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A NOVEL DEEP LEARNING ARCHITECTURE FOR VEHICLE MAKE AND MODEL RECOGNITION: A REVIEW

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Abstract: : Vehicles make and model recognition (VMMR) is an important component of the Intelligent Transport System (ITS).It plays an essential role in traffic monitoring and vehicle surveillance. This paper is to review different methods for vehicle recognition, different deep learning architecture to check which can give better accuracy. License plate recognition is earliest method for vehicle recognition. After development of technology vehicle make and model recognition is done using different architecture. As there is a similarity occurs in different types of cars there is a chance for false prediction.so the large scale data set and different data augmentation technique is needed to increase the number of images. CNN model is applied to train and test the data set.

Index Terms **- deep neural network, license plate recognition, vehicle make and model recognition, ensemble learning**

I. INTRODUCTION

Vehicle recognition is an important concern as unauthorized vehicles are used to carry an enormous amount of illegal activities such as street crimes and even terrorist activities. In big cities, as millions of vehicles are running on roads which makes it impossible to detect an unauthorized vehicle.so this issue is more critical in big cities. In this regard, vehicle recognition is essential to help law traffic surveillance management systems and law enforcement agencies to ensure better security for their citizens. Traffic police use only number plate recognition as an identification tool for tracking such vehicles but fake license plates are used to hide the identity of stolen and unregistered vehicles which makes it difficult to detect them.

Therefore, number plate recognition systems [1] cannot be a reliable approach for the identification of illegal vehicles .so it is important to extract other important features, such as vehicle type detection, vehicle color recognition, and vehicle make & model recognition. vehicle make and model recognition with license plate recognition system play a fundamental role in Intelligent Transport System (ITS), e.g. vehicle re-identification, vehicle tracking, suspicious vehicle detection, real-time traffic monitoring, and vehicle allocation scheme [2]. Identifying vehicle make and model is a complicated task due to intra class variation, view-point variation, and different illumination conditions. The chances are quite low that the vehicle will be correctly recognized from such an image.

II. LITERATURE SURVEY

1) Guha et al proposed A System Design for License Plate Recognition Using Edge Detection and Convolution Neural Network. In this paper they used preprocessing, edge detection, and morphological dilation to the input image for license plate detection. Character segmentation is executed based on region properties and morphological operation is applied to extract the plates object. The extracted characters are recognized through automatic feature extraction with Convolution Neural Networks. Their simulation results illustrate that the system accuracy is quite remarkable. [1]

2) Suresh chavhan et al demonstrates the Emergent intelligence (EI) technique's capability for solving public transport system problems. In this scheme, the EI technique is utilized to collect, analyze, share and optimally allocate transport resources effectively. This scheme's results show the reliability and accuracy [2]

3) Yang et al proposed a technique which highlights vision related tasks centered on car. In this paper they collected a large-scale dataset, "Comp Cars". This dataset covers not only different car views, but also their different internal and external parts, and rich attributes. Importantly, the dataset containing a surveillance nature set and a web-nature set. They also demonstrate car model classification, car model verification, and attribute prediction. [3]

4)Fawzy et al proposed an Optimized Neutrosophic k-Means With Genetic Algorithm for Automatic Vehicle License Plate Recognition(ONKM-AVLPR) .They performed some image processing techniques such as edge detection and morphological operations to utilize the license plate(LP) localization .k-means clustering algorithm is applied to segment (LP) characters. Finally CCLA algorithm is applied for identifying the connected pixel regions and grouping the appropriate pixels into components to extract each character. This methodology has the ability to be suitable for both (Arabic –Egyptian) and English (LP). The proposed system achieves high degree of recognition accuracy for the whole system .that is about 94.27% accuracy [4]

5) Tourani et al proposed vehicle License Plates Detection (LPD) and Character Recognition (CR) method. This system is designed for Iranian vehicle license plates, which is having the characteristics with different resolution and layouts, digits/characters, various background colors, and different font sizes. They used separate fine-tuned You Only Look Once (YOLO) version 3 platforms for each of the phases and extracts Persian characters from input images. For training and testing stages, a wide range of vehicle images is collected. Their results show an accuracy of 95.05% on 5719 images. [5]

6) Gupta et al proposed Automatic vehicle license plate recognition (VLPR) using optimal k-means with convolutional neural network for intelligent transportation systems. This paper presents a deep learning-based VLPR model using optimal K-means (OKM) clustering-based segmentation and Convolutional Neural Network (CNN) based recognition called OKM-CNN model. The OKM-CNN model operates on three main stages namely License Plate (LP) detection, segmentation using OKM clustering technique and license plate number recognition using CNN model. The characters in LP get recognized with the help of CNN model. [6]

7) Shvai et al proposed vehicle-type classification for automatic toll collection (ATC). This vehicle classification method used one camera to obtain vehicle class probabilities using a set of convolutional neural networks (CNNs) and the Gradient boosting-based classifier is used to fuse the continuous class probabilities with the discrete class labels obtained from the OS. The results of this paper show that it performs better than the existing ATC system and, hence, reduce the workload of human operators [7]

8)D Liu proposed Image Classification of Vehicle Make and Model Using Convolutional Neural Networks and Transfer Learning.in this paper large datasets called Stanford cars dataset and domain-specific features are used to fit the data. They implement , train, and test several state-of-the-art classifiers such as GoogLeNet, VGG, CaffeNet trained on domain general datasets for identifying the make and models of cars from various angles and different settings, with the added constraint of limited data and time. They got accuracy about 80% using GoogLeNET. [8]

9)Lu and Haung proposed vehicle make and model recognition (VMMR) method from frontal images of vehicles. They performed the recognition task in two stages such as brand level &finer level recognition of specific vehicle models. Dataset contain 12238 front vehicle images with 400 different vehicle model of 58 major vehicle make. This approach is tested on a large-scale vehicle image database collected and achieved 95 % accuracy. [9]

10)Simonyan and Zisserman proposed Very deep convolutional networks for large-scale image recognition .from this paper we learned vgg16 architecture. Through evaluation of networks of increasing depth using vgg16 architecture with 3 × 3convolution filter. A significant improvement on the prior-art configurations can be achieved by pushing the depth to 16–19 weight layers. [10]

11)Zhang et al proposed a residual learning framework to ease the training of networks. They reformulate the layers as learning residual functions with reference to the layer inputs. The residual networks are easier to optimize and can gain accuracy from increased depth. [11]

12)Watkins et al proposed Vehicle classification using ResNet localization and spatially-weighted pooling .they investigate whether ResNet architectures can perform more than traditional Convolutional Neural Networks on the task of fine-grained vehicle classification. They train and test ResNet-18, ResNet-34 and ResNet-50 on the Comprehensive Cars dataset without pre-training on other datasets. They find that using Spatially Weighted Pooling and localization both improve classification accuracy of ResNet50.this method achieves higher accuracy about 96.351%on comprehensive cars data set than traditional CNNs. [12]

13)Zhang et al introduced mix up technique in random erasing .mix up trains a neural network on convex combinations of pairs of examples and their labels.it regularizes the neural network to favor simple linear behavior in-between training examples. Mix up improves the generalization of state-of-the-art neural network architectures.it also reduces the memorization of corrupt labels, increases the robustness and stabilizes the training of generative adversarial networks. [13]

14)Kang et al introduced a new data augmentation technique called Random Erasing for training the convolutional neural network (CNN). Random Erasing is parameter learning free, easy to implement, and can be integrated with most of the CNN-based recognition models.it is complementary to commonly used data augmentation techniques such as random cropping and flipping, and yields consistent improvement over strong baselines in image classification, object detection and person re-identification.[14]

15)Durrani et al evaluated the performance of the recent different deep neural networks for vehicle recognition to identify 196 different types of vehicles based on their make, model, and year using Stanford Cars data. They used Transfer learning to reduce the training time. Different augmentation methods such as random erasing, horizontal flip, random crop, resize, rotate, shear, and sharpen were applied to the training dataset to increase the number of images. They proposed ensemble learning framework using k-fold cross-validation has improved accuracy of image classification for the vehicle make and model recognition. The final achieved accuracy is 93.96% through ensemble models of DenseNet201. [15]

III.METHODOLOGY

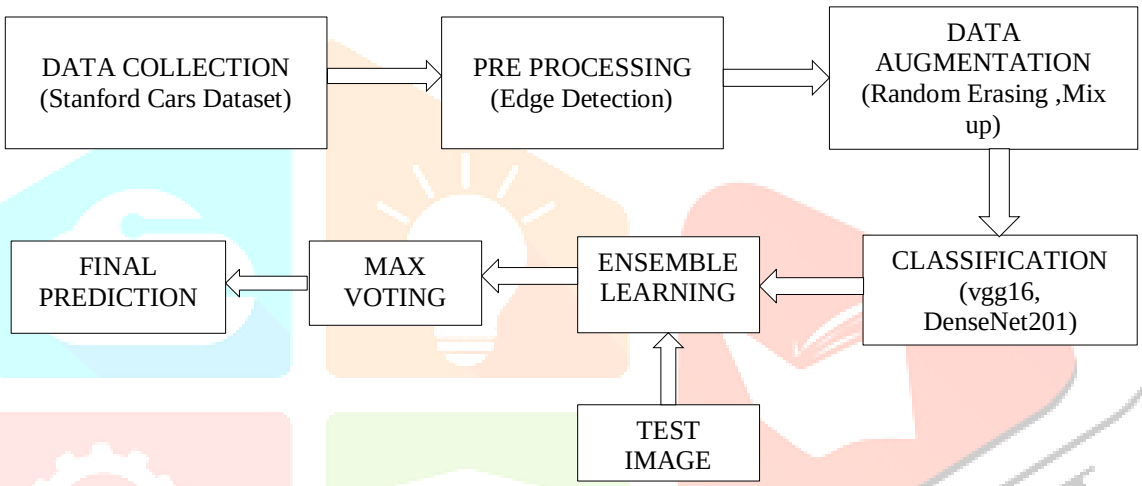

Fig 1: Proposed methodology

My proposed work to do vehicle make and model recognition using deep learning techniques. The work is implemented in python platform. Here the data is collected from Stanford cars dataset which available in website. Then preprocessing is applying to detect vehicle's edges since cars model are differ mainly on edges of vehicle. Then data augmentation techniques such as random erasing, horizontal flips and mix up to increase the number of images for training and testing. Then train the data sets for vgg16 and DensNet201 model. This train supervised model pass through ensemble learning with test image to get final prediction through max voting.

IV.CONCLUSION

In this article, we introduced a survey of some papers. Each paper introduced different technique for vehicle recognition. Earlier method for vehicle recognition is through number plate recognition. advanced technology is that vehicle make and model recognition.in many paper shows that thy have false prediction occurred.so our system is used to get better prediction on vehicle make and model recognition than previous methods .We are expecting that our work gives more accuracy and better result in future work.

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