Road Damage and Fire Detection using SVM Classifier

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Abstract— Most of the rural and sub urban roads are not ideal for driving due to faded lanes, irregular potholes, improper and invisible road signs. This has led to many accidents causing loss of lives and severe damage to vehicles. Many techniques have been proposed in the past to detect these problems using image processing methods. But there has been little work specifically carried out for detecting such issues. To address this acute problem, the study is undertaken with the objectives like, to make a survey of Indian roads, to suggest the method to potholes and signs and their classification and to suggest automated driver guidance mechanism. In this regard, shape features method which adopts edge directed features Therefore; the attempt is made to invent an automated driver guidance mechanism to make the driving safe and easier in roads. The experimental results obtained are tested by taking videos which consists of fire and path holes to make the proposed system complete. Support vector machine is used for the classification purpose.

Key words: Road Signs Edge Directed Features, SVM, Blobs, Shape Features, Kernel, And RBF Kernel

I. INTRODUCTION

Developing an automated fire and path hole detection system is very important in the context of bad road conditions. A driver finds it difficult to control the vehicle due to sudden pot holes or bumps or sudden turns where the road signs are not very prominent or missing most of the times. Suppose if there is a system with integrated motion camera and an integrated onboard computer with the vehicle, a simple driver guidance system based on frame by frame analysis of the motion frames can be developed and there by generate the alarm signals accordingly So that the driving can be made quite easier.

Road Image analysis is very important aspect for automated driver support system. Real-time qualitative road data analysis is the cornerstone for any modern transport system. So far, most of the analysis is done manually and the use of image processing techniques for qualitative analysis is still at its early stage. In this paper Description about novel image processing algorithms together with the results is given, which assign a qualitative description to a road scene. The qualitative description of a road scene can be used for controlling road lights and putting hazard signals on the road.

The ever increasing apathy of the road development authorities is one of the major reasons for the increasing road mishaps. Potholes trigger majority of such mishaps.

While driving in the night just the headlights might not suffice in assisting the driver to detect the presence of the pothole. Many other unexpected hurdles on road apart from potholes may cause severe consequences. Abysmal road conditions cause wastage of precious fuel, wear and tear of the tyre and damage to the vehicle. All these reasons demand that it is important to collect information of such bad road conditions and through a series of processing and analysing the obtained information, appropriate conclusions are derived which in turn, warn the driver. In the information gathering phase, a vehicle with a camera mounted on its front end travels along the road, thereby capturing images of the road. Henceforth in the analysing phase, this data will be processed by an algorithm to detect potholes along the path travelled earlier by the vehicle. It is this algorithm which will determine the reliability of the pothole detection by the system in place. For this purpose, the algorithm has to identify edges that are caused exclusively by potholes on the road. However, unwanted disturbances that are treated by the system as noise would affect the ultimate outcome. To overcome this problem, the dataset has to be pre-processed before the algorithm can use the dataset to detect potholes. The system would then evaluate an index which would clearly differentiate the pothole and the non-pothole road. On the basis of this evaluated index, an alert will be generated by the system.

Fire is a terrifying weapon, with nearly unlimited destructive power. Fire accidents are a major cause of human suffering and material loss and the one that perhaps are predicted the least accurately. Most existing work in fire occurrence prediction focuses on prediction of wildfires in forests and those caused by volcanic eruptions, residential and official buildings. Surprisingly prediction of fire occurrence like care accidents has not been fully explored because the factors that influence fires are too many. The idea behind this research is to provide an detect the fire at a instant in the event of fire car mishaps suddenly by the use of Image processing and Machine intelligence techniques that might significantly reduce the death toll and loss of property caused by fire accidents.

Since the presented thesis work emphasizes on the development of a highly robust parallelization approach for detection of the potholes as well as fire in case of sudden mishaps and thus coming up with a efficient approach that could facilitate optimum performance, here it is required to have a complete knowledge transfer about the image processing and its relation with parallel architecture and computing strategies. Therefore, in this section a brief of these systems has been provided.

II. RELATED WORK

The study presents an application of computer vision methods to traffic flow monitoring and road traffic analysis. The said application is utilizing image-processing and pattern recognition methods designed and modified to the needs and constraints of road traffic analysis. These methods combined together gives functional capabilities of the system to monitor the road, to initiate automated vehicle tracking, to measure the speed, and to recognize number plates of a car. Software developed was applied, approved with video monitoring system based on standard CCTV

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cameras connected to wide area network computers. Traffic signal lights are triggered using an inductive loop. At a traffic light, an automobile will be stopped above an inductive coil and this will signal a green light. Unfortunately, the device does not work with most motorbikes. Using a passive system such as a camera along with image processing may prove to be more effective at detecting vehicles than the current system (1). The study determines that the features of various motorbikes and automobiles are sufficient enough to classify it as traffic (2). The study introduces a visual zebra crossing detector based on the Viola-Jones approach. The basic properties of this cascaded classifier and the use of integral images are explained.

The authors propose detection of road signs from stream of video frames. The technique here is a thresholding on RGB color space and binary masking for extraction of the road sign areas. This is the technique adopted here in this paper for extracting the ROI of road signs (3). The author presents a robust and real time approach to lane marker detection in urban streets based on generating a top view of the road, Gaussian filters are used, RANSAC line fitting is used to give initial guesses to a new and fast RANSAC algorithm for fitting Bezier Splines, which is then followed by a post-processing step (4).

The study proposes a methodology to detect lanes in video frames. This method used here is a parabolic lane model to represent lanes in each video frame. Randomized Hough transform and a Genetic Algorithm is used to estimate the parameters of lane model. The proposed method is tested on different road images taken by a video camera from Ghazvin-Rasht road in Iran (5).

This paper presents road signs are detected by means of rules that restrict color and shape and require signs to appear only in limited regions in an image. Which are then recognized using a template matching method and tracked through a sequence of images (6). Real-time Traffic Sign Detection paper Yield sign, stop sign and red-bordered, circular signs are considered. First, image is colour segmented based on a thresholding technique. Then, corner features are detected using convolution masks Geometric constraints used for shape recognition along verification methods for each sign (7).

Hough has proposed an interesting and computationally efficient procedure for detecting lines in pictures. In this paper the use of angle- radius rather than slope-intercept parameters simplifies the computation further. Also it is concentrated on general curve fitting, and gives alternative interpretations that explain the source of its efficiency (8).

III. PROPOSED SYSTEM

In the proposed system there are two issues that we are concerned about. One is in the detection of the sudden fire the other one is with the detection of the potholes. Both the tasks are implemented using their shape features. Shape feature provides edge oriented and region properties methods for their feature extraction.

Edge detection is basically image segmentation technique, divides spatial domain, on which the image is defined, into meaningful parts or regions. Edges characterize boundaries and are therefore a problem of fundamental importance in image processing. Edges typically occur on the boundary between two different regions in an image. Edge detection allows user to observe those features of an image where there is a more or less abrupt change in gray level or texture indicating the end of one region. Many edge detection techniques have been developed for extracting edges from digital images. Gradient based classical operators like Robert, Prewitt, sobel were initially used for edge detection but they did not give sharp edges and were highly sensitive to noise image. Among them canny’s edge procedure gives the best results.

The second algorithm that places the emphasis is region properties which give the properties of the pothole as well as the fire. The properties obtained using region properties are Area, Perimeter, Form factor, Major Axis, minor axis, Roundness, Compactness. All the individual features obtained converted into single dimension by mathematical mean. Finally the features obtained using the two techniques are stored in the knowledge base for training and synthesized by machine intelligent technique called support vector machine.

SVMs belong to the general category of kernel methods. A kernel method is an algorithm that depends on the data only through dot-products. When this is the case, the dot product can be replaced by a kernel function which computes a dot product in some possibly high dimensional feature space. This has two advantages: First, the ability to generate non-linear decision boundaries using methods designed for linear classifiers. Second, the use of kernel functions allows the user to apply a classifier to data that have no obvious fixed-dimensional vector space representation. The prime example of such data in bioinformatics are sequence, either DNA or protein, and protein structure.

The first two advantages describe about the linear and non-linear methods. In the linear case the hyper-plane is a straight marginal plane that bifurcates the classes. The classes may be any number of classes however the data should be grouped linearly which takes the following form.

\[ f(x) = w^T x + b \]  

(3.1)

There is specificity that the data has to be linear or non-linear. It all depends on the way the features are stored and trained. However the more preferred is the non-linear SVM which adds a tail called kernel trick in addition to the linear form. The kernel trick is a mathematical essence which will define the hyper-plane in different variations. The kernel trick used in the proposed

RBF kernel is a popular kernel function used in various learning algorithms. In particular, it is commonly used in vector classification. The widely used Radial Basis Function (RBF) kernel is known to perform well on a large variety of problems. RBF network can be used to find set weights for a curve fitting problem. The weights are in higher dimensional space than the original data.

Alternatively, it could also be implemented using the adjustable parameter sigma plays a major role in the performance of the kernel, and should be carefully tuned to the problem at hand. If overestimated, the exponential will behave almost linearly and the higher-dimensional projection will start to lose its non-linear power. In the other hand, if underestimated, the function will lack regularization
and the decision boundary will be highly sensitive to noise in training data.

There are three basic classes of radial basis functions.

\[ k(x, y) = \exp \left( -\frac{\|x-y\|^2}{2\sigma^2} \right) \]  
(3.2)

\[ k(x, y) = \exp(-\gamma\|x - y\|^2) \]  
(3.3)

IV. RESULTS

In the following work it is evident that our system has estimated the coarse ware and identified the pothole as well as fire at appropriate places.

![Fig. 4.1: Clean Road](image1)

![Fig. 4.2: Fire Detected Authentication](image2)

![Fig. 4.3: Clean Road](image3)

![Fig. 4.4: Pothole Authentication](image4)

V. CONCLUSION

For accurate information, fire and pothole detection is very much essential. The applications in this paper discusses about the major approaches and their applications, particularly in all fields and concepts of public field applications and crime analysis. All the algorithms are efficient to improve the quality of detection. Algorithm has to be still more effective to obtain more accurate diagnostic information. Also there is a need to improve algorithms to make system robust. In view of this sufficient information about various methodologies in related work of different are presented in this paper.

REFERENCE


