Abstract—This paper introduces an ANN (Artificial Neural Network) based machine learning technique for vehicle identification and trail. The ANN is trained by the images from database which has been focused to feature extraction. This tough system is amalgamated with a Kalman filter, for manifold vehicle tracking and thus removing flawed noisy signals to construct an inclusive vehicle identification and trail system and assessed on public province based images of vehicles on fluctuating traffic, elucidation and climatic stipulations. Selective sampling, and retraining of informative samples is done which provides high recalling rate, and better localization effects on the identified and trailed images. The idea of this paper can be extended in the application of automated traffic control based on density of vehicles per unit time rather than preset timings.

Keywords—Machine learning, feature extraction, Kalman filter, Artificial Neural network.

I. INTRODUCTION

Automotive accidents tend to injure nearly 50 million people each year. As a result of these misfortunes it is approximated that nearly 1 million people face their catastrophic ends annually, a major factor of concern. Medical care, properties subjected to damage and other assorted expenses associated with auto accidents accounts nearly 3% of world’s domestic product [9].

These problems faced economically and pains encountered physically there have been a great interest in building up safety systems by vehicle manufacturers and academics. Reliability, accuracy, and efficiency in recognizing hazardous conditions are the basic prerequisites of safety systems [3]. Interest is focused in proposing a safety system that avoids collisions by skillfully detecting lane pedestrians [1], departures [6] or other vehicles [5]. Computer vision is a significant tool that is recognized worldwide in the growth of intelligent vehicles.

A perceptive way of information delivery to drivers is a weird potential displayed by vision-based vehicle recognition system [4]. Attractive framework for vehicle recognition and tracking is introduced in this paper. Vehicle recognition based learning system follows two iterations, one employing guiding the artificial neural network and the tracking procedure aiding vehicle recognition.

This adopted style shows a noticeable drop in false positives per frame and false-detection rates at the same time care is being provided in preserving a high vehicle-recognition rate [2].

The detection and trail system is incorporated with a type of filter say Kalman extending its support in vehicle tracking. The role of this paper summarizes the following. A learning framework for on-road vehicle detection and trail follows neural based learning. Correlation of trailed images with trained artificial neural network is taken on to distinguish and track the vehicles on-road. Results disclose that this well trained identification and trail system yields a commendable precision and recalling rates and also maintains good localization effects.

II. TECHNIQUES

A. Vehicle identification and trail

Vehicle identification and trailing continues with the tracking process. The tracking process includes the following steps for its completion. Receiving the inputs, foreground detection, filtering and cropping are the steps which forms the basis of tracking. The block diagram illustrating complete vehicle identification and trail is shown in Fig. 2.

B. Receiving the inputs

Receiving the inputs is the primary step in the tracking process. A PC is used in getting the inputs that is the video images and converts them to corresponding frames. These converted frames are used employed in foreground detection.

C. Foreground detection:

To check whether the individual pixels of a particular video frame corresponds to background or foreground, the foreground detector carries out a comparison of color or grayscale of that particular video frame with a background model. It then computes a foreground mask. GMM (Gaussian Mixture Model) is employed to detect the foreground that converts foreground mask to binary format.
Gaussian Mixture models are formed by combining multivariate normal density components used for data clustering. These binary images that are produced as output by foreground detector is directed to filtering.

D. Cropping and feature extraction

The tracked region by Kalman filter taken separately by cropping. To this region, feature extraction technique is applied. This paper uses Discrete Wavelet Transform as the feature extraction technique. Feature extraction method employed here helps to separate the high frequency components such as noise present in the image from low frequency components of the image so that noise gets removed and aids in fast transmission of images from wavelet transform block to artificial neural network for correlation and identification process[2].

E. Correlation and recognition

The images of Kalman filter is given to correlation. Correlation compares this tracked region of the filter with the feature extracted images loaded in the data base by a learning process termed neural network which is sufficiently trained to assist in correlation of the tracked images. During correlation if the correlation factor exceeds 0.9, then the image is said to be tracked and hence identified. Thus starting with neural learning, followed by trailing and recognition fulfills the process of on-road vehicle identification and tracking.

III. ALGORITHMS & FILTERS

A. Kalman filter

Kalman filter has the ability to track multiple objects [7]. Here objects points to vehicles. A common application of the filter is to control the vehicles. Linear quadratic estimation is an algorithm that uses a series of measurements inspected over time, containing noise, the unsystematic deviations and also includes other imprecision and produces estimates of nameless variables that seems to be more accurate than those based on an introverted measurement alone. Kalman filter functions on noisy input data from foreground detector to generate best possible approximation of the principal system state. The working of the filter is a two-step process. The Kalman filter produces estimates of the current state variables along with their qualms in the anticipating process.

Once the result of the consequent measurement is analyzed, these estimates are diminished using a weighted average, with more weight age given to estimates with licensed certainty. Thus filter aids in categorizing the frames into assigned, predicted unassigned or missed.

Kalman filter helps in multi tracking of the vehicles, and assist in its classification. If certain frames in a any track under supervision is not tracked for a specific time, then those tracks will be deleted by default. This finishes tracking process and proceeds with feature extraction and cropping which leads to identification phenomena.

B. Artificial Neural based learning:

Artificial neural based learning belongs to machine learning community. Machine learning is simply a branch of artificial intelligence, associated with the production and study of systems that can gain knowledge from data. Machine learning uses two fundamental terms namely representation and generalization. Representation refers data instances and appraises functions on these instances.

Generalization is the system performance on unobserved data episodes. ANN depicts a computing system comprising simple, highly interconnected processing fundamentals, routing information by their dynamic state response to external inputs [8]. Neural networks are arranged in layers. Layers are made of multiple interconnected nodes that embed an activation function. Patterns are introduced to the network through input layer, which corresponds to one or more hidden layers where the actual processing is done through weighted connections, and links to an output layer [10]. The diagram of ANN is shown below in Fig.1.

Fig 1. Feed forward neural network

Each of the circles in the Fig.1 is termed neuron containing an input-output transfer function. Feed forward back propagation neural network is used here paper which employs diversity of transfer functions. The extracted wavelet features of the loaded database images serve up as the input in training the ANN. This trained neural network is then saved and fulfills the learning process in vehicle recognition and tracking framework [11].
IV. BLOCK DIAGRAM

The block diagram depicts the complete functional description of vehicle identification and trail. The input frames are fed to foreground detector which helps in detecting the foreground of the images and then subjected to filtering by kalman filter and the functions proceed as shown in fig 2.

![Block Diagram](image)

Fig 2. Functional description of vehicle recognition and tracking.

V. EXPERIMENTAL ANALYSIS

The experimental appraisal divulges that there is significant drop in false positives per frame and increase in true positive rates. True positive rate is the ratio of detected vehicles to total number of vehicles.

False positives are a factor that is employed in the estimation of false detection rates. False detection rate is the ratio of false positives to the sum of detected vehicles and false positives. These two parameters are used in estimating the performance, efficiency and linearity of the tracked regions. Fig.3 shows the improved performance and Fig.4 depicts the linearity and appreciable efficiency in tracking phenomena. Performance plot of Fig.3 depicts that the tracking is achieved with less number of iterations. Fig.4 shows the linearity and the peak efficiency in tracking. This project is implemented using MATLAB, a numerical computing platform. This version of MATLAB employs computer vision system toolbox. For supporting simulation, computer vision and design of video processing system.

It also includes methodical procedures for detecting the movements, extracting the features, tracking and object detection, stereo vision video processing and analysis, etc. For swift prototyping, the system toolbox bears fixed point arithmetic and C-code generation unit.

VI. SIMULATION RESULTS

The simulation results clearly shows the performance efficiency and linearity of the identified and tracked images.

![Simulation Results](image)

Fig 3. Represents the performance plot
VII. CONCLUSION

The ANN based framework for on-road vehicle identification and trail is launched in this paper backup with multilevel Haar filter for feature extraction, Kalman filter for multiple tracking and feed forward artificial neural network as learning method. This neural based framework helps in realizing complete vehicle identification and trailing system, joined with quantitative analysis. The designed system has been appraised on public domain based images of vehicles on varying traffic, and climatic conditions which provide a distinguished precision and recalling rates convoyed with a substantial localization effect.

REFERENCES


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