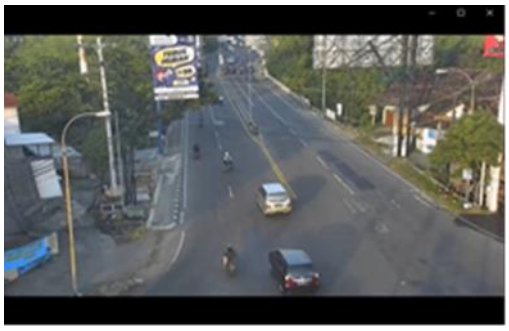

**Fig 7** Recording from the internet

The author also uses some data taken from the internet which consists of highway to carry out the training process in which there are cars, motorcycle, truck and Mrs. S.

### 2.5 Implementation

After collecting data, data annotation is then performed. Data annotation aim for give label on picture with give box barrier (bounding *box)* and class name on each object. Then, do the *training data* aim for practice computer with process data Which has in annotate so that formed something characteristics for consideration reach a prediction. The next step is to implement the *You Only Look Once* (YOLO) algorithm for do detection and classification vehicle. Implementation done with implement results design to in device soft use Language Which can be read by computers.

**Program Flowcharts**

To facilitate the creation of *vehicle object detection and classification programs* some needed stages, namely by making the program work system *flowchart* look like following.

**Fig 8** Flow chart Program YOLO object detection

The following is an explanation of Figure 8 Flowchart of the YOLO Object Detection Program:

1. Video Recording Input is when entering video recordings that the program needs to detect passing vehicles.
2. Pre-Processing is the process of classifying image objects manually using the software. Users can classify all objects and save the resulting images along with .txt to the data folder before entering the program.

3. YOLO Object Detection is when the program has started working on detecting vehicles and creating a line to count the vehicles that pass through it.
4. The vehicle detection box is when the program has successfully detected a vehicle that will pass.
5. Counting the number of vehicles is when a vehicle that has been detected crosses the line and the counter will automatically increase.
6. Waiting for a vehicle to cross the line is when the line is still waiting for a vehicle to pass through it.

**Annotation object**

Annotation or object labeling is the process of creating labels on images in a way provides a bounding box (bounding *box)* along with the class name on the object. Labeling stage, the object is carried out when the data in the form of a video recording of the MH Thamrin road section, Tangerang City, is processed become picture on each videos.

Object labeling is divided into four classes, namely cars, motorcycles, buses and trucks. Objects that are labeled only look behind according to the results of the recorded video. This label uses annotations in the YOLO annotation format. The result of the annotation is data that contains information on the location of the bounding box.

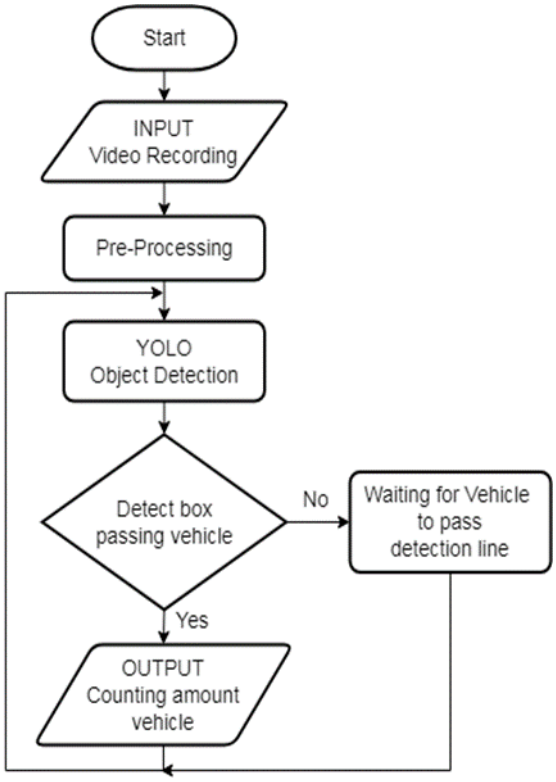


**Fig 9** Process object annotation

**Data Training Process**

After annotation finished done, step furthermore do process *training.* Process it aims to train the computer by processing images and annotations that have been made so that patterns or characteristics are formed from each class that will become the material computer considerations in reaching a decision or prediction. In this section using YOLOv3 *pre-trained weights.* By using *transfer learning techniques. Transfer learning* is something technique Which use model Which has in- *trained* previously (pre-*trained model)* that can be used to classify new datasets without must do *training* data from beginning. Process *transfer learning* on Darknet use data files, cfg files, And *pre-trained weights.* Data files containing location picture Which used for *train* and *test.* Cfg file contains shapes network used for *training*, and *pre-trained weights* containing model *weight* Which has trained before on network YOLO.

## 3. Result and Discussion

This chapter discusses the many results of testing and results this Final Project research. With the aim to determine the level of success of the system design that has been proposed and worked on. Testing done includes program tests using the YOLO method, motorbike and 4-wheeled vehicle detection tests more, and vehicle counter detected crossing.

### 3.1 Software Installation

**A. Downloads files weight and files configuration YOLO**

The next step is to download *the weight file* and *configuration file* The completed YOLOv3 *training* is shown in Figure 10 . This file is the essence of algorithm YOLO for detect object and *files configuration* is arrangement from algorithm YOLO.

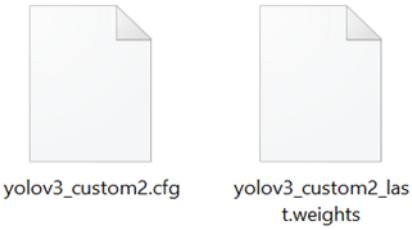


**Fig 10** YOLO weight and cfg files

**B. Anaconda Python installation**

Anaconda is developed by the Anaconda Organization, Inc. (Continuum Analytics). Anaconda is a distribution package of the Python and R programming languages and contains several additional packages for data science programming, scientific computing (scientific computing) such as data science, machine learning, large-scale data processing, predictive analysis, mathematics to engineering in one distribution platform. which is user friendly. Anaconda provides many pre-installed libraries and packages. Some of them are NumPy, SciPy, Pandas, Scikit learn, nltk, and Jupiter. Anaconda is also one of the most popular data science learning platforms today. Anaconda provides conda

as a package manager while Python provides pip as a package manager. Pip Python allows installation of python dependencies. On the other hand, Anaconda conda allows installation of both python and non-python library dependencies. The use of anaconda is related to Data Science and Machine Learning.

### C. Install OpenCV

OpenCV is a Python library used to solve computer vision problems. Computer vision includes understanding and analyzing digital images by computers and processing the images or providing relevant data after analyzing the images. OpenCV is an open source library used in machine learning and image processing. OpenCV performs tasks such as recognizing handwritten numbers, human faces and objects.

In order to use OpenCV, we need to install it.

**Step 1** - Make sure Python and pip are pre-installed in your system Type the following command in command prompt to check if python and pip are installed in your system.

**To check Python**

```
C:\Users\Aderian>python --version
Python 3.8.6
```

**Fig 1** Program code check python

If python is installed successfully, the version of python installed on your system will be displayed.

**To check pips**

```
C:\Users\Aderian>pip -V
pip 20.2.1 from c:\users\aderian\appdata\local\programs\python\python38-32\lib\s
ite-packages\pip (python 3.8)
```

**Fig 2** The program code checks pip

The pip version will be displayed, if it is successfully installed on your system.

**Step 2** – Install OpenCV

OpenCV can be installed using pip. The following command is run in the command prompt to install OpenCV.

```
C:\Users\Aderian>pip install opencv-python
Collecting opencv-python
  Downloading opencv_python-4.6.0.66-cp36-abi3-win32.whl (26.2 MB)
     |                                | 26.2 MB 93 kB/s
Collecting numpy>=1.14.5; python_version >= "3.7"
  Downloading numpy-1.23.2-cp38-cp38-win32.whl (12.2 MB)
     |                                | 8.6 MB 35 kB/s eta 0:01:43
```

**Figure 3**OpenCV install program code

This command will start downloading and installing packages related to the OpenCV library. When finished, a successful installation message will be displayed.

### 3.2 Vehicle Detection with You Only Look Once (YOLO) algorithm

In the detection process, after all the required *software has been* installed with Good. Step furthermore is combine files *weight* , *configuration* , And dataset on One folders.

a. Import libraries

Use libraries cv2, numpy, And time. Libraries cv2 function For do *computers vision tasks* . Libraries numpy function For processing data numerical.

```
1  import cv2
2  import numpy as np
3  import time
```

**Figure 4** Input library program code

b. Load *network* YOLOv3

Using file *weight,* cfg and *name files. The weight file* is a model that has been *training,* the heart of the YOLO algorithm for detecting objects. Cfg files are configuration files, where all arrangement algorithm YOLO there is on files the. And *name files* are files Which containing What is the name object Which can detected use algorithm YOLO. Here the author uses *name files* which contain five classes to be detected. After that set *the minimum* probability of eliminating low predictions with a value of 0.5. As well as make settings to filter the low bounding box with a threshold value 0.5 If more big so object will detect with Correct, If No so will missed. The threshold value changes from 0 to 1. The closer to 1, the greater the detection accuracy, the closer it is to 0 the less accuracy but also the greater the number of objects detected. To produce a color on each detected object.

```
weight_height_target = 320
model_cfg,model_weights = 'yolov3-tiny.cfg','yolov3-tiny.weights'
confThreshold = 0.5
nmsThreshold = 0.3
inccount1 = 0
inccount2 = 0
inccount3 = 0
inccount4 = 0
inccount5 = 0
inccount6 = 0
inccount7 = 0
inccount8 = 0
inccount9 = 0
inccount10 = 0
inccount_reset = 0
start_time = time.time()

net = cv2.dnn.readNetFromDarknet(model_cfg,model_weights)
net.setPreferableBackend(cv2.dnn.DNN_BACKEND_OPENCV)
net.setPreferableBackend(cv2.dnn.DNN_TARGET_CPU)

result = cv2.VideoWriter('result.mp4',cv2.VideoWriter_fourcc(*'XVID'),20,(320,320))
```

**Fig 15** Code program load *network* YOLOv3

c. Read *frames* for loop

Then do loop on *frames.* Here will done function loop for catch *frame-by-frame* with function *read,* that is read *frames* from videos input. If *frames* No taken, for example on end videos, so program will stop the repetition.

```
net.setInput(blob)
layernames = net.getLayerNames()
outputnames = [layernames[i-1] for i in net.getUnconnectedOutLayers()]
outputs = net.forward(outputnames)
counter1,counter2,counter3,counter4,counter5,counter6,counter7,counter8 = findObject(outputs,img)
```

**Fig 16** The program code reads the iteration frame

d. Take *blob* function from *frames*

Then, data will have processed use libraries OpenCV for changed become form *blob* (Binary *Large Object)* of *the frame*. Using the function *'cv2.dnn.blobFromImage'* will return 4-dimensional *blob* from *frames* moment This after subtraction average, normalization, and exchange of RB channels (Irwan, Putrada, & Prabowo, 2019). on function *'cv2.dnn.blobFromImage'* containing parameter *frames* Which is input picture Which will processed through a neural network in the form of a classification. 1/255.0 as *a scale factor* for average reduction. The size (416,416) is the size on YOLO. *swap Rb* give assumption on picture is at in channel BGR, however mark mean assuming we are using RGB sequence. To overcome this difference, we can set the value to ' *True* ' to select the R and B channels. The resulting shape own amount frame, amount channel, wide and tall. *Blob* used for extract image features and resize it. In YOLO there are 3 *frame sizes*, namely 320x320, 416x416, and 609x609. Here the author uses size frame 416x416 order to process detection has speed and accuracy Which balanced.

```
while True:
    _, img = cap.read()
    img = cv2.resize(img,(weight_height_target,weight_height_target))
    cv2.imshow('video',img)
    blob = cv2.dnn.blobFromImage(img,1/255,(weight_height_target,weight
```

**Fig 17** The program code retrieves the blob function from the frame

e. Get *bonding boxes*

On step This done extraction whole information object Which detected and display it on screen. Do initialization list *bounding_boxes* for box barrier that surrounds the object. *Confidences* give YOLO a confidence score for something object, belief value (confidence*)* of detected objects has a value of 0 to 1. ClassIDs for provide labels object class Which detected.

Looping for each *output_from_network* and looping for each *detected_object* on *result* with extract *class_current* And *confidence_current* . Using commands *confidence_current* to filter predictions weak with ensure that objects are detected with a probability greater than the minimum probability. Then do scale coordinate box barrier for displays with Correct on picture original. So, extract coordinate and dimensions from box barrier with return coordinate box barrier in form: *x_center, y_center, box_width, box height.* Use the information to get *the top-left (x, y)-coordinates* of the box barrier. Then update list *bounding_boxes* , *confidences* , and *classIDs* .

```
cv2.circle(img, (xMid, yMid), 1, (0, 0, 255), 1)
cv2.rectangle(img,(x,y),(x+w,y+h),(255,255,0),1)
cv2.putText(img,f'{classes[classIds[i]].upper()} {int(confs[i]*100)}%',(x,y-
```

**Fig 18** Bounding box program code

f. *Results Testing Counter Vehicle Crossed*

In testing This Already seen that vehicle Which crossed Already can be calculated by counter on Program use method YOLO.

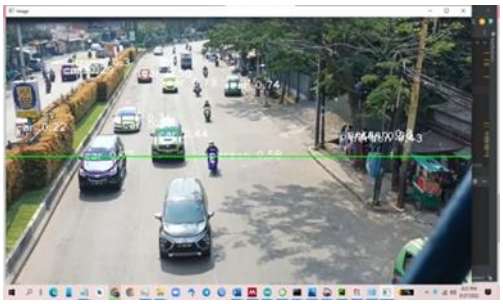

**Fig 19** Process of calculating vehicles

On testing time This program YOLO Already can count vehicle. Marked with the help of a green line that serves to calculate the number of vehicles that pass through it and the results will be displayed on the screen on the left corner. Furthermore, is with taking data with method observe How many Lots passing vehicles for 30 seconds to 2 And see compatibility between program counters and manual counts. Retrieval process Data was collected using 3 different video samples from various sources Which There is on Internet as well as recording writer. As for data from results analysis is as following:

**Table 3** Table of video test results

| Datasets | Duration | Number of vehicles | | |
|---|---|---|---|---|
| | | detected | Manuals | Error Detection |
| Video 1 | 25 Seconds | 17 | 23 | 6 |
| Video 2 | 25 Seconds | 44 | 53 | 9 |
| Internet videos | 25 Seconds | 35 | 29 | 6 |

On Table 3 takes data with test accuracy counting detection program and counting manuals can conclude that Still there is Lots detection error. Because data success Already found so can do process calculation accuracy program detection with method.

**Video Dataset Calculation 1:**

Data Accuracy

= 100% - (error detection / manual calculation x 100%)

= 100% - (6 / 23 x 100%)

= 100% - 26%

= 74%

**Video Dataset Calculation 2:**

Data Accuracy

= 100% - (error detection / manual calculation x 100%)

= 100% - ( 9 / 53 x 100%)

= 100% - 16%

= 84%

**Calculation of Video Dataset from internet:**

Data Accuracy

= 100% - (error detection / manual calculation x 100%)

= 100% - ( 6 / 29 x 100%)

= 100% - 20%

= 80%

**Total calculation accuracy:**

= Dataset Results

(Video 1 + Video 2 + Internet Video)

Number of Datasets

= (74% + 84% + 80%) / 3

= (238%) / 3

= 79%

In the results of the 1st video dataset, the results of the confidence calculation are obtained by 74%, the 2nd video dataset by 84% and the video dataset from the internet by 80%. As for when running the program, the results of detection using video input produce different confidence values for each frame, this is due to the object changing position, and the results obtained from the accuracy of the calculation of the vehicle detection and classification program using the You Only Look Once (YOLO) method are 79%.

## 4. Conclusions

Program counter vehicle Which crossed in road highway use the help of the modified YOLO object detection method so that it doesn't only detect vehicle but Also can count vehicle Which through it. Results from testing program with method YOLO object detection Already Can differentiate motorbikes with _ wheel 4 or more be marked with detection box green color on the vehicle Which is at in frames videos. based on the YOLO method object detection has succeeded in calculating the number of vehicles that pass sensors detection with mark accuracy 79%. Pprogram counter vehicle Which crossed No only use YOLO object detection method but also uses several librays Which There is on Python Anaconda application.

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**Conflicts of interest**

The authors declare no conflicts of interest.

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