METHOD FOR TRAFFIC ACCIDENT SEVERITY PREDICTION

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Abstract **— A high accident risk prediction model is built in this work to examine methods for Traffic Accident severity prediction and identify priority intersections for improvement. A traffic accident database was compiled and examined, and a junction accident risk prediction model based on it was developed. different methods were created to predict the possible high accident risk Using Gaussian Blur, Otsu's thresholding, and Character segmentation algorithm. Image Processing was used to develop an accident risk prediction model. This model can also identify the key factors that affect the occurrence of high-risk intersections. The ability to predict the risk of traffic accidents is important in the prevention of the occurrence of accidents and to reduce the damages caused by accidents proactively. This paper introduces a new way of method for Traffic Accident severity prediction Using the same environmental characteristics as high-risk intersections for model inputs for estimating the level of danger that may occur in the future, which can be utilized to prevent future traffic accidents. The main issue of this paper is to make the probability of a road accident and warn the user based on the predicted risk. The risk is calculated based on challans that are registered with the vehicles.**

***Index Terms*— image processing,risk prediction, traffic accident intersection,challans.**

I.INTRODUCTION

In the past, traffic accident management and subsequent improvements relied mostly on the post-hoc analysis of traffic accidents and surveys of intersections that are prone to accidents.

To effectively reduce accident risk, in recent years traffic accident management agencies in countries around the world have not only established standards and operating procedures for road surveys but have also sought to develop accident risk analysis and prediction

methods. The hope was that longitudinal accident data would be used to identify and rank high-risk intersections, allowing for efficient prioritization of scarce resources to minimize the frequency and severity of traffic accidents.With only 1 percent of the world's vehicles, India accounts for 11 percent of global deaths inputs for estimating the level of danger that may occur in the future, which can be utilized to prevent future traffic accidentsEvery year, 4.5 lakh people are killed in traffic accidents, with 1.5 lakh people dying. There are many reasons for the occurrence of a road accident like overspeeding, drunken driving, distractions to driver, red light jumping, avoiding safety gears like seat belts and helmets, non-adherence to lane driving, and overtaking in the wrong manner. Even Though the government is taking many actions to avoid road accidents, they are still out of control, so it is our responsibility to be careful while driving.

The proposed traffific accident risk prediction model is based on the environmental factors of intersections, applying techniques such as Gaussian Blur, Otsu's thres holding, and Character segmentation algorithm.Image Processing were used to develop an accident risk prediction model.In

practical applications, our proposed model can be used to predict the probability (risk) of accidents at different intersections by identifying similar environmental variables, thus allowing authorities to take practical steps to effectively reduce the incidence and severity of accidents along with the costs associated with such accidents.

The rest of the paper is organized as follows:

II. LITERATURE SURVEY

There is a significant growing interest in the field of traffic accident risk prediction. There are many approaches to risk prediction. Most of them are machine learning models that are trained with historical data available. Different models have considered different parameters. Apart from these ML models there are other approaches also proposed based on real-time scenarios. Every approach has its own set of parameters taken into consideration to predict the risk. Apart from different risk prediction studies the below literature survey also includes different vehicle number plate recognition methodologies.

H. Ren, Y. Song, J. Wang, Y. Hu, and J. Lei (2018)Time-of-flight (TOF) detector systems based on plastic scintillation counters have been very powerful tools for particle identification in collider detectors.

With the rapid growth of urbanization, a surge in vehicle numbers has resulted in major traffic accidents, resulting in fatalities and significant financial losses. The ability to predict the risk of traffic accidents is important in the prevention of the occurrence of accidents and to reduce the damages caused by accidents proactively. However, traffic accident risk prediction with the high spatiotemporal resolution is difficult, mainly because of the complex traffic environment, human behavior, and the unavailability of real-time traffic data. Based on the quantitative analysis of big traffic accident data, this paper first introduced an important characteristic of traffic accidents - the spatiotemporal correlation and then constructed a high accurate deep learning model for traffic accident risk prediction based on spatiotemporal correlation patterns. The traffic accident warning system may be able to use the predictive accident risk. The proposed technology can be integrated into an intelligent traffic control system to improve traffic prediction and control.

Chandan R, Veena M (2020) proposed a mechanism for Vehicle Number Identification Using OPENCV with Machine Learning.

The proposed system involves five steps Preprocessing, Gaussian filtering, Character Segmentation, License plate detection, and Character recognition. For character recognition, the authors used a KNN classifier.

Surveillance is important in most applications. Vehicle number plate detection is the major part of traffic surveillance. The detection of number plates has become more challenging and interesting in the past few years. The most challenging part of number plate detection is the varying size, shape, and font styles of the number plates. The interesting part of number plate detection is its use in security applications. This project proposes a method to detect the vehicle number plate using methods like edge detection and morphological operations. The approach is performed in five steps. The First step is image acquisition which captures the image scene using a camera. The next step is pre-processing which involves the conversion of an image to a different model and noise reduction. The next step is license plate detection which involves the use of various edge detection algorithms. The final two steps are character recognition and character matching which involves a KNN classifier and finally, the characters are compared with test samples and matched.

A Novel Method for Indian Vehicle Registration Number Plate Detection and Recognition Using Image Processing Techniques was proposed by **Ravi Kiran Varma P and Srikanth Ganta (2019).** Pre-processing, detection, and recognition are the three key aspects of the suggested methodology.

Ragini Bhat, Bijender Mehandia(2014) proposed a method for the recognition of vehicle number plates using MATLAB . First, the plate location is retrieved using morphological operations, and then the plate characters are segmented individually. Finally, for plate character identification, template matching is used in conjunction with correlation.

III. PROPOSED ALGORITHM

Gaussian Blur :

Gaussian blur is the result of blurring an image by a Gaussian function. It is a widely used effect in graphics software, typically to reduce image noise and reduce detail. It is also used as apreprocessing stage before applying our machine learning or deep learning models. Gaussian smoothing is also used as a pre- processing stage in computer vision algorithms to enhance image structures at different scales. In gaussian blur we make use of gaussian function to build convolution matrix.

$$G(x,y) = \frac{1}{2\pi\sigma^2} e^{-\frac{x^2+y^2}{2\sigma^2}}$$

Here x and y are horizontal and vertical distances from origin and σ is standard deviation of gaussian distribution.

Otsu's thresholding :

Otsu's method, named after Nobuyuki Otsu, is used to perform automatic image thresholding. In the simplest form, the algorithm returns a single intensity threshold that separates pixels into two classes, foreground and background. This threshold is determined by minimizing intra-class intensity variance, or equivalently, by maximizing inter-class variance.

The following steps are followed in thresholding algorithm

1. Processing input image.
2. Obtain image histogram.
3. Compute threshold value T.
4. Replace image pixels with white where saturation grater then T and black where saturation less then T.

Character Segmentation

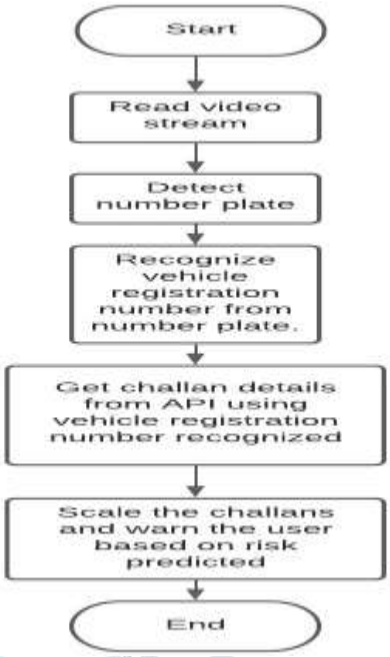
In digital image processing and computer vision, image segmentation is the process of partitioning a digital image into multiple segments (sets of pixels, also known as image objects). ... Image segmentation is typically used to locate objects and boundaries (lines, curves, etc.) in images. In our case we use it to locate characters on number plate detected.

The following steps are followed in character segmentation

1. Preprocessing.
2. Character enhancement

DESIGN AND IMPLEMENTATION

The following figure depicts the procedure followedin the development of the above proposed system. It starts from reading a video stream, from which the number plates are recognized. The recognized numbers are used to find the challans associated with the corresponding vehicle. The challans list is further made use in prediction of risk and warn the user based on risk predicted.



1. Video to be processed is read from a live stream.
2. Image Preprocessing
3. We need to blur and convert into grayscale to reduce the noise.
4. Find vertical edges of the image.
5. Binarize the image for revealing the plate.We make use of otsu's thresholding for binarization purposes.
6. By applying closing morphological transformation, we can reveal the rectangular whitebox.
7. Then extract the valid contour
8. To recognize the characters on the license plate precisely we must apply image segmentation
9. Now apply adaptive thresholding on the plate's value channel image to binarize it and reveal the characters
10. After binarizing, apply bitwise not operation to find connected components.
11. Find contours in the character candidate mask and extract these contour areas from plate's value threshold image.
12. Now we can recognize the characters one by one using OCR.

13. Recognised registration number is passed to the apiclub API.
14. The API will return the total challan amount, challan number, challan date and all other challan related information registered on the corresponding vehicle in the json format as shown below.

{
"code": 200,
"status": "success",
"response": {
"vehicleId": "DL6CK0805",
"challan_no": "HR8294200817114839",
"challan_date": "2020-08-17 11:48:39",
"challan_status": "Cash",
"amount": 500,
"payment_date": "2020-08-17 11:48:39"
}
}

15. The response json object is processed and the challan registered with the corresponding vehicle is extracted.
16. The challan amount extracted is made use inorder to get the probable combination of the constituent challans, based on the central RTO fines to different offences. We made use of the subset sum algorithm inorder to find this.
17. Below table gives the list of fines imposed by traffic police which are returned by API, probable reason for corresponding fine and the risk predicted by the proposed system.

Challan returned by parivahan	**Probable reason**	**Risk predicted**
10,000	Drink and drive	10
100	Overloading	8
400	Over speeding	9
1,000	Dangerous driving	9
500	Driving without license	6
900	Driving without insurance	4
800	Signal jump	7
550	No helmet	4
16,000	Juvenile driving	6

18. Every offense issued by the RTO is associated with a risk factor.
19. After finding a combination that satisfies the given sum the risk is calculated on the scale of 10 and the threshold is set at 5.
20. If the predicted risk is above the threshold value, then the system will warn the user with a beepsound and the image of the vehicle with more riskis popped up.
21. In case of multiple challans associated with vehicle risk is the mean of all individual challan risks.

IV. RESULTS

The purpose of the accident risk analysis is to predict the risk of accidents at various intersections. From the number of accidents and the number of casualties in the past, the risk level of each intersection is estimated. By identifying the key environmental factors that affect the occurrence of accidents at intersections, a risk prediction model was used to predict the degree of accident risk at that have not yet occurred.

Video stream is read through camera. System will detect the vehicle registration number plate making use of different image processing techniques. The number plate detected is passed to OCR which will recognize the vehicle registration number.

Fig:Image of car captured

Vehicle registration number found using OCR is passed to API which returns the challan registered with the corresponding vehicle. The challan amount received is scaled using subset sum algorithm and the risk of accident is predicted. When the risk predicted is greater than the threshold the system will warn the user with a beep sound and the vehicle image with more risk will be popped up.

Fig: Number plate detected

The vehicle with predicted risk more than the threshold. Along with the popup the system will make a beep sound for 3 seconds whichhelp the user to take necessary actions.

In the below scenario the risk predicted by the above proposed system is 7 which is more than the threshold fixed which is 5. So, the system will warn the user with a beep sound and the image of the vehicle will pop up

Fig: Image showing Predicted risk

The following confusion matrix depicts the performance of number plate detection system

Total = 500	Predicted NO	Predicted YES	Sum
Actual NO	237	4	241
Actual YES	12	247	259
Sum	249	251	500

Table: Confusion Matrix

Accuracy = (TP+TN)/Total
= (247 + 237)/500
= 0.968
Precision = TP / Predicted YES
= 247 /251
= 0.98
Recall = TP/(TP+FN)
=247/(247+12)
=0.95

ABOUT API USED

The API above system making use(https://api.apiclub.in/api/v1/challan_info/) gives data based on echallan.parivahan.gov , a portal maintained by the central government. The below figure shows the challan associated with the vehicle demonstrated above.

Fig :Challan verified at parivahan portal

V. CONCLUSION

A method for Traffic Accident severity prediction model based on traffic accident data is established and validated for accident risk prediction .The number of traffic accidents at intersections with similar environmental characteristics is used to predict the likelihood of traffic accidents in the future. Of a total of 320,315 traffic accidents reported, 32,110 occurred at 19,115 provincial highway intersections. Risk clustering in terms of CBI was performed for accident data for provincial highwayintersections and various learning methods were used to establish a prediction model for high- risk intersections. Results show that environmental variables such as road width, speed limit and presence of roadside markings are significant predictors of accident incidence.

The above research briefs us about the road accidents, different reasons for road accidents and different measures to avoid road accidents. This project describes a method to detect the probability of occurrence of a road accident and warn the user before so that the user can take necessary precautions to avoid the accident.

The steps followed by the proposed system are explained below.

The process starts from reading a video stream, this video stream is made use to detect the number plates and recognize the vehicle registration numbers coming in opposite directions. These registration numbers are sent to the API which return the challan associated with the corresponding vehicle. This challan amount is used to calculate the risk factor and warn the user.

There are different websites that give the challans details based on the vehicle registration number, but it is not possible for the user to check these details and scale them parallelly with driving so this tool will help in automation of finding challans and scaling them.

REFERENCES

1. H. Ren, Y. Song, J. Wang, Y. Hu and J. Lei, "A Deep Learning Approach to the Citywide Traffic Accident Risk Prediction," 2018 21st International Conference on Intelligent Transportation Systems (ITSC), 2018, pp. 3346-3351, Doi:10.1109/ITSC.2018.8569437.
2. Chandan, R. and Veena, M., 2020. Vehicle Number Identification using Machine Learning & OPENCV. *database*, *5*, p.6.
3. Ganta, S. and Svsrk, P., 2020. A Novel Method for Indian Vehicle Registration Number Plate Detection and Recognition using Image Processing Techniques. *Procedia Computer Science*, *167*, pp.2623-2633.
4. Bhat, R. and Mehandia, B., 2014. Recognition of vehicle number plate using matlab. *International journal of innovative research in electrical, electronics, instrumentation and control engineering*, *2*(8), pp.1899-1903.
5. Rastogi, D., Khan, M.S., Jindal, K. and Singh, K., A Real-Time Vehicle Number Plate Detection and Recognition System.
6. Varshini, N., Kasarla, S. and Subhani, S., 2019. A Novel Approach to Vehicle Number Identification using Raspberry pi 3.
7. Wang, J., Liu, X., Liu, A. and Xiao, J., 2019. A deep learning-based method for vehicle license plate recognition in natural scene. *APSIPA Transactions on Signal andInformation Processing*, *8*.
8. Roy, S., Choudhury, A. and Mukherjee, J., 2013. An approach towards detection of indian number plate from vehicle. *International Journal of Innovative Technology and Exploring Engineering (IJITEE)*, *2*(4), pp.241-244.
9. Rana, S.S., Kabir, M.H., Rana, M.S. and Sarker, S.K., 2019. An Efficient Method of Vehicle Registration Number Plate Extraction and Recognition using Image.
10. Agbemenu, A.S., Yankey, J. and Addo, E.O., 2018. An automatic number plate recognition system using opencv and tesseract ocr engine. *International Journal of Computer Applications*, *180*(43), pp.1-5.