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A Hybrid Approach for detecting vehicle using Dynamic Bayesian networks and neural networks

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ABSTRACT:

The development of computer technologies makes the complicated things simpler. Image processing is the one of the most interesting area which can apply to solve many real time situations. We are proposing a new method to detect the vehicles automatically by using the Dynamic Bayesian networks. The proposed system designs the pixel wise classification method to detect the vehicles. We are using a color transformation technique to separate vehicle color and non vehicle color. We are using neural network edge detector to find the edges of the images. Finally we use DBN for classification. We conducted the experiments on various images.

KEYWORDS: Aerial survey lines, Dynamic Bayesian networks, neural network edge detector, vehicle detection, image processing.

I.INTRODUCTION

The increase in the number of vehicles on the roadway network has forced the transport management agencies to depend on advanced technologies to take better decisions. In this perspective aerial surveillance has better place nowadays. Aerial surveillance provides monitoring results in case of fast-moving targets because spatial area coverage is greater. One of the main topics in intelligent aerial surveillance is vehicle detection and tracking. Aerial surveillance has a long history in the military for observing enemy activities and in the commercial world for monitoring .resources. Such techniques are used in news gathering and search and

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rescue aerial surveillance has been performed primarily using film. The highly captured still images of an area under surveillance that could later be examined by human or machine analysts. Video capturing dynamic events cannot be understood when compared with aerial images. Video observations can be used to find and geo-locate moving objects in real time. Video also provides new technical challenges. Video cameras have lower resolution when compared to the framing cameras. To get the required resolution and to identify objects on the ground, it is necessary to use the telephoto lens, with narrow field of view. This leads to the shortcoming of video in surveillance— it provides a "soda straw" view of scene. The camera should be scanned to cover the extended regions of interest. Observer who is watching this video must pay constant attention, to the objects of interest rapidly moving in and out of the camera field of view.

II.RELATED WORK

The system, proposed by Hsu-Yung Cheng [1] escaped from the stereotype and existing frameworks of vehicle detection in aerial surveillance, which are region based or sliding window based. Pixel wise classification method is designed for vehicle detection. Hsu-Yung Cheng proposed Hierarchical model proposed by Hinz and Baumgartner [2] which describes different levels of details of vehicle features and detection method based on cascade classifiers has the disadvantage of lots of miss detections. Vehicle detection algorithm based on symmetric property [3] of car shapes is prone to false detections. The high computational complexity of mean-shift segmentation algorithm is a major concern in the existing methods. One method utilizes color transformation in case of still images and an approach tends to utilize wide area motion imagery. Linet al.[4] proposed a method by subtracting background colors of each frame and then refined vehicle candidate regions by enforcing size constraints of vehicles In [4], the authors proposed a moving-vehicle detection method based on cascade classifiers. Multi scale sliding windows are generated in the detection stage. Disadvantage of this method is that there are lots of miss detections on

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rotating vehicles. Choi and Yang [5] proposed a vehicle detection algorithm using the symmetric property of car shapes. Therefore, they applied a log polar histogram shape descriptor to verify the shape of the candidates. Unfortunately, the shape descriptor is obtained from the fixed vehicle model, such that the algorithm inflexible. The algorithm in [6] relied on mean-shift clustering algorithm for image color segmentation. The high computational complexity of mean-shift segmentation algorithm is another concern.

III.ARCHITECTURE OF PROPOSED SYSTEM

Our proposed system contains different modules which work independently to produce the final result. The entire process contains two phases called training phase and detecting phase as shown in the given figure.

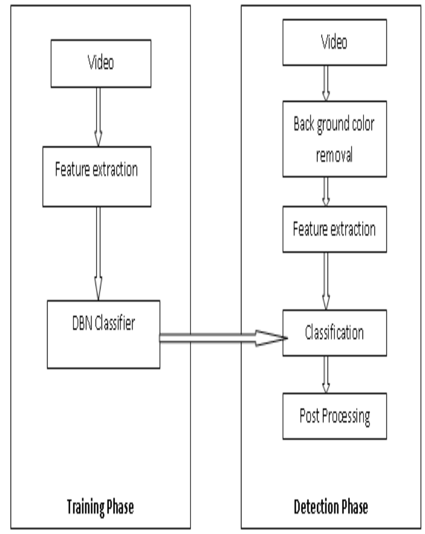

Figure 1: Architecture of the proposed system

All the important features are extracted from the sequence of frames in this Training Phase. These features are given to the DBN used to classify the images during detection phase. The feature extraction was also done at detection phase. In the detection phase, we first perform background color removal similar to the process proposed in [7]. Afterward, the same feature extraction procedure is performed as in the training phase. The extracted features serve as the evidence to infer the unknown state of the trained DBN, which indicates whether a pixel belongs to a vehicle or not.

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IV.VEHICLE DETECTION FRAMEWORK

The vehicle detection framework contains the following modules.

4.1 Frame Extraction
4.2 Back ground color removal
4.3 Feature Extraction
4.4 Classification
4.5 Post Processing

4.1 Frame Extraction:

The set frames are extracted from the given video for the further processing in this module.

4.2 Back ground color removal:

We construct the color histogram of each frame and remove the colors that appear most frequently in the scene. These removed pixels do not need to be considered in subsequent detection processes. Performing background color removal cannot only reduce false alarms but also speed up the detection process.

4.3 Feature Extraction:

In this module we extract the feature from the image frame. In this module we do the following Edge Detection, Corner Detection, color Transformation and color classification. The frame edge image is able to transfer by performing detect edge, corners and places for color transform.

4.4 Classification:

In this module we perform pixel wise classification for vehicle detection using DBNs(Dynamic Bayesian Network). We obtain the conditional probability tables of the DBN model via expectation maximization algorithm by providing the ground-truth labelling of each pixel and its corresponding observed features from several videos.

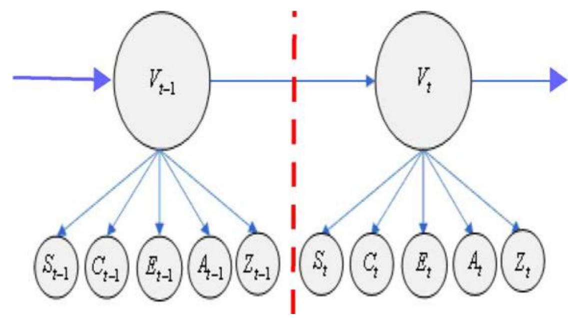

Figure 2: DBN model for pixel wise classification.

The Bayesian rule is used to obtain the probability that a pixel belongs to a vehicle is given by

$$P\left(\frac{V_t}{S_t}, C_t, E_t, A_t, Z_t, V_{t-1}\right) = P\left(\frac{V_t}{S_t}\right) P\left(\frac{V_t}{C_t}\right) * P\left(\frac{V_t}{E_t}\right) P\left(\frac{V_t}{A_t}\right) P\left(\frac{V_t}{Z_t}\right) P\left(\frac{V_t}{V_{t-1}}\right) P(V_{t-1})$$

4.5 Post Processing:

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In this module we can use morphological operations to enhance the detection mask and perform connected component labeling to get the vehicle objects. The size and the aspect ratio constraints are applied again after morphological operations in the post processing stage to eliminate objects that are impossible to be vehicles.

V.NEURAL NETWORK EDGE DETECTOR

Neural network can be used as non linear edge detector to detect the edges of the given image. The entire process contains two phases one is training and another one is testing. The weights are calculated in training phase and the edges are calculated in the testing phase by using these weights as [8]. The entire process is explained in the following diagram.

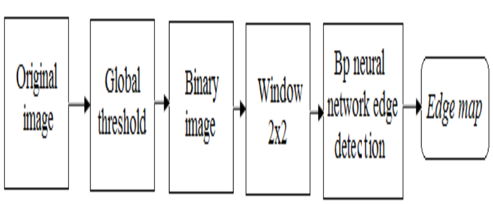

Figure 3: Neural network edge detection process

The original image is converted into gray scale image by using global threshold(Ott's method) and then it is converted into Binary image which is given as an input in the form 2X2 window to the Neural network detector and which produces the edges of an image. Here we are using supervised learning using Back propagation algorithm and provides 16 visible patterns for getting the weights in testing phase[8].

Figure 4: Image edge detection using Neural Networks

VI.EXPERIMENTAL RESULTS

The experimental results are shown in the following figures.

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Figure 5: Input Video


Figure 6: Multiple frame generation


Figure 7: Background color removal results

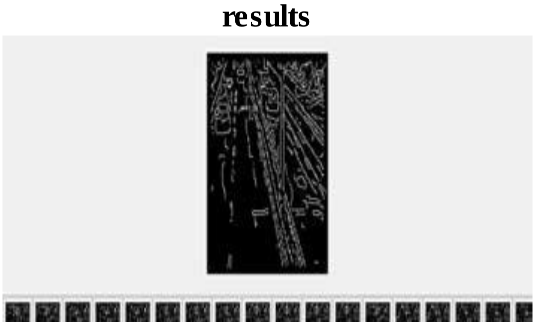
Figure 8: Edge detection


Figure 9: Color classification

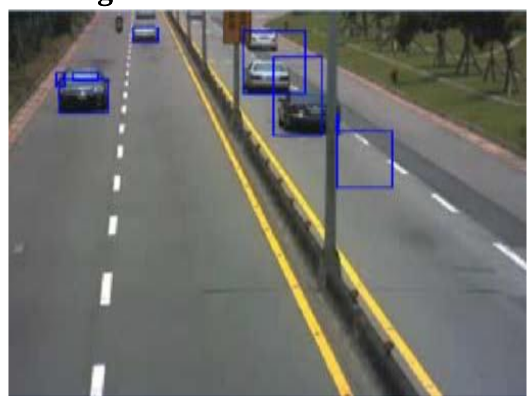
Figure 10: Detecting Each and every vehicle

VII. CONCLUSION

Our proposed system efficiently detects the vehicles as shown from the experimental results. Our proposed system takes less time to process the given videos. Neural network edge detector improves the efficiency of our proposed system in two ways by time and we are not suffering to select the threshold levels to find the edges. Dynamic Bayesian Networks uses simple probability theory to classify the elements.

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