IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

Vehicle Safety Belt Detection & Plate Number Recognition using Machine Learning

Dr. Uma Rani V, Sayedahmad Seyar Sawayz

Associate Professor of Computer Science and Engineering, MTech Student
School of Information Technology,
Jawaharlal Nehru Technological University, Hyderabad, Indian

Abstract: According to WHO, more than 1.35 million deaths occur each year in vehicle accidents, but they would have a 40-50% probability of survival if they used seat belts properly. So, ensuring that seat belts are worn by every driver is a vital component of active safety measures. Many nations, including India, make it illegal for drivers to drive without wearing a seat belt otherwise the drivers will be given an appropriate punishment. But currently check of this behavior is completely done manually, which not only increases the burden on the police but also has low efficiency, especially if there are a big number of vehicles traveling at a high rate. The main goal behind this research determines whether the seat belts in the vehicle are belted or unbelted. First, the driver area is located based on the vehicle outline. Then the potential seat belt edges are detected by an effective algorithm Hough Transform, and the result is finally obtained by further verification of the edges. After the detection of the seat belt if the seat belt has not been detected then the model will go for plate recognition. The area of the number plate is determined using automatic number plate recognition (ALPR). Therefore, we propose an approach that can detect the seat belt automatically in the images taken by the camera and recognize the plate number of the vehicle.

Index Terms **-** Vehicle Seat Belt Detection, Plate Number Recognition, Machine Learning, Safety belt detection and license plate recognition

1. INTRODUCTION

As per the National Highway Traffic Safety Administration (NHTSA) reports, unbelted passenger vehicle drivers caused 9,385 fatalities on US highways in 2014. 63,000 lives were saved in car crashes between 2010 and 2014 following the adoption of a seat belt restraint device. Drivers or passengers in a vehicle could become projectiles during an accident. If the belt is unbuckled the passengers can very easily be ejected resulting in death and statistics showed that using a belt could give a surviving probability 44% more. Only a little amount of work has been put into seat belt detection research so far. In this paper, an approach of seat belt detection and plate number recognition for monitoring images is proposed which has three main procedures. The first one is to obtain the boundary of driver area. The second step is to detect the seat belt's edges. The study of edge detection has taken a lot of time and effort. On this foundation, an approach for color edge identification based on the direction information measure in the HSV color space is refined, allowing for the detection of probable seat belt edges. Some regions are extracted based on the potential edges as candidate regions and projected by following Sobel operator and the third procedure is to detect and extract the number plate. Automatic number plate recognition (ANPR) can be used to accurately and efficiently store and process licence plate photos recorded by cameras. In ALPR, we can use a variety of strategies depending on the situation, such as picture quality, fixed car placements, and multiple plate extraction. The ever-increasing vehicle count in our roads have hindered the smooth flow of traffic. It finds great use in managing real-life applications such as border control, parking, motorway road tolling, journey time measurement, access control, road traffic monitoring etc. A vehicle in a country is distinguishably identified by a unique alphanumeric number, which will be depicted on its license plate. Systems commonly use cameras to take the picture. Due to a change or a distinct form in color, texture size, shape, and position of plate regions in such images the localization of plate regions is a challenging task. ANPR system completes the entire process passing through different stages. The stage is based on some features of the captured image to extract the license plate from the image. In the next stage by projecting their color information we can segment the license plate. After those characters are extracted. Finally, recognition using template matching is done.

With technological advancements, increased vehicular traffic on roadways produces a significant demand for traffic management and monitoring. Nowadays, computers use machine learning and image processing to monitor traffic. It saves manpower while also doing difficult tasks such as highway vehicle counts, parking infraction alerts, database administration, blacklisted and stolen car notifications, and so on. Vehicle and transportation management are time-consuming and difficult chores. If everything is done by hand, there will be a lot of mistakes and challenges. As a result, a recognition system for automatic detection of vehicle number plates is Rrequired. In recent years computer vision technology has made great strides in dealing directly with real world problems. As a result, we might anticipate a new era of machine vision applications. The goal is to investigate current issues in machine vision applications and encourage information exchange in highly effective and practical machine vision approaches.

2. LITERATURE REVIEWS

Every year, about 1.2 million people die on the world's roadways, with another 20 to 50 million suffering non-fatal injuries. The global epidemic of traffic-related injuries is rapidly increasing over the world. In the previous five years, the majority of countries have embraced the World report on road traffic injury prevention principles, which provide direction on how countries may apply a comprehensive approach to enhancing road safety and lowering the death toll on their roads. However, to far, no global road safety review has been done to determine the extent to which this strategy is being used. Based on data from a standardized survey completed in 2008, this study is the first comprehensive assessment of the situation of road safety in 178 nations. The findings serve as a benchmark for countries to compare their road safety performance to that of other countries, while the statistics supplied can be used as a worldwide "baseline" against which progress over time can be compared. A number of noteworthy conclusions are included in the Global Status Report: t -PX JODPNF BOE NJEEMFJODPNF nations have greater road traffic fatality rates than high-income countries (21.5 and 19.5 per 100 000 population, respectively) (10.3 per 100 000). Low- and middle-income countries account for almost 90% of all road fatalities, despite having only 48% of all registered autos on the planet [1].

Based on image analysis, the invention proposes a vehicle safety belt detection method and apparatus. The image analysis field of intelligent transportation is used to apply the vehicle safety belt detection method and devices premised on image analysis. The position of a safety belt is first identified using a line segment detection method; the safety belt is then correctly positioned based on the angle and length of the line segment. The image-based vehicle safety belt detection method and gadget can store information about vehicles with unbelted passengers and give sufficient, reliable, and rigorous evidence for detecting the traffic offence of not fastening the safety belt [2].

One of the most crucial links in the license plate identification process is the placement of the plate. The recognition and effects in the latter phase are directly determined by whether the plate localization is successful and how exact it is. We have proposed an algorithm for the license plate localization based on density and projection for the license plate area has a significant density difference in the difference image. The findings suggest that this approach can locate the license plate region fast and accurately [3].

3. METHODOLOGY

Architecture of proposed system is shown in the figure 1. The two main steps for algorithm are divided into: Seat belt detection & Plate Number Recognition. In first Step the system detects the driver if face is detected then it will enter the Seat belt detection module, securing band detection module detects two parallel oblique lines immediately below the face using the Hough Transform Algorithm, and two oblique lines are connected with the window edge. If detected, then the driver has worn a securing band, otherwise does not have a safety belt and system will trigger second steps where it will detect the number plate.

In Number Plate Recognition there are two main steps Segmentation and Recognitions of the Numbers. In segmentation stage, we use various filters, morphological operations, contour algorithms, and extract the region of image that contains the plate. In Number Recognition stage in order to recognize the segmented characters efficiently we use the Convolutional Neural Network CNN. Furthermore, steps are described as follow:

3.1 PRE-PROCESSING

In any Machine Learning project majority of time is spending in Dataset cleaning because when we are downloading images from internet or we get any dataset might have many issues and we need to clean our data. A few pre-processing steps to perform before defining the location of the license plate and driver detection. These pre-processing steps are contrast enhancement and noise filtering in which help enhance the contrast of the uploaded image and also reduce the noise background, respectively.

These issues can but be identified as existing of noise in the images, deleting of blank images and unnecessary images. It can be done manually and automatically using OpenCV library in python. So, when we are having the images and if the images are Visible and clear we will use those images to train our model otherwise we will discard it.

3.2 SEAT BELT DETECTION AND PLATE RECOGNITION

Grayscale: RGB to Gray Conversion: Important edges and other elements cannot be identified in a colour image. Because processing an RGB image is difficult and time-consuming, we must first convert a coloured image to a grayscale image.

Image Binarization: For image binarization, the grayscale image is converted to a binary image based on the known Otsu method. (The Otsu method produces a single intensity threshold that divides pixels into foreground and background classes.) This feature allows the system to take the input image and turn it into binary format which contain only white and black the reason for binarization is to ease the system to recognize and differentiate the image's foreground and background. A threshold value is pre-defined to tell the system to change the pixel to white color if the pixel value is lower than the limit value and vice versa.

Sobel filter: Sobel filter, is used in image processing, particularly used for edge detection algorithms where it creates an image emphasizing edges. When we apply this mask on the image it prominent vertical edges. It simply calculates the difference of pixel intensities in an edge region, similar to a first order derivate. Because the value of the centre column is zero, it does not contain the image's original values; instead, it calculates the difference between the right and left pixel values around that edge. In addition, the first and third column's centre values are 2 and -2, respectively. This gives the pixel values at the edge of the screen additional weight. The edge intensity is increased, and the image is boosted in comparison to the original.

Hough Transform Algorithm: The Hough Transform (HT) is a robust method for finding lines in images. The Hough transform is a technique for separating characteristics of a specific shape inside a picture. The Hough transform is most typically used to detect regular curves like lines, circles, ellipses, and so on. However, this method has undergone numerous advancements over the years, allowing it to detect various shapes such as circles, triangles, and even quadrilaterals of specified shapes.

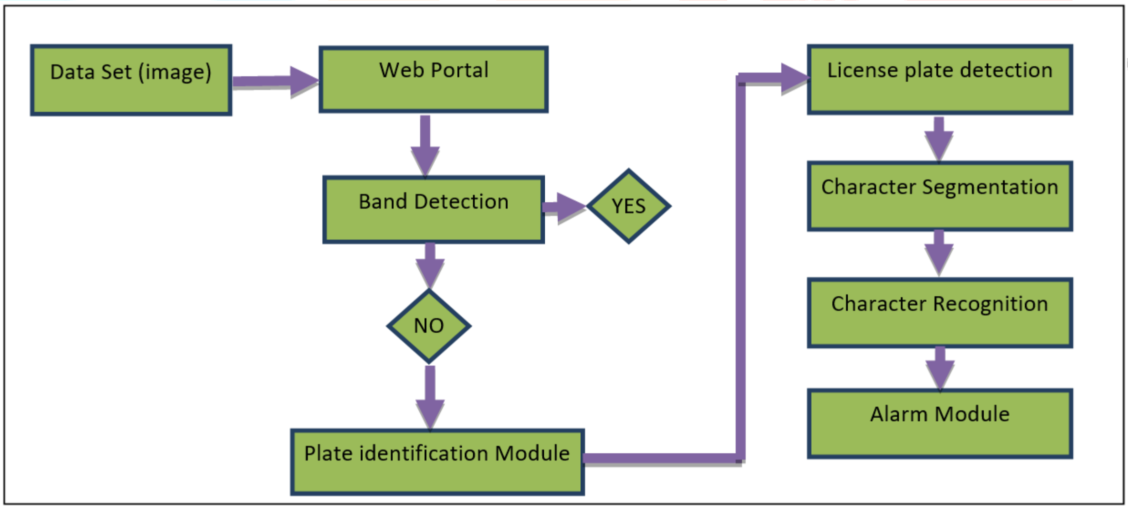

Fig 1: System Architecture

3.3 CONVOLUTIONAL NEURAL NETWORK (CNN)

In order to detect the Vehicle seat belt and recognize the number plate efficiently, we used artificial neural network training to train our system over a dataset. After this training, we used the same neural model to detect the seat belt and recognize the characters in number plate. We used a CNN with 2 convolution layers at the beginning and 2 fully connected layers at the end with 10 epochs to get high accuracy. We used a dataset to train the CNN. The dataset consists of 200 sample images for each of the 100 with seat belt and 100 of non-seat belt. Out of the 200 samples, we used the first 180 samples as training data and remaining 20 samples as test data. We first trained the model with the number of training steps followed by testing. We used TensorFlow to train and test our model. The result shows that the method gets 97.3% correct detection rate shown in [fig 3] by rejecting 3.7% test samples. Compared with the traditional methods based on image processing, the proposed method has higher correct detection rate.

```
Model: "sequential_1"
_________________________________________________________________
Layer (type)                 Output Shape              Param #
=================================================================
conv2d_1 (Conv2D)            (None, 62, 62, 32)        896
_________________________________________________________________
max_pooling2d_1 (MaxPooling2 (None, 31, 31, 32)        0
_________________________________________________________________
conv2d_2 (Conv2D)            (None, 29, 29, 32)        9248
_________________________________________________________________
max_pooling2d_2 (MaxPooling2 (None, 14, 14, 32)        0
_________________________________________________________________
flatten_1 (Flatten)          (None, 6272)              0
_________________________________________________________________
dense_1 (Dense)              (None, 256)               1605888
_________________________________________________________________
dense_2 (Dense)              (None, 2)                 514
=================================================================
Total params: 1,616,546
Trainable params: 1,616,546
Non-trainable params: 0
```

Fig 2: Model Training Result

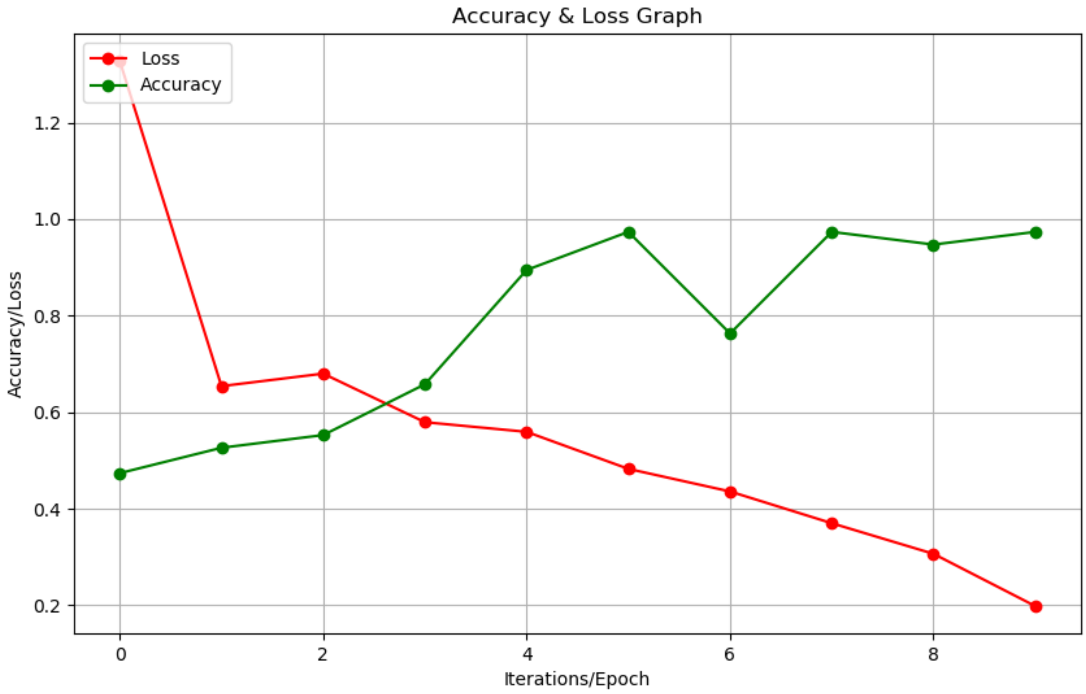

Fig 3: Accuracy and Loss Graph

In above graph red line refers to loss and green line refers to accuracy and x-axis represents epoch and y-axis represents accuracy and loss and when epoch increases then accuracy get better and loss get reduce.

4. Experimental Results

The proposed technique is evaluated on two hundred real world images captured under the conditions including various illumination and weather. There are hundred images having seat belt and others not.

A. Dataset:

Proposed Vehicle Seat Belt Detection and Number plate recognition system was tested on a number of images. Each image is of different length and also the environment conditions. Dataset contains license plates from India.

B. Output:

This method successfully detected and recognized license plates from India. The proposed system is fast, efficient and cost-effective, where it can detect the seat belt and recognize the number plate within 5 seconds of time The final output shown in figure 4, 5 and 6.

Fig

Fig 5: No Car Belt Detected

Fig 6: Number plate Recognition

5.Conclusion and Future Work

Wearing a seat belt is such an effective active safety strategy that it deserves more attention. In this project, seat belt detection, and number plate recognition based on images is proposed. Current Car license recognition is applied very extensively in traffic offense detects and is subject to greater attention. After adding securing band detection, effectively can catch the state whether the driver fastens the safety belt. Particularly after the driver being detected, then detect whether closing of the safety belt, improves the accuracy of detection. the proposed System detects seat belt fastness and recognize the plate number in different environmental conditions. Also, the used image processing techniques gave the model points against lightning changes. These results may provide practical insights into future researches and industrial development.

Although we can see that so many algorithms have been implemented in various previous projects, in order to make a robust system for car belt detection and number plate recognition, there are still many loop holes left in the system which can be filled in order to make the system more future-proof and reliable. Our project however works on the images that does not have sun reflections and are high quality for detecting the seat belt and the number plate recognition works on the simple font styles which is being used normally on license plates of the cars as per the rules made by the governing bodies of traffic department. But in order to handle the cases where people don’t follow these rules, it can be handled in future projects being implemented in this field of license plate recognition furthermore the project can be explored by detecting the seat belt from video by applying advanced image processing and machine learning algorithms.

6. References

1. World Health Organization, "Global Status Report on Road Safety: Time for Action," Geneva, WHO, pp. 1-3, 2009.
2. U LEVY, "Seat belt detection system for vehicle," USA, US2007195990-A1[P], 23 Aug, 2007.
3. J. R. Su and Z. Ma, "Car License Plate Location Based on the Density and Projection," International Conference on Computational Intelligence and Natural Computing(CINC), pp. 409-412, Wuhan, China,6-7 June, 2009.
4. T. Zhang, X. H. Luo and X. J. Zhu, "License plate location based on singular value feature," 3rd IEEE International Conference on Computer Science and Information Technology (ICCSIT), pp. 283-287, Chengdu,
5. Mayasari, N. & Siahaan, A.P.U., "Vehicle Plate Recognition using Template Matching, "International Journal for Innovative Research in Multidisciplinary Field, vol. 4, No. 10, pp. 259-263, Oct. 2018.
6. Koo, K. et al., "Character Segmentation and Recognition Algorithm of Text Region in Steel images, "Proceedings of the 8th WSEAS International Conference on Signal Processing, Robotics and Automation, Pohang, Korea, 2009, pp 293-298.
7. B. Chen, W. L. Cao and H. C. Zhang, "An efficient algorithm on vehicle license plate location," IEEE International Conference on Automation and Logistics(ICAL), pp. 1386-1389, Qingdao, China, 1-3 September, 2008.
8. F. Russo and A. Lazzari, "Color Edge Detection in Presence of Gaussian Noise Using Nonlinear Prefiltering," IEEE Transactions on Instrumentation and Measurement, Vol. 54, No. 1, pp. 352-358, February 2005.
9. S. Agaian and A. Almuntashri, "Noise-Resilient Edge Detection Algorithm for Brain MRI Images,' 31st Annual International Conference of the IEEE EMBS Minneapolis, pp. 3689-3692, Minnesota,USA, 2-6 September, 2009.
10. G. K. Srivastava, R. Verma, R. Mahrishi and S. Rajesh, "A Novel Wavelet Edge Detection Algorithm for Noisy Images," ICUMT '09. International Conference on Ultra-Modern Telecommunications & Workshops, pp. 1-8, St. Petersburg, USA, 12-14 Oct, 2009.
11. X. K. Sun and G. Sun, "A New Noise-resistant Algorithm for Edge Detection," 2010 Second International Workshop on Education Technology and Computer Science (ETCS), pp. 47-50, Wuhan, China, 6-7 March, 2010.
12. L. Q. Niu and W. J. Li, "Color Edge Detection Based on Direction Information Measure," The Sixth World Congress on Intelligent Control and Automation(WCICA), pp. 9533-9536, Dalian, China, 21-23 October,2006