A FRAMEWORK FOR REAL TIME INCIDENT DETECTION

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ABSTRACT-In the growth of population in world, people use vehicles to meet their comfort and necessity. As society has developed, the number of vehicles has increased and road conditions have become complicated, increasing the risk of crashes. This lead to heavy traffic, pollution etc. at the same time there is increase in incidents like accidents, breakdown of vehicles, infrastructural damages, etc. Therefore, a service that provides safe vehicle control and various types of information is urgently needed. In order to detect the various incidents, we sought to design and implement a real-time traffic information system and a smart camera device for smart assistance systems. This will be useful for providing help in isolated accident prone areas via notifications send through the system. With the help of these notifications necessary aid and help will be provided to the victims.

Keywords: Grayscale Image algorithm, Canny edge detection, background subtraction.

I. INTRODUCTION

One of the most important methods to solve the traffic congestion is to detect the incident state in a roadway. The proposed idea describes the development of methods for road traffic monitoring aims at the acquisition and analysis remote sensing imagery of traffic figures, such as presence and number of vehicles, incident detection and automatic driver warning systems. Real time extraction and localization of incident in aerial images is an emerging research area that can be applied to vision-based traffic controlling. Techniques based on neural network, radon transform for angle detection and traffic flow measurements are used for road extraction, vehicle detection and incident detection.

Traffic incident usually occurs unexpectedly and making problem for traffic flow, also in some cases the death penalty because of this matter. Incident is the major factor for traffic delay, safety and pollution in a roadway. Developing an automatic incident detection (AID) and alarm system for highways and intersection can help and increase traffic delay and reduce roadway traffic flow. AID systems can help other drivers to reduce speed in order to avoid potential for additional incidents. An algorithm has been proposed to develop of automatic incident detection system. Traffic incident affect on traffic flow and increase the number of vehicles rapidly in the scene. Another features for traffic incident is illegal directions of vehicles and acceleration, to describe the traffic state in a scene. Thus, there is a critical need for secure and privacy aware detection and dissemination of traffic-related events. Such a system will allow drivers to make more informed decisions about their travel, therefore reducing congestion and travel times. Ultimately, the system will not only make our roads safer by reducing traffic congestion, it will also reduce air pollution, lost productivity and wasted fuel.

Incident Detection: Incident detection is a technique in which incidents are recognized by using various recognition algorithms. Incident detection is used for traffic management purposes and it also helps in notifying about an incident detected. In this technique it extracts the features from different images captured by camera.

Image Processing: Image processing is a method to convert an image into digital form and perform some operations on it, in order to get an enhanced image or to extract some useful information from it. It is a type of signal dispensation in which input is image, like video frame or photograph and output may be image or characteristics associated with that image.

I. LITERATURE SURVEY:

[1]"Freeway incident detection using hybrid fuzzy neural network" D. Srinivasan, S. Sanyal and V. Sharma.

A new technique for freeway incident detection using a hybrid neuro-fuzzy system is proposed. This neuro-fuzzy system uses a self-rule-generating algorithm that organises the training data into clusters and learns the fuzzy rules automatically. Gaussian membership functions are assigned based on statistical properties of the training data set. Fuzzy rules are automatically obtained from the clusters and a neural network constructed using them. The training of parameters is performed using two modified linear least squares regression models. Different algorithms are implemented to obtain improvement in the speed of convergence. Real I-880 freeway traffic data are used to test the effectiveness of the developed fuzzy-neural system. To assess the transferability of the trained system, the network was trained on AYE dataset from Singapore and then adapted onto I-880 dataset from USA. The system is observed to be highly adaptable giving excellent results after adaptation. The results obtained show high potential for the application of this neuro-fuzzy system to the problem of freeway traffic incident detection.

[2]"Incident Detection Algorithm Based on Radon Transform using High-Resolution Remote Sensing Imagery" Seyed Mostafa Mousavi Kahaki , M.D. Jan Nordin Amir Hossein Ashtari.

Traffic controlling and incident detection for avoid traffic congestion is an emerging research topic due to rapidly increasing interest in their use. The traditional methods to solve this problem are traffic incident detection using ground cameras located in the highways or intersection. The control of traffic is a difficult and time consuming task which need to several human operators. Recently, with considering highresolution aerial imagery, the new methods of incident detection using remote sensing imagery can save the time and cost. Development of an intelligence transportation system using remote sensing imagery which is able to control the traffic on a roadway has had more remarkable performance. Many developed countries have paid attention to the traffic management of roadways since last recent years. Investigations about road extraction and vehicle detection in aerial imageries involved in information and data related to GIS and this maintained data needs to become up to date in every certain period of time.

[3]"Automatic Incident Detection in Intelligent Transportation Systems Using Aggregation of Traffic Parameters Collected Through V2I Communications" Otilia Popescu, Sarwar Sha-Mohammad, Hussein Abdel-Wahab, Dimitrie C. Popescu, Samy El-Tawab.

Accurate detection of traffic incidents is particularly important on highways, since the majority of disruptions in highway traffic flow are due to incidents and many highway incidents are underreported. According to the World Health Organization 2013 report, more than 1.2 million people die annually in highway-related crashes and as many as 50 million more are injured and, by 2030,highway-related crashes are projected to be the 5th leading cause of death in the world. This reinforces the need for accurate AID to alert drivers about incidents in order to reduce congestion and enhance roadway safety, and makes the study of AID techniques an important aspect of current and emerging ITS.

[4]"An Architecture for the Notification of Traffic Incidents" Yan Gongjun, Stephan Olariu and Dimitrie Popescu.

There is a *critical need* for secure and privacyaware detection and dissemination of traffic-related events. Such a system will allow drivers to make more informed decisions about their travel, therefore reducing congestion and travel times. Ultimately, the system will not only make our roads safer by reducing traffic congestion, it will also reduce air pollution, lost productivity and wasted fuel. In addition, the system can be augmented to provide other services to the travelling public, including advertising services available at particular highway exits and assisting with emergencies and planned evacuations. By judicious aggregation of the input collected by these sensors, it is possible to infer the presence of congestion. Once congestion has been detected, this information is uploaded on the passing cars alerting the drivers and allowing them to act to avoid being stuck in traffic.

[5]"Vision-based Automatic Incident Detection System using Image Sequences for Intersections" Seyed Mostafa Mousavi Kahaki and Md Jan Nordin.

Traffic incident usually occurs unexpectedly and making problem for traffic flow, also in some cases the death penalty because of this matter. Incident is the major factor for traffic delay, safety and pollution in a roadway. Developing an automatic incident detection (AID) and alarm system for highways and intersection can help and increase traffic delay and reduce roadway traffic flow. AID systems can help other drivers to reduce speed in order to avoid potential for additional incidents. The efficient algorithm has been proposed to develop of automatic incident detection algorithms. Traffic incident affect on traffic flow and increase the number of vehicles rapidly in the scene. Another features for traffic incident is illegal directions of vehicles and acceleration, to describe the traffic state in a scene.

[6]**Detecting and positioning of traffic incidents via video-based analysis of traffic states in a road segment.**

Traffic accidents, stalled vehicles or spilled loads commonly occur in road traffic. These traffic incidents often bring about unexpected occlusion in the corresponding lanes, and even cause secondary accidents. Detecting and positioning these incidents quickly and accurately can provide strong support for the early warning, timely accident-rescue and speedy congestion-evacuation.

[7] Traffic incident detection system using series of point detectors.

The research framework is based on a single-point video base traffic flow monitoring system on freeway section that processes the microscopic traffic variables to evaluate the traffic state between detectors that not coverage by detectors vision. In real-world, there are many types of incidents that can happen anywhere at anytime, where theirs definition are subjective to different interpretation and application. Therefore the focus should be on the detection of lane-blocking incident that is a major impact on traffic congestion.

[8]A detailed view of feature extraction in image processing systems.

Feature extraction describes the relevant shape information contained in a pattern so that the task of classifying the pattern is made easy by a formal procedure. In pattern recognition and in image processing, feature extraction is a special form of dimensionality reduction. The main goal of feature extraction is to obtain the most relevant information from the original data and represent that information in a lower dimensionality space.

II. MOTIVATION

Power outages and power thefts are increasing day by day. There are some parts of the nation where electricity is not available. So in order to avoid power thefts, power outages there is need to know amount of electricity used by each and every

house, so that power surplus problem can be avoided. Now normal meters are vulnerable to many attacks. Whereas smart meters are intelligent and can detect attacks on it. Forecasting has huge impact if done properly and can solve these problems efficiently. Prediction model using proper technique can help us to get more accurate value. Nowadays Prediction model often fail to predict accurate value due to dataset inaccuracy and modelling technique used. Motivation for this work lies in helping utilities to predict the consumption more accurately to solve problems they are facing due to inaccuracy.

III. METHODOLOGY

3.1 Proposed Model

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of which it is concluded

3.3.1 Canny edge detection algorithm:

Canny edge detection is a technique to extract useful structural information from different vision objects and dramatically reduce the amount of data to be processed. Process of canny edge detection algorithm has following steps:

a. Apply Gaausian filter algorithm to smooth the image in order to remove the noise.

b. Find the intensity gradient of the image

Gausian filter:

To smooth the image, a Gaussian filter is applied to convolve with the image. This step will slightly smooth the image to reduce the effect of the noise on the edge detector. The equation for the Gaussian filter kernel of size (2k+1)(2k+1) is given by:

$$H_{ij} = \frac{1}{2\pi\sigma^2}\exp\left(-\frac{(i-(k+1))^2+(j-(k+1))^2}{2\sigma^2}\right); 1 \le i, j \le (2k+1)$$

3.3.2 Discrete Wavelet Transform

In numerical analysis and functional analysis, a discrete wavelet transform (DWT) is any wavelet transform for the wavelets are discretely sampled. The DWT of signal x is calculated by passing it through a series of filters. First the samples are passed.

$$y[n] = (x * g)[n] = \sum_{k=-\infty}^{\infty} x[k]g[n-k] y[n] = (x * g)[n] = \sum_{k=-\infty}^{\infty} x[k]g[n-k]$$

The signal is also decomposed simultaneously using high pass filter. Since half the frequencies are removed, half the samples can be discarded according to Nyquist rule. The output of the filters is processed as follows:

$$y_{\text{low}}[n] = \sum_{k=-\infty}^{\infty} x[k]g[2n-k] y_{\text{low}}[n] = \sum_{k=-\infty}^{\infty} x[k]g[2n-k]$$

$$y_{\text{high}}[n] = \sum_{k=-\infty}^{\infty} x[k]h[2n-k]$$

3.3.3 Hidden Markov Model(HMM):

HMM is a statistical markov model in which the system being modeled is assumed to be a markov processwith unobserved (hidden) states.

General description of HMM is as follows:

$$\begin{aligned}
&NN = = number of states \\
&TT = = number of observations \\
&\theta_{i=1...N} \theta_{i=1...N} = = emission parameter for an observation associated with state ii \\
&\phi_{i=1...N,j=1...N} \phi_{i=1...N,j=1...N} = = probability of transition from state ii to state jj \\
&\phi_{i=1...N} \phi_{i=1...N} = = NN-dimensional vector, composed of \phi_{i,1...N} \phi_{i,1...N}; must sum to 11, t. \\
&(hidden) state at time t \\
&y_{t=1...T} y_{t=1...T} = = observation at time t \\
&F(y|\theta) F(y|\theta) = = probability distribution of an observation, parametrized on \theta\theta \\
&x_{t=2...T} x_{t=2...T} \sim \sim Categorical(\phi_{x_{t-1}}) Categorical(\phi_{x_{t-1}}) y_{t=1...T} y_{t=1...T} \sim \sim F(\theta_{x_t}) F(\theta_{x_t})
\end{aligned}$$

3.3.4 Support Vector Machine(SVM):

Support Vector Machines are supervised learning models with associated learning algorithms that analyze data used for classification and regression analysis.

Computing the SVM classifier amounts to minimizing an expression of the form

$$\left[\frac{1}{n}\sum_{i=1}^{n} \max(0, 1 - y_i(w \cdot x_i - b))\right] + \lambda w^2. \quad (2) \left[\frac{1}{n}\sum_{i=1}^{n} \max(0, 1 - y_i(w \cdot x_i - b))\right] + \lambda w^2.$$

IV. RESULT ANALYSIS:

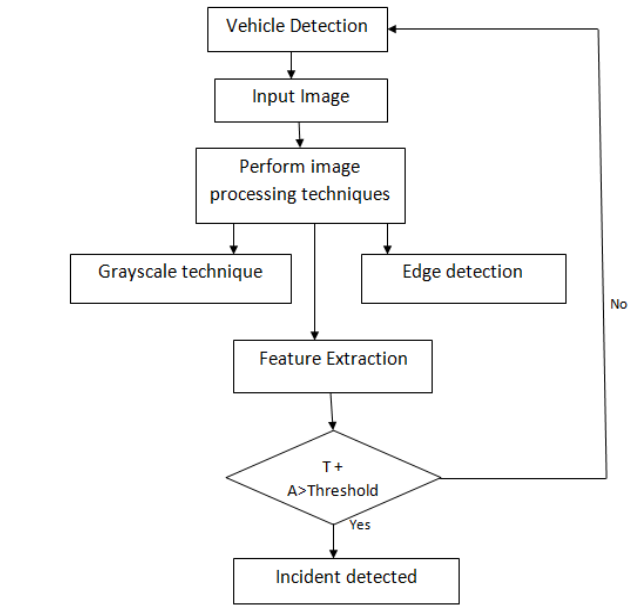

Fig.1 Incident detection algorithm flowchart

There are some parameters to evaluate the incident detection algorithm: FAR is False Alarm rate and MTTD is Mean Time To Detect.

A. False Alarm Rate(FAR):
FAR is the ratio of false detected incidents by the systems to total real incidents, which can be given as percentage.

B. Mean Time To Detect(MTTD):

TTD is the time to detect until the system gives the result.

In oreder to compare the results of the proposed algorithm and other methods such as SVM,ANN and many more, we used FAR and MTTD to evaluate the system. Table 1 shows the comparison of the results using different methods.

Table 1

The comparison performance of proposed algorithm and other methods

Detection Method	**Proposed Method**	**HMM**	**SVM**	**Partial squares regression**
FAR(%)	0.9		1.03	2.15
MTTD(s)	10		41	29

The below graph shows the efficiency comparison of proposed method and reference mehod:

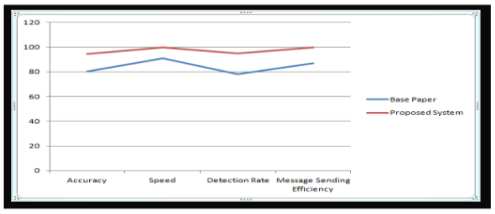

Fig.1 Efficiency comparison graph

Table 2

The efficiency based on each parameter of proposed method

Parameter	**Proposed Method**	**Reference method**
Accuracy	91	81.7
Speed	98.2	87
Detection Rate	97.8	78.3
Message Passing efficiency	100	82

The experimental incident detection result shows that the best true detection rate has just 0.9 for false alarm rate and the meantime to detect based on the proposed method is about 10 seconds. Comparison between the results of the proposed algorithm and other methods shows that proposed algorithm has better performance in detection. Also the proposed system shows accuracy in transformation of messages to the emergency centers.The proposed AID system has a good performance for the real time intelligent transportation system using highways and intersections.

Time complexity:
The running time consist of N loops(iterative and recursive) that are logarithmic, thus the algorithm is a combination of linear and logarithmic. The time complexity of the algorithm is **0(N*log(N))**.

V. CONCLUSION

The proposed AID algorithm will detect an incident on a roadway. For this goal, the most affected traffic incident featured have been selected such as traffic flow, acceleration, angle and direction of vehicles. These features have the most effect on traffic data when an incident happens. After extracting the features, AID system will analyze the data in order to detect the incident.

REFERENCES

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