Automatic Tollbooth Credit System using Vehicle detection and Number Identification

TamilarasuViswanathan, M Mathankumar

Abstract: ***A computer vision based toll booth credit system is proposed using vehicle (object tracking) detection and Number (text recognition) identification. Set of vehicles database loadedin a predetermine network and support vector machine (SVM) classifier identify the vehicle. Name plate details recognize using optical character recognition (OCR) and corresponding details produce inside the toking scheme with minimal "imbinarize" global method. Additionally Histogram of Oriented Gradient (HOG) for partitioning the data with extracted feature. The proposed scheme shows the excellent automatic credit system than any-other existing scheme.***

Keywords:Object tracking, tollbooth, OCR, SVM and HO.

I. INTRODUCTION

In recent years, computer vision makes impact on Transportation system, medical imaging, health monitoring scheme and other text object based automotive embedded systems. This new technology makes impact on transportation system for controlling traffic, accident management and automatic car driving scheme. [1] -[6]. Overall block diagram of the proposed scheme is shown in Fig 1. The process flow start with vehicle (object) identification and simultaneously OCR used for identify the number plate details to execute the credit system from the data base and other related details along with it. Most of the things done within seconds compare with the manual human interaction. The overall gain of LLC converter is product of inverter gain, tank gain and transformer turns ratio. The main objective of this work is to identify the vehicles from predefined database with SVM classifier.

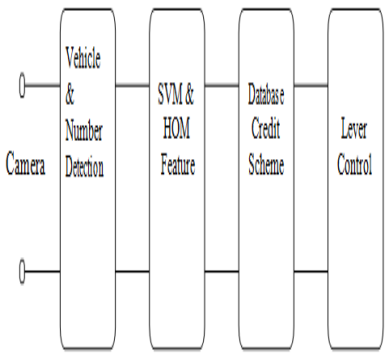

Fig.1 Structure Of Automated Toll CreditScheme

To execute the details related with number plate details based on OCR with imbinzarize along HOG partitioning feature. To incorporate vehicle identification based on the database with predefined network.

To enhance the toll credit system with fast OCR with HOG partitioning feature for quick detailsearch.

II. PROPOSED VEHICLE DETECTION

The steps involved in first part of proposed automated toll credit scheme is shown in Fig2.

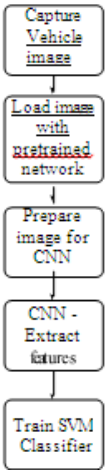

Fig.2 Vehicle Detection Steps

A. Convolution Neural Network

Convolution neural network is one of the machine learning scheme for identifying the images for a classifier form the data of pool. From the extracted images, the feature identification is quite simple for classifier like SVM. In this work, HOG used for extracting the feature using this network producing accurate features than any other work. [7] - [8]

B. Training and Testing

Captured image match with available image data set for identifying the type of vehicle with four category of vehicles (Cars,Buses,Trucks and Vans) shown in Table 1. This data set already stored in a compact memory space for quick reading from the collection 1291 images. Next step to load the pre-trained network with more trained images with different views. Here the MATLAB neural network toolbox used for training the image set loaded using Google net. The general structureof trained network shown in Fig 3.

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Category	Similar Sets
Cars	56
Buses	22
Trucks	147
Vans	311

Table I Vehicles sample dataset –used

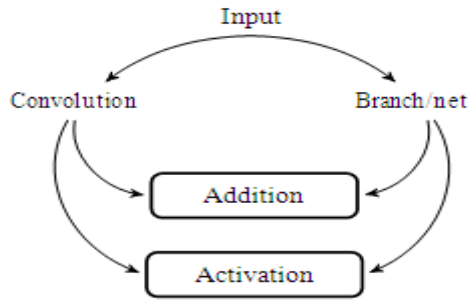

Fig. 3. CNN Single image load with google net

C. SVM Classifier

CNN generate a layer contains activation of captured data (some layers only).To remove the convolution layer is the primary task before the classification. Primitive data extracted in terms of proper representation with essential features of the actual input. This data loaded with memory (match with size) activation output are arranged with classifier. [9] -[11].

D. Evaluate Classifier

A fast gradient solved used for classifying into linear parameter for accelerating the more parameter features. Iterate the process for complete extract image features using proper classifier evaluation (see (Fig 4).

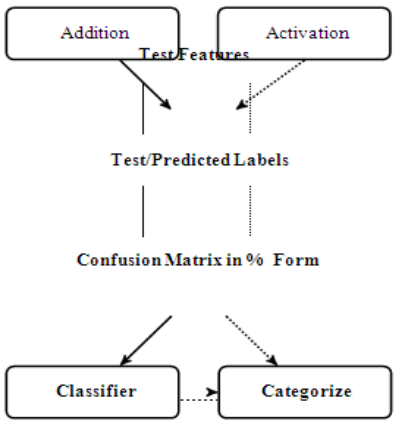

Fig. 4 CNN Single image load with google net

III. PROPOSED NUMBER IDENTIFICATION

In this section, the number plate details extraction is explained. Placement of number plate is not same in all the vehicles and also need to identified unstructured to drive after vehicle detection. A standard algorithm followed to identify with all size of text and getaccurate.

A. Principal Curvature-based Region Detector

This type of detect used to find the contrast different between number plate with text and number with gradient density profiles(see Fig 5). Initially, images as identified as small line based regions detect with text and non-text curvatures.

Fig. 5 Curvature detection of numbers

B. Accessing Geometric features

To differentiate text region with non-text one geometrical aspects(Eccentricity,Eulernumber,Solidity,Aspectratio and Extent) to be consider for based on the property value shown in Table 2.After applying the geometrical aspects,the next level diagram shown in Fig 6.Still some of text not detected for make more accurate need to remove undesiredstrokes.

Aspects	Value	Property
Eccentricity	1	Greater
Euler number	-5	Lesser
Solidity	0.5	Lesser
Aspect ratio	2	Greater
Extent	0.1-1	Between

Table II: Geometrical Aspect Values For Identify Text

Fig. 6.Implication of Geometrical aspects after Region detection

C. Stroke Variation Removal

A conventional approach of binary thinning method used for reducing the stroke variation. it is based on the human

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understandable text with same font size and equal width of all the text. Initially a threshold value identified, makethosevalueas test variation do the same process for similar text. Process clearly explain in the Fig.7

D. Matching Detection Results

All individual character detection need to compile into singe words and formaline for matching with database. Every detect number with meaning full detect format for self evaluate itself for better results. The bounded box regions calculated from neighbor region properties and also remove the overlapping between adjacent texts. The general bounded box formula used inEq.1

Xmin = Xmin +boundedbox
Xmax = Xmax +boundedbox
Ymin=Ymin+boundedbox
Ymax = Ymax +boundedbox

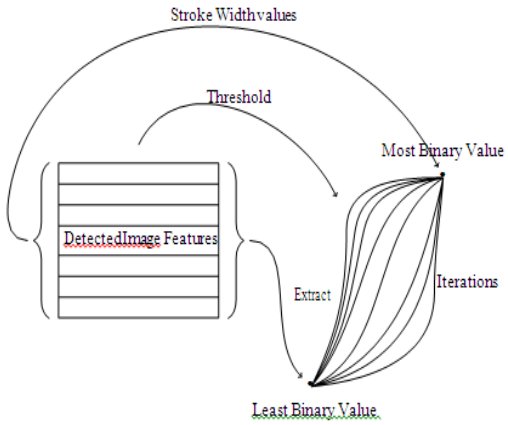

Fig. 7. Stoke variation removal - Binary thinning

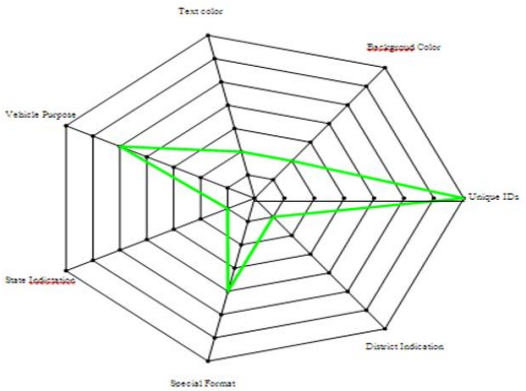

Fig. 8.Vehicle Detection andMatching

Next step to expand the boxes to small extend as follow the equation Eq.2

$$X_{min} = X_{min} \times (1 - extentsize)$$
$$X_{max} = X_{max} \times (1 + extentsize)$$

$$Y_{min} = Y_{min} \times (1 - extentsize) \quad (2)$$
$$Y_{max} = Y_{max} \times (1 + extentsize)$$

The final numerical detected values shown in single bounded box with zero overlap as shown fig9.this can bedetected with more number of detection with proper database and other neighborhood features.

Fig 9 matching detection results

IV. VALIDATION

A. Arrangement and Comparison

This proposed schemed applied with camera of tollbooth and monitor the response time with human employed and MSER scheme shown in Table 3.From the table the proposed scheme is superior in terms of Responsetime, memory man- agement, waiting period as well as improvedaccuracy.

Parameters	Human Employed	MSER	Proposed
Response Time/Vehicle	90s	70s	45s
Memory Size/image	NA	120KB	72KB
Vehicle WaitingPeriod	>300s	195s - 700s	90s - 300s
Accuracy	Humar error	81%	92%

Table III:Parameters Comparison Of Proposed Scheme WithExisting

Fig. 10.Vehicle and Number Detection car - CNN and SVM Classifier

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Fig. 11 Vehicle and Number Detection bus - CNN and SVM Classifier

V. CONCLUSION

A novel automated tollbooth credit system was proposed with enhanced in memory management,accuracy and database access than existing scheme. Curvature based detector implemented for differentiate text and non text regions and exact numerical detail extracted from the SVM classifier withproper geometrical features.A binary thinning method enhance the stoke variation improve process.Individual text identification form a bonded box contain all the recognized text match with database. Results shows that the necessity and improvementof proposedscheme.

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