# Number Plate Detection and Analysis using OpenCV and Deep Learning

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# Abstract

This paper works on the Number plate detection using the domain of the deep learning. In which it's goes under the image processing as well. It has to recognize the only number plate in which the characters have to be localized. However, because to the various sizes of cars, detection remains an issue that has a direct impact on vehicle accuracy. so, that it has to be used under the open CV. In this paper it has to be detected with the number plate detection is a deep learning training model. However, the yolo algorithm will be the part of it. The YOLO object detector recognizes things in images and video streams using Deep Learning, and OpenCV. Using object detection, you'll be able to determine not just what's in an image, but also where it is. In the realm of highway management, intelligent vehicle identification and recognition is becoming increasingly important. However, due to varied vehicle sizes, which has a direct influence on vehicle accuracy, vehicle detection remains a problem. This research presents a vision-based vehicle identification with display the details. This paper leads with the optical image reorganization using the yolo algorithm. It has to be present the details of the owner, type of the vehicle, model and Some of the cases details of the theft condition also has to be printed as an output for the result. we found that ResNet152V2 gives better accuracy when compared to other models.

**Keywords**: You Only Look Once, Optical Character Recognition, Intelligence Transportation System, Batch Normalization, Single Shot Multibox Detector, Intersection Over Union, KNN, CNN, bounding box prediction, User-Based Driving Insurance, Multivariate Alteration Detection.

# 1. Introduction

Vehicle recognition and measurements in expressway observing video groupings are fundamental for powerful thruway traffic the board and control. In light of the broad utilization of traffic observation cameras, a huge assortment of traffic video data has been collected for study When looking at a more far off street surface, a more prominent survey point is once in a while utilized. At this survey point, the size of the vehicle's items varies emphatically, and the recognition precision of something seemingly insignificant distant the street is low. While working with refined camera settings, it's basic to successfully oversee and use the previously mentioned difficulties. The previously mentioned concerns are tended to in this review, and the vehicle location discoveries are applied to multiobject.

#### **1.1 Over View of Vehicle Transportation**

Since it should include vehicles exactly and continuously while managing confounded circumstances like impediment, light shift, and shadow influence, traffic stream discovery is an extreme issue in Intelligent Transportation Systems (ITS). Over the past couple of many years, numerous researchers have offered an assortment of speculations and answers for vehicle count. Virtual line/district based approaches and element following based techniques are the two kinds of arrangements overall. Turnpikes, interstates, and streets are more packed as the quantity of vehicles out and about ascents. Wise transportation frameworks (ITS) are being created across the world to make transportation more compelling, trustworthy, cleaner, and more secure by gathering, cognizing, and overseeing information on traffic streams from different sources. For traffic stream observing, arranging, and the board, the capacity to recognize, track, and count moving vehicles is turning out to be progressively critical.

#### 1.2 Scope of The Work

In the past, inductive loop detectors, infrared detectors, radar detectors, and videobased technologies were all utilised to identify automobiles. In comparison to other strategies, vision based systems based on traffic cameras placed outside are lightly impacted by environmental conditions likecloudy, light, shadow, and so on. Vision based systems, on the other hand, have aroused academics' interest in the last decade since they can provide many advantages over earlier techniques, such as uninterrupted traffic flow, ease of installation, and ease of modification

#### 1.3 Image Classification Processfor Object Identification

The car enterprise has relied on conveyance Telematics (VT) for some of motives for greater than a decade. Pay as You Drive (PAYD), additionally referred to as User-Based Driving Insurance (UBI), is the maximum extensively utilised coverage technique via way of means of car coverage companies worldwide. Users' cars are equipped with on-board devices that seize riding statistics whilst they're at the avenue. Installing such gadgets is turning into vital in numerous countries. This nation understanding is finished to discover riding behaviour and avenue abnormalities withinside the United States. The availability of such records gives up new regions for study. In practise, numerous forms of WIM

resolutions are hired, every with its very own set of benefits and disadvantages. Machine learning (ML) techniques are regularly hired in Intelligent Transportation Systems (ITS) and its applications. A brand-new WIM device for VT and navy use is withinside the works. The element that follows discusses the to be had WIM systems, the talents of American nation statistics, and the navy. The subsequent phase discusses the problems with prototype layout and the answers that have been implemented. Several alternatives have been studied so that it will create a advanced regression ML model. The prototypedevice is then evaluated in assessment to different WIM systems.

#### **1.4 Problem Statement**

The statement of vision-based vehicle identification and analysis can help describe the problem. This study focuses on the question of whether a vehicle can have the number plate detection utilizing the database control, on the other hand, compares the database with the obtained picture to see if they are similar or not. It falls under the category of image processing since the input is a picture, and the output is a text continuous.

#### **1.5 Vehicle Detection Research**

The modern city transportation system is typically overcrowded, and separating freight transport from private cars and public transportation flows is a common practice to alleviate traffic congestion in urban areas. During rush hour in Riga, for example, there are restrictions on freight transport movement in the city centre and across the Daugava River bridges. Many technical structures, such as bridges, are extremely sensitive to vehicle weight. The proposed solution will allow for the automatic detection of vehicles that do not adhere to weight restrictions when crossing bridges. It will make the job of a transportation police officer easier, and it will improve the reliability of transportation construction.

It will be critical for future IoT-based ITS development to collect as much real data about vehicles as possible in order to organise the transportation flow system more effectively. This article is about sensor development for collecting weight data. Data obtained are utilised as the foundation for modelling. At least four system parts must be combined: sensing technologies, data transfer, traffic flow simulation, and decision making. Weight sensor development and testing have already been completed in the laboratory. Furthermore, several additional services, such as weight control systems, could be incorporated to the system. It would be feasible to provide a thorough concept of the online traffic control system using real data.

#### **1.6 Significance of The Work**

In most cases, the data storage and processing unit also provides power to the system from a power supply connected to external AC or DC batteries. User communication unit the user communication unit connects the CPU unit, the data storage unit and the user interface. The communications link can be connected directly to a personal computer on site or remotely via a wired or wireless modem link to operate the systems. The acquisition of movement forces is based on minimizing the differences between measured and theoretically calculated deformations. Because the measured strain reflects the sum of all axle forces on the bridge, it is impossible to differentiate the contribution of each axle.

# 2. Related Works

The purpose of the literature survey is to obtain a clear understanding of the existing problem in the particular area of the domain. By clearly understanding all the previous development and their works will provide the best way to obtain the perfect problem statement existing in the present condition. The following section summarizes the history of those works which are done previously, highlighting the strengths and weaknesses of each method. Various authentication methods were proposed and reviewed here.

- 1. Image Processing
- 2. Vehicle Flow Detection
- 3. Vehicle Detection

Several methods for vehicle recognition in authentication systems and speed computation schemes have been proposed in the literature survey.

#### 2.1 Need of Image Processing

Image processing is commonly perceived as incorrect image manipulation in order to achieve a degree of beauty or to promote a popular reality. Image processing, on the other hand, is best defined as a method of converting between a human seeing system and digital imaging technology. Human eyesight does not interpret the environment in the same way that digital cameras do, because digital cameras have more sound effects and bandwidth. Significant differences between human and digital detectors, as well as specific processing procedures to aid translation, will be discussed. In order for others to duplicate and confirm human results, image modification should be approached scientifically. Documenting and reporting on processing actions is part of this, as is applying the same procedure to relevant control images.

#### 2.2 Processing Color Image

The human visual framework, which can recognize countless various varieties and variety powers, can perceive around 100 shades of dark. Subsequently, the shade of a picture can contain an abundance of extra data that can be utilized to help picture investigation, e.g., B. Object recognition and extraction in light of variety. Each tone is distinguished by three unique sizes. The not set in stone by the prevailing frequency. The figure shows that apparent varieties happen in the electromagnetic range between 400 nm (violet) and 700 nm (red).



Fig 1: The visible spectrum.

The virtue of the excitation decides the immersion, which is relative to how much white light joined with the variety. An unadulterated variety is completely immersed, meaning it contains no white light. The tone and immersion of a variety decide its chromaticity. At long last, not entirely set in stone by how much light, with all the more light comparing to additional extraordinary varieties [21].

Colorless light needs tone and exclusively has sum or power. The power of dim level is estimated. It is an actual amount since force is represented by energy. Splendor, then, not entirely set in stone by variety discernment and is hence mental. At the point when blue and green are both similarly splendid, the blue is viewed as a lot hazier than the green. It's likewise worth focusing on that human view of power is nonlinear, with standardized force changes going from 0.1 to 0.11 and 0.5 to 0.55 seen as equivalent changes in brilliance [2].

Variety is resolved generally by an item's reflectance characteristics. We see the reflected beams, while others are consumed However, the shade of the light source should be considered as well as the idea of the human visual framework. For instance, an article that reflects both red and green light seems green when no red light is gleaming on it, and red when no green light is radiating on it. In unadulterated white light it seems yellow (= red + green).

#### **2.3 Vehicle Flow Detection**

One of the most significant technologies inside the site visitors tracking system is vehicle-go with drift detection and monitoring through virtual image. First, we utilized the Gaussian combination distribution approach to cast off the influence of transferring cars on this text, and then we produced the historical past images for automobile drift. By combining the advantages of the historical past distinction set of rules with the inter body distinction operator, real-time historical past is segmented integrally and dynamically up to date suitably by matching the reconstructed image with current historical past. To ensure the reliability of automobile recognition, 3 through 3 window templates are send to eliminate the distant noise area inside the picture of car shape. The structural information of the template is used to do some graphical morphological filtering. As a result, the corrosion and expansion units may be found. The Kalman filtering version is utilised to realise the monitoring of fast transferring vehicles in order to narrow the target seek scope and improve the calculation pace and precision of the set of rules. The approach has suitable real-time and trustworthy performance, according to the results of the experiments [7].

# **3.Proposed Work**

The YOLO algorithm is the approach used in the proposed real-time vehicle detection system. The architecture of the YOLO algorithm essentially consists of three levels. The remainder block, the detection layer and the upper sampling layer are the three. YOLO v3 can predicts three different scales. the recognition layer identifies feature maps at 32, 16, and 8 pixel increments. This includes recognition at 13 x 13, 26 x 26, and 52 x 52 scales with an input of 416 x 416. The network scans the input image until it reaches the first

level of recognition, at which point it steps the features of that level capture an image 32 to perform recognition. Layers are also sampled by a factor of two before being concatenated with feature maps of the same size from a previous layer. layer 16 is used to perform a new recognition on the layer. The same upsampling technique is repeated, followed by a final detection at stride layer 8. Based on three anchors given, each cell predicts three bounding boxes on each scale, for a total of nine anchors. (The anchors change depending on the scale.) improves the identification of tiny objects, which was a common problem with previous versions of YOLO, according to YOLO researchers. Oversampling improves network learning of fine-grained features, which is critical for detecting tiny objects.



Figure 2: Architecture of YOLO

#### 3.1 General Framework of The Proposed System

Our proposed system process's main aim was detecting the vehicle, scan the licence plate, and identify the vehicle model and details.



Figure 3: Proposed system design for vehicle detection

#### **3.2 ImageCapturing**

A media communications framework (for instance, a modem and a phone line that sends picture/video groupings to the picture handling framework and ) and a picture handling framework (for instance, a side of the road mounted camcorder gathering continuous pictures/video floods of checked traffic, and) (e.g., a PC handling outlines from a video clasp to remove traffic information).



Figure 4: Image Capturing

#### **3.3 Vehicle Detection**

Moving vehicles are recognized using video assessment. Three fundamental development division approaches are frame contrast, entropy shroud, and optical stream strategy, which may be used in a grouping of purposes, for instance, video perception, traffic checking, and people following. Yet the packaging contrast approach has a lower figuring multifaceted nature and is easy to use, it a large part of the time forgets to get the entire systems of various types of moving vehicles. The constant edge and the reference profile are utilized in the broadly useful establishment allowance. A moving vehicle is described as a differentiation between the continuous edge and the reference frame that is more noticeable than the breaking point. The optical stream method can perceive a moving vehicle regardless, when the camera is moving, but it is progressively sluggish leaned to upheaval. Since the development area in certifiable pictures is usually clearly, optical stream appraisal requires just area taking care of. Thusly, the optical stream approach is unequipped for recognizing the specific math of a moving vehicle. Considering the recently referenced computations, it is evident that normal moving vehicle ID structures have basic limitations.

- 1. The exact shape of a moving vehicle cannot be detected using frame difference.
- 2. The optical flow approach is noise-sensitive.

#### **3.4 Number Plate Extraction**

To remove number plate characters from a vehicle photo. The identification method is done in advances. The even and vertical edge location approaches are utilized to start the number plate extraction process. These procedures depend on the elements of the edge introduced by the edges of the characters on the vehicle's number plate. Coming up next is a portrayal of the method for removing number plates from an entire picture.

1.Peruse the photograph of the vehicle as the info picture (I) and yield it to the legitimate aspects (IC).

2.Use morphological cycles like conclusion in mix with the suitable organizing component.

3.By naming associated parts in it, you can get the contrast between I-Ic and track

down all possibility for Number Plates. Measure properties like region, significant part presents length, and region >70 in the picture above.

4.Utilizing the Closing and Distension Process, select competitors whose Major Axis Length is bigger than and eliminate objects that won't ever have number plate.

5.Crop and show the biggest associated part as a number plate.



Figure 5: Number plate Extraction

#### 3.5 Number Plate Localization

Any ANPR system is designed on the detection or location of the number plate of the vehicle pictures. This study presents a valid justification for detecting number plates in a number of contexts. There are two phases: first the input image is pre-processed and then the localization is performed.

#### **3.6 Character Recognition**

i. Standardization is the most common way of refining characters into a block with no extra blank areas (pixels) on every one of the four sides. From that point forward, each character is scaled to a similar size. Layout matching requires the utilization of fitting methods. The information photographs should be a similar size as the data set characters to contrast the characters and the data set. A suitable calculation for character acknowledgment is layout coordinating. The image of the person is contrasted with those in the data set, and the best closeness is determined. A connection work is utilized to quantify comparability and select the best match.

- ii. Take segmented characters picture as input from the previous stage and load a database of letters and digits as templates (0-9, A-Z).
- iii. Compare the similarity of segmented characters and template characters with all of the loaded templates using the correlation tool.
- iv. Correlation coefficients will be the output of the above function, and the greatest value correlation coefficient for the matching template will be found.
- v. For ease of use, provide each template a unique identity, and the matching template is recognised as a recognised character.
- vi. Repeat the procedures above for the other characters, and the GUI will show the detected character as a number plate.

#### **3.7 Bounding Box Prediction**

Just go for it predicts four directions for each jumping box: tx, ty, tw, and th the focal point of the bouncing box predicts four directions for each bouncing box: tx, ty, tw, and th. The focal point of the bouncing box predicts four directions for each jumping box: tx, ty, tw, and th. The focal point of the jumping box arranges is tx and ty comparative with the lattice cell's middle, while the shape, width, and level are tw and th, individually. The last jumping box forecast outcome should be refined utilizing the formula below:

$$b_x = \sigma(t_x) + c_x$$
  

$$b_y = \sigma(t_y) + c_y$$
  

$$b_w = p_w e^{t_w}$$
  

$$b_h = p_h e^{t_h}$$

Figure 6: Bounding box prediction formulas

The width and height of the anchor are represented by pw and ph., respectively. This transition is depicted in further depth.

The YOLO method generates bounding boxes in the manner of (bx, by, bw, bh). The box coordinates are bx and by, and the box shape is bwand bh (width and height). To generate boxes, we generally use the top-left coordinate (x1, y1) and the box shape (width and height).

# 4. METHODOLOGY

The proposed system comes up with the complete implementation of the recommended system and the YOLO algorithm using deep learning. It recommends the YOLO algorithm having the object detection for pre-training of detects only the license plates. For each product review we are using the digital image processing for every frame. This recommendation system works for a new user in an RTO holder. A user with some search/purchase using YOLO algorithm and also for the users in a comparing with CNN algorithm clustering of product description.

#### 4.1 Flow of Execution

- 1. Reading the dataset
- 2. Number plate recognition
- 3. Analysis of number plate

#### 4.2 Number Plate Identification

A framework utilizes optical person acknowledgment on photos to peruse vehicle enrollment plates and give vehicle area information. can be utilized to save camera pictures as well as text from tags, for certain renditions likewise putting away a driver's representation This task achieves tag acknowledgment in three stages: picture catch, vehicle identification, and area and vehicle type discovery. Following these three cycles, the tag is perceived for the one of a kind vehicle and conveys vehicle data. Accordingly, consensus and expectation are poor. The model will be underfit assuming that there are too couple of textual styles, bringing about unfortunate expectation. Moreover, in light of the fact that information was scant, Complex models, for example, Gradient Boosting, overfit the information, bringing about wrong gauges. Accordingly, more straightforward models like K-Neighbors appeared to do competently.

#### Analysis Of Number Plate

The state or union territory in which the car was registered is indicated by the first two letters of the number plate. If the car was registered in Maharashtra, for example, the first two letters of the vehicle number plate will be 'MH. 'The district in which the car was registered is indicated by the next two numbers after the first two alphabets.

Each region is given a unique sequential number. The third portion of the number plate is distinctive and aids in vehicle identification. If there isn't a unique number remaining to assign, the last digit is replaced with an alphabet. The number plate concludes with an oval emblem that reads 'IND,' indicating that the car was registered in India.

#### 4.3 Training Model of Yolo

The model was prepared utilizing the K Nearest Neighbors (KNN) approach. Numerous different models were tried, including Decision Tree and Gradient Boosting, however K Neighbors outscored them all. To find the best potential A randomized inquiry was utilized to track down the model's hyper boundaries. Randomized search is a kind of upgraded boundary clear or lattice search that plays out a thorough pursuit inside a physically characterized space of hyper-boundaries connected with the learning calculation. Lattice search is directed by execution pointers like preparation set crossapproval and approval set assessment. The boundary space for framework and randomized look is something very similar. The boundary values are tantamount, yet the run-time for randomized search is essentially longer.

With regards to 'separate' weight, closer focuses are given more weight, while farther focuses are given less weight. The model, the randomized search is taken care of a rundown of hyper boundaries had a go at during preparing, as well as a rundown of hyper boundaries had a go at during preparing. For this task, a few qualities for the boundaries 'K' and 'weight' were researched, and it was found that when K = 4, weight = distance, the calculation performed better during the acknowledgment stage. Numerous typefaces that seem to be exemplary Number Plate text styles were utilized to prepare the model. Prior to saving, the person is resized to a standard 20x30 pixel size.

4.3.1 Clustering and Image Segmentation

The process of dividing a single image into many fragments is known as image segmentation. This is commonly used in digital images to identify objects or other relevant information. Image segmentation can be accomplished in a variety of ways, as shown below:

- Thresholding methods like Otsu's
- A type of segmentation is color-coded K-means clustering. Texture techniques such as
  - Texture filters are available, as are transform methods such as watershed

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segmentation. An efficient method for doing image segmentation is to use algorithms, tools, and a complete environment for data analysis, visualization, and algorithm development.

# 4.3.2 Clustering Image

Grouping and order are procedures for portraying visual data at an undeniable level. The objective is to find a document picture characterization (bunching) that gives generally a similar data about the picture chronicle as the whole picture set assortment. The classes made give a straightforward summation and portrayal of the picture content, which can be utilized for an assortment of picture data set administration errands.

Picture grouping empowers the improvement of effective recovery calculations as well as an easy to use data set interface. The accompanying issues are regularly tended to by picture grouping strategies:

- Image characteristics how the image is displayed.
- Data organisation feature How to organise the data.
- Classifier the process of categorising images into groups.

4.3.3 Global Thresholding Method

The picture histogram is utilized in the worldwide thresholding strategy. The picture histogram is a factual diagram that shows the quantity of pixels for each grayscale on the y-pivot and the grayscale esteem on the x-hub. The picture histogram can be utilized to compute the worth of the limit to be used while changing over a grayscale picture to a twofold picture naturally. The fundamental thought is to decide the convergence of the closer view and foundation pixel values. On the off chance that a pixel's force level is lower than the limit, it is gone to dark (grayscale = 0), in any case it is set to white (grayscale = 255). The limit fills in as a boundary line.

#### 4.4 Filtering Images Using OpenCV

Images, unlike textual data, can be utilized to extract a variety of features. These elements highlight the image's qualities. We may utilize these features to blur, sharpen, and extract edges from images, among other things. We shall use the concept of convolution to do this task. Convolution is the process of applying the kernel to each pixel in a picture. Kernel? A kernel is a tiny matrix made up of numbers that usually add up to one. We can extract numerous features from an image depending on the kernel values.

In this task, we will simply blur an image with convolutions. For our task, we will use the filter (kernel) listed below. This kernel is sometimes referred to as an averaging filter. It averages the surrounding pixels and assigns the value to the centre pixel, as the name implies. You can also use a different set of variables; just make sure that they all add up to 1.

After reading the image, we'll generate our kernel and turn it into a NumPy array. Then we'll invoke the cv2.filter2d() function, which will accept the input picture, depth, and kernel. That's the end of it. We can simply display our findings.

#### 4.5 OCR

OCR, or Optical Character Recognition, is a groundbreaking technology in today's digital age. OCR is a comprehensive procedure in which images/documents present in a

digital environment are processed and the text extracted as conventional editable text.

4.5.1 Purpose of OCR

OCR is a technique that converts scanned paper documents, PDF files, or digital camera pictures into editable and searchable data.

4.5.2 Execution Steps

Step 1: Load cv2.imread

Step 2: Convert the colour image to grey colour image

Step 3: Grey image to grey scale image

Step 4: Implimize the grey scale

Step 5: Detect the licence plate only

Step 6: Licence plate grey scale image to colour image

Step7: Colour image converter to improved colour image

Step 8: Image to text conversation

4.5.3 Stop Images

The image analysis it can be recognized only licence plate other than those images are neglected due to the reason of neglecting the below following list:Books, buses, cars, cycles, vegetables, fruits, etc.

# **5. RESULTS AND DISCUSSIONS**

In a software system, the performance analysis is calculated using two factors: Time Complexity and Space Complexity. Software performance analysis examines how certain software performs on a regular basis and documents what leads to delays performance and creates problems now and in the future. Performance concerns aren't usually embedded into software in such a way that they can be easily detected during the Quality Analysis phase. Many companies will do software performance study at random, but this is insufficient. Because faults aren't always obvious, performance must be regularly examined for issues. Catching anything early (possibly even before the end-user is harmed) can save a lot of time and effort. The performance analysis is the tool that informs the developer about the system's quality.

#### 5.1 Steps with Images

imgOriginalScene



# 6. CONCLUSION AND FUTURE ENHANCEMENT

This paper "Number plate detection using deep learning having the yolo with openCV" is cost-effective, eco-friendly, practical and the safest way to identify number plates by its openCV structure accurately You might wish to look at camera photos connected with Plate Analysis records to make that a VRM has been appropriately interpreted or that a vehicle meets its description. Images can be saved as part of an record and seen by

displaying the record as normal. However, because the ALPR process might collect a significant number of photos, your system administrator may decide to save these images in an external ALPR system rather than loading them into the database. In which analysis data has been permitted with an access of the transportation department, we have usage the Demo data set. So that, it has been working with a best accuracy. while with the taken part of Time complexity and Space complexity has the shows the best results.

This paper mainly focuses on identifying the number plate using the image analysis by deep learning. The latest improved algorithms are being used to develop the accuracy rate. In the future work of this research, more efficient methods can be used and add on the live image extraction from the cc camera on it. With an add on the image can be taken from the Video by the motion capturing provide the details of the theft analysis & details of the exact rate.

#### **6.1 Limitations**

1. CNN may recognize the wrong thing or misidentify a non-object as an object, resulting in an incorrect total number of cars.

2. The detection line was utilized to determine the vehicle's direction of motion and classify it for counting depending on the direction of the tracking trajectory.

3. In these public locations, it is required to detect and monitor abnormally behaving cars, as well as to send data to a cloud platform for storage and later analysis by IoT becomes tough.

4. The movement speed of pixels of moving objects in a grayscale picture is referred to as optical flow.

5. RCNN works based on the CNN conditions which can be worked on in the preamble.

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