

A Literature Survey on Vehicle Classification and Detection Algorithms

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Abstract: Vehicle image classification can depict the visual vehicle with a semantically significant classification straight forwardly. Inspired by its significance, this paper discussed about compare a quick vehicle image classification algorithms based on images and videos and also vehicle detection algorithms pros and cons. So far various algorithms have been executed for vehicle classification. Every calculation takes after various strategies for identifying vehicles from videos. By assessing a portion of the regularly used methods (or) Techniques we featured most usable methodologies for vehicle classification. In this paper also discussed about the drawbacks of vehicle classification based on videos. In this paper we pointed out the working of a few video based vehicle grouping algorithms and think about these algorithms based on various execution measurements, for example, Vehicle object classification methods (or) principles, vehicle object detection ratio etc.

Keywords: classification, detection, PCA ,SVM

I. INTRODUCTION

Pattern recognition and computer vision is used for the safety and convenience marks in our lives. The government has built monitors the movement on roads .There are cameras involved for crime detection and transportation capacity. The data analysis of traffic is good for future crime and transport problems prevention. The old ones consisted of videos attaching labels to required frames. but now these are automated .Now, the objects are identified ,classified and automatically processed. For processing and classification[94][95] of vehicles are important but it is difficult because of the poor quality of the images taken by the cameras.

Classification is very important in computer vision. It is used in object tracking, surveillance system, and vehicle detection. Classification [[92][93] is just to make putting into categories easy constructing classes by putting the pixels of the digital image into these classes. The classification of the object is done by its characteristics and its objective of work.

Classification can be of two types :

- i)Unsupervised – where the sample is not provided by the user .
- ii) Supervised- where the sample is provided to the trainer for classification by the user.

There are few points to remember:

- i) Traffic cameras are very important for intelligent transport system. They are used to count vehicles, finding queue length, traffic length and for classifying and detecting the vehicles.
- ii) Vehicle detection becomes tiring in heterogeneous traffic, the different features often lead to occlusion and one more factor is bad camera resolution and angel of the camera.
- iii) The object detection is done in three steps:
 - a) Sliding window phase-where searching of objects is done at various scales and positions.
 - b) Feature extraction

c) classification- classifying each window, at each window whether it containing object or not.

iv) Commonly used techniques for object detection are HOG [8], SIFT [9] and SURF [7]supported by SVM based classification.

v) Deep learning approaches now include object recognition[6], detection[5][3], tracking[2] and image segmentation[4] in computer vision for object recognition[4] and face recognition[1] deep learning has outperformed humans because of its superior performance.

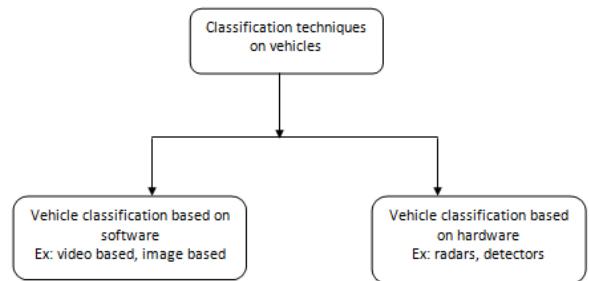


Fig1: Vehicle classification based classification done by using designing components. In the above diagram discussed about the vehicle classification divided through software and hardware. Software based classification means video based and image based. Another design is hardware i.e. Radars and detectors etc.

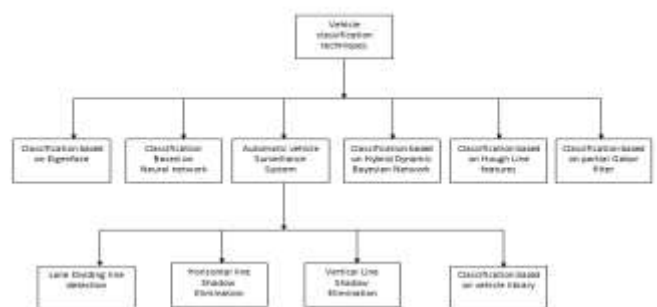


Fig2 : Vehicle Classification Techniques[89]

Above diagram discussed about the various techniques of vehicle classification, totally vehicle classification contains 6 techniques; those are Eigen face, neural network, surveillance system, Hybrid Dynamic Bayesian network, Hough line features and partial Gabor filter. Again surveillance system contains four techniques those are lane dividing line detection, Horizontal line shadow elimination, vertical line elimination and classification based on vehicle library.

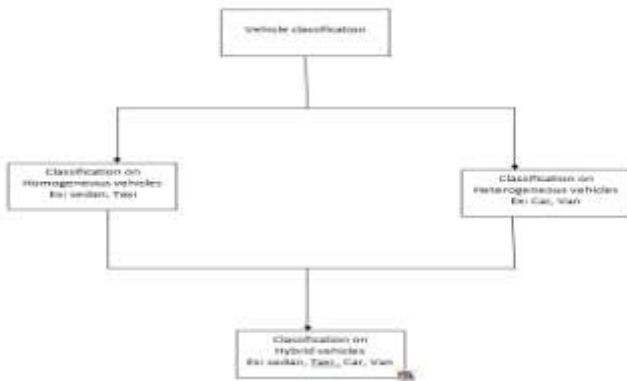


Fig3: Vehicle classification based on features [89]

Above diagram explained about vehicle classification based on features that means similar features, non-similar features and combination of similar and non-similar features. That is represented as Homogenous vehicles, heterogeneous vehicles and Hybrid vehicles. A homogenous vehicle means vehicles contain similar features ex: sedan and taxi. This type of classification is also known as intra-vehicle classification. A Homogenous vehicle means vehicles contain different features ex: car and Van. This type of classification is also known as inter-vehicle classification. But in proposed algorithm of vehicle classification for both the homogenous and heterogeneous, so it will be called as Hybrid vehicle classification. That means it contains sedan, taxi, car, bus and van etc. Nearly 11 vehicles are used as inputs for vehicle classification in proposed algorithm.

Detection of moving object is a difficult task there are many methods to achieve these they are

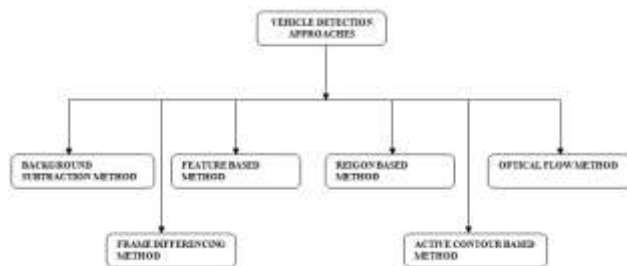


Fig4: Vehicle Classification Techniques [28]

II. DETECTION METHODS

1) BACKGROUND SUBTRACTION METHOD:

These methods are used to detect a moving object for the static camera. It is a process of extracting foreground

objects from the background. This method uses the difference of current image and background image. This converts videos into frames, colored images into grey images. It is done using morphological operations. But the disadvantage is that it does not work properly in bad weather conditions. Also there is problem detecting the starting and stopping of the vehicle [10].

2) FRAME DIFFERENCING METHOD:

It is similar to background subtracting method. In this method difference between pixels of consecutive images is calculated. If the difference is small it is considered as background image if its large then it's considered a moving image [11]. It's a fastest technique to implement but it fails to detect slow vehicles. The background subtraction method and frame differencing method can be used accurate detection of vehicles.

3) FEATURE BASED METHOD:

The features are detected by extracting the features from the vehicle regions. The steps are:

- i) Vehicle segmentation
- ii) Background is established, ie separating moving to background images.
- iii) Feature of the vehicle is extracted.
- iv) It is classified further by extracting the ratio, accuracy and compactness etc [12].
- v) Thus, features can be detected by collecting and analyzing the features moving vehicles segmented to background image [13].

As compared to the background subtraction method it has low complexity and its fast but the features are not grouped accurately for it's a failure.

4) REIGON BASED METHOD:

This method subtracts the image from the background or previous frame and then process its features .The connected part of the vehicle is called "blob" [14]. This method is useful for free flowing traffic and insensitive to occlusions but gets affected to shadows.

5) ACTIVE CONTOUR BASED METHOD:

This method uses boundaries of vehicles and tracks them. This method has low complexity than region based method but offers difficulty in occlusions [15].

6) OPTICAL FLOW METHOD:

This method uses the motion of the vehicle. This calculates the motion between the camera and the traffic flow. This method offers good performance but needs many calculations and has complexity and is sensitive to noise [16]. Thus not used much for trial time vehicle detection [16].

S.No	Detection Method	Advantages	Limitations
1	Background Subtraction	It is a simple technique and good accuracy in detection process	Noise and shadow conditions not work well
2	Frame differencing	It is very fact and easy implementation	Not able to detect slow moving
3	Feature based	It is also implement easily and handle occlusion	It totally dependence on features
4	Region Based	It is useful to free traffic following	Cont handle occlusion and shadow conditions
5	Active contour	complexity is low	Low detection accuracy and cont handle occlusion
6	Optical flow	It is good for getting good accuracy of detection	It contains more calculations(or) complexity

Table 1: comparison of various detection approaches [28]

2.1 Vehicle Detection Related Works:

Y.Wang [17] proposed a real time vehicle detection system for traffic monitoring with shadow removal. L-W Tsai, J-W Hsieh and K-C Fan[18] have detected vehicles using colours and edges. But congestion makes it difficult to work.W.Zhang, Q.M J.Wu[19]used intraframe ,interframe and tracking levels. N.K.Kanhre and S.T. Burchfield [20] separated occluded vehicles Exchanged background subtraction algorithm was used by M. Vargas ,J M Milla ,S.L Toral and F. Barrero used sigma delta filer ,applied to urban road traffic scenes[21]. R.Cucchiara M.Piccardi and P.Mello used artificial techniques [22]. Optical flow method is proposed for the surveillance of the system .optical flow algorithm and background subtraction method is being used by S.S Paygude and Dr.Vibha Vyas and Manisha Chaple for vehicle and speed calculations and traffic monitoring [23]. A.Gyaourova, C.Kamanth, S.C Chenug proposed block matching technique using motionless airborne camera [24]. Hasesgawa O., and T.Kanade [25] proposed a system for vehicle detection. D.Beyer, P.McLauchian, B.Coifman and J.qlik [26] proposed measurement parameters using feature based method. J.C.Lai, S.S Huang and C.C Tsang offered a traffic surveillance system for highway that uses geometric features [27].

III. SURVEY ON VEHICLE CLASSIFICATION FRAMEWORK:

Existing video annotation and retrieval systems:

The Object classification is difficult. Vehicle classification poses another challenge as inter-class variability is relatively smaller compared to intra-class variability approaches for vehicle classification can be classified into four categories.

1.3D model-based approaches:

3D model-based approaches have been proposed for the purpose of object detection and tracking [29, 33, and 34]. In a region of interest (ROI) was extracted using statistical background modelling and extraction of foreground using background subtraction. Edges were detected using either the Sobel edge detector or the canny edge detector. 3D wireframes of the models in the database are projected onto the image, and the best match is found based on the best matching pixel position [35], or mathematical morphology to match the model to the edge points [29]. All the models are subjected to the matching process, and the one with the highest matching score (i.e., lowest matching error) is selected as the model.

2 .Global feature-based approaches:

Gupte et al. [36] proposed a system for vehicle detection and classification. They classified the tracked vehicles into two categories: cars and non-cars. The classification is based on vehicle dimensions, where they compute the length and height of a vehicle and use them to distinguish cars from non-cars5 [36]. Avely et al. [37] used a similar approach, where the vehicles are classified on the basis of length using an uncalibrated camera. However, this method also classifies the vehicles into two coarse groups: short vehicles and long vehicles. In order to achieve a finer-level classification of vehicles, a more refined method needs to be devised that can detect and model the invariant characteristics for each vehicle category considered.

3. PCA-based approaches:

Chunrui and Siyal developed a new segmentation technique for the classification of moving vehicles [38]. They used simple correlation to get the desired match. The results shown in the paper are for the lateral view of the vehicles, and no quantitative results were given. Towards this goal, a method is developed by Zhang et al. [39]. In their work, they used a PCA-based vehicle classification framework. They implemented two classification algorithms: Eigen vehicle and PCA-SVM to classify vehicle objects into trucks, passenger cars, vans, and pickups. These two methods exploit the distinguishing power of principal component analysis (PCA) at different granularities with different learning mechanisms. Eigen vehicle approach used, [18] is similar to the proposed approach PCA + DIVS. However, we use distance from mean image in PCA space instead of finding distance from each image from each class as done [39]. The performance of such algorithms also depends on the accuracy of vehicle normalization.

4 .Local feature-based approaches:

Local features have certain advantages over using global features as they are better suited to handle partial occlusion. In traffic surveillance, if the intersection monitoring is desired, then overlapping of passing vehicles will result in partial occlusion and errors in extracting ROIs. SIFT [40]

has shown to outperform other local features in terms of repeatability [41]. Ma and Grimson developed a vehicle classification approach using modified SIFT descriptors [30]. They used SIFT features to train the constellation models that were used to classify the vehicles. They considered two cases: cars vs vans and sedans vs taxis. They reported good results for the difficult case of classifying sedans vs taxis. However, they do not report combined classification results for sedans vs vans vs taxis that will show the scalability of the approach. We used the same dataset provided by them. We implemented constellation model based approach that differs slightly from [30], but we were able to achieve similar accuracy with better computational complexity.

Other approaches:

Koch and Malone [42] used infrared video sequences and a multinomial pattern-matching algorithm [43] to match the signature to a database of learned signatures to do classification. They started with a single-look approach where they extract a signature consisting of a histogram of gradient orientations from a set of regions covering the moving object. They also implemented a multi-look fusion approach for improving the performance of a single-look system. They used the sequential probability ratio test to combine the match scores of multiple signatures from a single tracked object. Huang and Liao [44] used hierarchical coarse classification and fine classification. Ji et al. used a partial Gabor filter approach [45]. In [32], Wijnhoven and de with presented a patch-based approach that uses Gabor-filtered versions of the input images at several scales. The feature vectors were used to train a SVM classifier which was able to produce results better than those presented in [30] in cars vs vans case. However, this approach is global feature based; therefore, it is not best suited for cases with partial occlusion. Recently, Buch et al. presented a traffic video surveillance system which employs motion 3D extended histogram of oriented gradients (3DHOG) to classify road users [31].

3.1 LITERATURE REVIEW ON VEHICLE CLASSIFICATION:

This includes the literature study on different classification method applied for vehicle detection and class identification. These methods are based on image level classification as well as video based recognition and classification.

Kanwal Yousaf [46] defined a comparative study on different vehicle recognition and classification approaches. Author defined the work on different associated applications. This application includes surveillance method, security system analysis, traffic recognition, congestion avoidance, accident detection. Author defined the algorithm for vehicle classification and recognition. Author defined the algorithmic approach for evaluation of the vehicle in the videos as well provides the method to perform the identification of vehicle class. The work also includes the identification of algorithmic study on different algorithmic approaches. These methodologies include the parameter level study based on different performance metrics so that the effective vehicle identification and classification will be done. Author defined the work using probabilistic

classification method that can provide more effective and accurate object detection. Author used the physical characteristics of vehicles as feature vector to perform effective classification. The classification includes the wheel distance analysis, wheel height analysis and vehicle structure analysis.

Mohamed Elhoseiny [47] defined a work on video surveillance system to classify the available objects in multiple classes. Author defined the work some specialized applications including the road safety application, parking application and baggage applications. Author defined the work on object detection and recognition so that the reliable scene based recognition can be obtained. Author defined work on surveillance video processing includes the low resolution image processing and occluded object processing. Author used the PCA based entropy analysis to generate the image features and to analyze the vehicle class identification based on configuration analysis.

Ghada S. Moussa [48] defined a geometric feature analysis approach for attribute selection and vehicle type identification. Author generated the work on economic prosperity analysis so that the vehicle class for road feature identification will be done. Author defined the fact driven analysis applied on feature class generation based on vehicle category identification. Author presented a hybrid method on geometric and appearance adaptive feature class generation. Author presented the work on multiple class based analysis as well as provided the intra class identification so that the vehicle generation will be done effectively. Author used the vehicle classification under geometric and appearance attribute analysis so that the multiple class based experimentation will be obtained. Author generated the vehicle class and provided the intra class classification so that the sub class of vehicle will be obtained. Author obtained the potential feature class generation based on the vehicle class identification.

Suresh Babu Chandalasetty [49] presented a work on moving vehicle classification. Author defined the road density analysis so that traffic control and the traffic density control for the cities will be identified. The work is here defined for the specific road monitoring. This kind of analysis includes the video surveillance system based processing so that the traffic management based work will be optimized for vehicle detection and classification. Author provided the work on traffic management and scene management with setting up the stationary camera on the road. Author presented the region and vehicle based communication so that the image sequence analysis will be performed. Author defined work as the layered model in which at first the background separation will be performed to identify the vehicle area. Once the vehicle ROI is tracked, the vehicle classification is performed to perform the recognition or classification of videos. Author identified the vehicle measures in terms of vehicle length, width, area, perimeter etc. This also includes the vehicle feature extraction and once the feature set obtained, the classification is performed using neural network approach. Author applied the work in weak environment. This paper defined the survey based analysis so that the cost of recognition and classification is reduced.

M.Vineela [50] presented a work on video stream processing using Bayesian network approach. Author defined the enhanced security mechanism to identify the target vehicle and based on which the aerial surveillance mechanism is proposed. Author improved the vehicle processing and detection algorithm. Author also provided the study on various associated algorithms so that the colour level features generation. Author presented a video stream adaptive feature extraction approach for vehicle feature based classification. These features include colour extraction, colour transformation, edge analysis, and movement analysis. Author used the moment preserving method along with Bayesian network approach to generate the vehicle class. Author defined the feature inclusive method to extract the pixel level information so that the neighbour region generation will be obtained. Based on this adaptive investigation, the vehicle class can be identified from the captured video.

Zhiming Qian [51] defined a work on multiple vehicles tracking on a video. Author defined the vehicle detection and tracking using multiclass SVM and PCA classifiers. Author defined the set as the training and testing set and performed the vehicle sequence based recognition applied on the traffic scenes. Author provided the vehicle class identification using the traffic scenes. Author defined the sample set based training information analysis applied to perform the vehicle recognition and classification. Author defined the sequence frame analysis under traffic observation to achieve the effective recognition. The feature set is here generated using SIFT method.

Yan-shuang Hao [52] presented a work on road vehicle classification using extreme learning method. Author defined the work on traffic scene analysis and provided the security and transportation management under extreme learning method. Author improved the classification results by analyzing the movement based on the edge feature analysis. Author obtained the fast and satisfactory results.

E. Michaelsen [53] presented a work on structural analysis defined on the local features and provided the thermal form generation on the videos. The video detection is here based on the movement effective analysis applied on the planner graphics transformation model. Author obtained the results using eigen value analysis applied to generate the average gradient from the image and perform the feature localization so that the effective recognition will be obtained. Author generate the finer level classification based on the adaptive feature analysis. Author obtained work on four called fix structure based analysis, risky structure, rejection class and the vehicle queue.

Habibu Rabiou[54] presented a work on vehicle recognition and detection based on the urban intersection analysis provided for the vehicles. Author obtained the traffic monitoring based application so that the predictive method will be applied for vehicle detection and classification. Author used the kalman filter approach to generate the feature segments and extract the features from the image. These features are here defined the form of vehicle extraction. Later on LDA classifier is applied to perform the detection and classification. Author obtained high recognition rate.

Mehran Kafai[55] presented the work on vehicle classification over the video using Bayesian network approach. Author defined the significant subject analysis so that the study based generation and the autonomous navigation based on the traffic analysis will be obtained. Author defined the security feature based analysis so that the video vehicle classification can be obtained. Author defined work on four vehicle classes called truck, SUV, sedan and unknown vehicles. Author generated the feature set based on the dimension analysis. Once the analysis is obtained, the feature set is generated. The hybrid Bayesian network is applied to perform the recognition. The feature vector based analysis is here obtained under the vehicle class formation so that the accurate class will be obtained. Author applied video on a larger video set and obtain high accuracy rate.

Longbin Chen [56] presented a work on integrated moving object classification applied on surveillance videos. Author analyzed the key features from the videos and obtained the real world conditions such as shadows, imagery objects, distortion analysis, arbitrary camera positions, mapping to the people group etc. Author obtained the analysis on discriminative features and generates the object information based on the histogram difference gradients. The feature set based on the distortion is later on defined on different camera views and provided the adaptation to generate the information object based on the performance class. This performance class is based on the environmental adjustments and provided the effective recognition respective to the dataset specification. information object based on the performance class. This performance class is based on the environmental adjustments and provided the effective recognition respective to the dataset specification.

Amol Ambardekar[57] provided the vehicle detection and tracking for the surveillance system. Author provided the application adaptive vision performance improvement approach so that the improvement to the recognition process in the real environment will be obtained. Author analyzed the video under parameter aspects with traffic scene specification with spatial view analysis and real time video derivation. Author generated the primitive geometric features from the video and provided the positional plane analysis for model based vehicle detection and classification. Author obtained the vehicle sequence under foreground object detection, speed estimation and classification.

Ryan P. Avery[58] provided the vehicle detection based on the image length based video camera estimation. The accurate camera activity is here monitored under the frequent video frame analysis and the video vehicle identification. Author distinguished the video and the vehicle frame identification and classification. The length adaptive vehicle classification and the image stream analysis so that the capturing to the video camera can be obtained. Author defined the work on language classification. Author defined a work on the actual observation so that the proposed algorithm.

Hakki Can Karaimier[59] presented a work on vehicle classification based on the directional video analysis based on the temporal average analysis. Author defined the work on classification method under shape based estimation. Author defined the application decision based approach for

vehicle level classification. Author defined the decisional estimation based on wrong decision and poor extracted features. Author defined a work on decision boundaries so that the feature space will be generated from the video.

Xue Mei [60] defined a work on vehicle tracking and classification based on the sparse feature generation and representation. Author defined a method on vehicle tracking so that the particle filters framework generation. Author also handled the critical challenges such as occlusion, noise and challenging feature analysis. Author defined a work defined work on sparse feature space generation and tracking under the target monitoring and template generation. Author also propagates the results based on the visual features. The recognition is here based on the target monitoring based feature tracking in moving vehicle.

Brendan Morris [61] provided the work on vehicle tracking for video streaming and provided the work on camera processing based on the target monitoring. Author provided the availability under the tracking algorithm with large volume information set. Author defined a query adaptive mechanism for vehicle type classification. Author provided the image measurement and classification based on the feature tracking and merging so that the relative recognition and classification. Author defined the work on the traffic resolution analysis based on the tracking approach.

Jeffrey B. Flora [62] defined a work on image based classification so that the vehicle monitoring and tracking under the model specification. Author defined the work on pipelined so that the analysis to the vehicle detection and segmentation so that the adaptive recognition will be obtained. Author defined the feature adaptive analysis based on the morphological so that the properties and histogram feature generation and feature adaptation will be obtained. Author defined the multi class analysis so that the support vector machine and classification. Author defined the SVM based classification under three classes. The video sequence classification and tracking so that the speed and relevancy analysis with different parameter formation so that the vehicle formation and tracking will be obtained. Author defined the work on tracking so that the speed feature analysis so that the speed feature so that the feature generation so that the tracking to the video will be obtained.

Sarfaraz Masood [63] has defined a work on Gabor filter adaptive classification approach for neural network. Author defined the access control mechanism under building and parking lot specification. Author defined a vehicle class identification method based on the feature adaptation. Author obtained the feature class and provided the visual object generation so that the feature tracking and feature formulation will be obtained in a generalized way. Author provided the work on adaptive variability analysis and object image generation. Author provided the feature adaptive visualization system for vehicle tracking and generating the functional aspects.

Yiling Chen [64] provided the work on video based vehicle detection and classification so that the vehicle scenario generation for videos will be obtained. Author defined an intelligent transportation system so that the tracking to the video under feature generation. The Gaussian mixture model so that the classification part analysis so that the SVM based fuzzy approach so that the recognition and classification will

be performed. Author defined the adaptive model for recognition.

Susmita A. Meshram [65] provided the work on traffic formulation and classification and vehicle formulation. Author provided the traffic vehicle classification and video processing. Author provided the classification model under vehicle count generation and formulation. Author defined the thresholding model and provided the object formulation so that the vehicle tracking will be done.

Celil Ozkurt [66] provided a work on traffic density estimation under vehicle classification and tracking approach. Author provided the work on the surveillance system for neural adaptive recognition. Author defined the traffic management and monitoring for vehicle traffic analysis so that the density so that relative tracking so that the vehicle classification and the recognition will be performed. **IoanaSporea** [67] has defined a work on spiking neuron based learning approach under neural network to perform the classification. Author analyzed the image under machine learning approach under impact of spikes over the image. Based on the spiking feature generation model, the linear predictive modelling is performed by the author. Based on this, the image feature is defined as the bench mark and the recognition process is performed over it. Author analyzed the work on many real-time image set including iris dataset.

RianoLorenzo [68] has defined a work on spiking neuron based pattern recognition using neural network. In this paper, Author identifies the pattern level analysis under pattern description and recovery so that the unsupervised learning results will be obtained from the work. Author defined a layered model to identify the image features and later on perform the recognition on the basis of real time feature modelling. Author presented the work as the relative information architecture based on the firing neuron.

Matthias Oster [69] defined a work on Saccadic Recognition system based on spike based analysis. Author applied the temporal information analysis under specification of information derivation from biometric retinal image. The derivation is here performed under moment level analysis defined for output encoding scheme. This scheme is here defined to control the object movement and provide the relative information generation so that the information classification based on the spiking values will be obtained effectively.

QingXiangWu [70] has presented a spiking neuron based work on knowledge representation and learning mechanism. Author presented an intelligent system to perform knowledge discovery and data mining. The work was presented an intelligent system based on the neuron identification so that the intelligent information processing so that the computational phenomenon based information derivation will be obtained. Author defined a work on logic rule based derivation so that the model specific recognition process modelling will be obtained so that the computational analysis will be obtained under effective data extraction. Once the feature points are obtained, the mapping to the result dataset is performed to identify the relative mapping over the database system. **Susumu Nagatoishi** [71] has defined a work to database.

Susumu Nagatoishi [72] has defined a work to improve the performance vector for pattern sequencing. Author defined the work as the pattern learning process so that the sequence generation based neuron selection process is defined underweight learning approach.

Yan Meng [73] defined a work on human activity detection under spiking neuron to regulate the gene defined network. Author defined a reliable classifier to identify the temporal feature saver the image and perform the weight effective analysis to generate the gene regulatory network so that the neural specific development will be obtained from the work.

Jae-sun Seo [74] has presented a model based on the CMOS features and specification of architectural constraints to the environmental constraints so that the learning method over the network will be obtained under scalability vector. Author defined a learning effective approach to generate the image features so that the information transition will be obtained. Based on these neuron features, the recognition process is performed and improved.

Qiang Yu [75] has defined a work on pattern recognition using spiking neuron based model to achieve time effective information model with machine learning process. Author presented the performance network based derivation applied on real time characters to that the relative pattern recognition will be obtained over the pattern image.

Kshiti Dhoble [76] has presented a work on temporal pattern based recognition system under spiking neuron based recognition. This vector includes the event representation, rank ordering and neuron learning. Author provided dynamism to the feature environment so that the information spikes will be obtained and the real information encoding will be done. The machine learning mechanism is here defined under accurate information transition.

Nimish Kale [77] has presented the sensor replacement based human activity recognition under distance analysis so that the daily activity monitoring will be done effectively. A feature vector based work is defined to perform the monitoring and to configure the server at low level. Author applied the real time object activity recognition on image set based on the configurationally analysis applied on rotated images. Author achieved the practical formation of motion analysis so that the sensor effective recognition will be obtained from the work. Author derived the body orientation based recognition to improve the recognition model so that the sensor data improvement will be done.

Soumitra Samanta [78] has presented detection and description based space time defined activity classification approach for detection of movement over the video data. Author defined a three dimensional model to generate the space time based analysis so that the interest analysis can be obtained. This kind of information derivation can be obtained under interest point analysis so that the video data processing based classification will be obtained from the work.

Kyungseo Park [79] has defined a behaviour analysis based recognition system in real environment to identify the abnormal human activity. Author presented the behaviour analysis so that that eventual analysis over the image will be obtained. Author map the scoring values under information aspect analysis so that the temporal aspects based analysis

will be obtained and determine the thresholding under episode value derivation and information classification the relative aspects.

Georgios Goudelis [80] has presented a facial poses based video sequence analysis approach to obtain the facial pose estimation in video sequences. The proposed a work based on the pose level estimation the algorithm under mutual information analysis under pose invariant analysis so that the view angle based recognition will be obtained from the work.

M. Mahmoud [81] has defined a behaviour identification based dissimilarity analysis approach to analyze the abnormal behaviour. Author observed the activity recognition based on the abnormal behaviour analysis defined in an intelligent environment. Author applied the distance level similarity analysis so that the derivation to the stable values to the environment is obtained. Author mapped different distance method including hamming method, fuzzy effective method and the abnormal pattern analysis to generate the information behavior so that the relative image recognition will be obtained.

Yingying Zhu [82] has presented the activity recognition based spatial context analysis approach for activity recognition. In this paper, Author presented an intelligent mathematical model to analyze the information context based on observation analysis and provided the information activity based derivation so that the information object will be recognized in more accurate form. The object derivational and the learning process under attribute value analysis is here defined based on the testing distance analysis. Author also provided the model constraint specification for parametric evaluation so that the prediction over multiple dataset will be improved. Author also provided the optimization the information extraction process under weight adjustment so that the relative information gain will be obtained from the work.

Nikolaos Doulamis [83] has defined a motion estimation based work under time and space analysis to identify the person fall. Author defined an integrated system to consider the camera specification so that the information tracking will be done under visualization effective properties adjustment with situation aspect specification. Author provided the combined framework based estimation to extract the object image by background elimination. Author also increased the accuracy rate scene level identification.

Toshiaki Miyazaki [84] has defined a work on human motion estimation and path identification under human movement path in a room. In this paper, Author defined the algorithmic model to identify the moment of multiple persons under visual sensing and relative hardware level adjustment.

Medhat H. A. Awadalla [85] has defined a work on neural network based spike generation to obtain the pattern chart estimation and recognition. In this paper, spiking neural network architecture is proposed to be used for control charts pattern recognition (CCPR). Furthermore, enhancements to the SpikeProp learning algorithm are proposed. Author also defined the multiple vectors based learning rules with some constant parameters includes the neuron thresholds. These parameters can be adaptive to improve the work in generalized environment. Here the

environment specifications are based on the neuron modelling.

JieYang [86] has defined an effective sign and translation recognition system. Author provided the sign level recognition so that the information object will be translated over the system. Author defined the detection and recognition mechanism under specification of the relative language. The sign language specification and relative object identification is here been performed under user centric evaluation so that the capability specific object identification will be done. To explore these capabilities, the feature extraction is applied over the image.

Eunju Kim [87] has defined an assurance specific activity recognition system. In this work, Author defined a work on differentiate analysis so that the activity over the object will be identified under significant object generation and the relative information object exploration. Author also provided the experimental analysis so that the recognition ratio will be improved.

Derek Hash [88] presented a work on activity recognition to achieve multiple goals. In this article, Author identified the fundamental issues and relative solution so that the accurate object identification will be done. Author analyzes the complexities under different levels so that the recognition accuracy over the complexities will be improved for the associated system specification..

S.No	Classification algorithm	Principle and Methodology	Classification objects	Total No. of Vehicle samples	Limitations	Average Accuracy
1	Automatic Traffic Surveillance System	Frame Grab Local Division Sequence Intensity Linearity Line	Car, MiniVan, Van, truck, truck	20000	Affected by varying lighting conditions	82% with sequence information but 60% without information
2	Neural Network	Simplex Network MLP classified network	Double Decker Bus, Chevrolet van, truck, 9000	400	Class's feature extraction problem and network condition	100% on training set while 92% test set
3	Classface	Right, left and bottom border extraction Eigenvalue method	300 vehicle face images	300	Face features not useful conditions such as rain, fog, etc.	100% for training set but not implemented in test set
4	Hough Line Feature	Hough Line transformation Exclusion method Convex operator	Location based detection of any type of vehicle	115	wrong results are obtained when part of moving object appears from region of interest	92% for training set while 90% test set
5	Partial Color Filter Based	Binary image edge image 80% upper image detail	Trucks, Van, Hatchback, cars	1100	For variations, shadows, color differences, threshold	94.17% for edge images of vehicles while 91.57% for vehicle detection
6	HDBC	Binary image Hybrid Dynamic Bayesian Network	Different types of buses, Mini Van, SUV, vehicles and unknown vehicle (for other vehicles)	940 images of 1000 real-time vehicle videos and 3 frames each, 1000-1000 images	For major class, Chances are the problem of 10% misclassification. Chance misclassification is 10% of 1000 images	97.00% for classification Rate 90% accuracy 3% of 1000 images

Table (1) : Comparison Between Vehicle Classification Algorithms [89]

S.No	Models	Accuracy	Number of vehicles for classification
1	PCA + DFVS (eigenvehicle)	98.5	2
2	PCA + DIVS	99.25	2
3	PCA + SVM	63.25	2
4	LDA	96	2
5	Constellation model (implicit shape)	96.25	2
6	Constellation model (explicit shape)	97	2
7	Constellation model	98.5	2

8	Patch-based object classification	99.25	2
9	VGG-s	96.38	6
10	VGG-Verydeep-16	90.18	6
11	CS-CNN	97.75	6
12	AlexNet	97.31	11
13	ResNet50	97.52	11
14	Large CNN	97.60	11
15	Bagging and Convolutional Neural Network	97.84	11

Table 2 () Comparisons of Various classification algorithms [90]

IV. CHALLENGES [91] FOR VEHICLE CLASSIFICATION

While planning framework in view of picture/video based image analysis, identification and traffic administration, various difficulties are looked by the researcher and some of the following challenges are as:

- ❖ Vehicles [91] are permitted to move in particular columns as indicated by speed point of confinement and vehicle compose, and so forth. Be that as it may, in India in the majority of the cases movement framework is non path based.
- ❖ Road conditions [91] are more changed and movement is not perfect conditions, there is absence of train and over-burden vehicle development is very characteristic.
- ❖ In India [91], vehicles are stopped oftentimes by the sides of the streets. There is no different Framework for vehicle stopping administration.
- ❖ Roads are not just possessed with vehicles [91], such a large number of impediments on streets make unsettling influence to the movement. People on foot don't have isolate routes for their development in the vast majority of the cases.
- ❖ Shapes [91] of the vehicles have a key part in acknowledgment; there is high intra-class change
- ❖ Among Indian vehicles. It makes the odds for miss acknowledgment.
- ❖ Within same vehicle class there are vast assortment and models. These appear to be unique in estimate what's more, appearance. It is for the most part seen in Indian vehicles like autos and Truck's.
- ❖ Vehicles recognition utilizing optical sensor is extremely testing because of immense inside class fluctuation in vehicles appearance.
- ❖ Hundred of pictures [91] and billion of classes.

V. CONCLUSION

The conclusion is that classification of the object in a computer vision is mostly used in researches as well as also in real-time applications. Different combinations of feature abstraction and classification can change the performance of the system, so it is tested with various algorithms and implemented with best approach among them through

accuracy. Indian Work done setting is only for blended traffic conditions. They are inadequate in inside same vehicle class there are expansive assortments and models. States of the vehicles have a key part in recognition. There is high intra-class change among Indian vehicles Streets are not just possessed with vehicles, such as significant number of hindrances on streets make problem to the traffic. In proposed algorithm of vehicle classification for both the intra-class and inter-class classification, so is called as Hybrid vehicle classification. That means it contains sedan, taxi, car, bus and van etc. Nearly 11 vehicles are used as inputs for vehicle classification in proposed algorithm and also get the good accuracy.

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