A Road Safety Approach towards Object Detection Using Image Processing and Deep Learning Techniques

[1]S.Priyadarsini, [2]G.VijiPriya, [3]Dr.E.S.Shamila

[1]Student Scholar, [2]Assistant Professor, [3]Associate Professor.
Department of computer Science and Engineering,
Jansons Institute of Technology, Coimbatore, India.

Abstract: **An image recognition model simply detect the probability of an object in an image. In contrast to this, object localization refers to identifying the location of an object in an image. An object localization algorithm will give the coordinates of the location of an object in an image to represent its location of an object with respect to the image. Object detection is one of the domain witnessing great success in computer vision. This paper explains the role of deep learning techniques based on convolutional neural network for object detection. A vision based speed breaker and crack detection for early warning notification will focus on the road region and detecting the speed breaker and crack on the road. The system will warn the drivers to slow down their car by reducing a motor speed when they are approaching the speed breaker. With this system, the driver can slow down their car at the appropriate time. This is achieved with CNN algorithm and it does not need its input to be fixed size. The Expectation-Maximization (EM) algorithm is a way to find maximum-likelihood estimates for model parameters when your data is incomplete, has missing data points, or has unobserved (hidden) latent variables which is used to detect cracks on roads.**

Index Terms: **OCR, EM, CNN, ANN.**

I. Introduction:

In recent days population of on road vehicles have been rapidly increasing which leads to more accidents. Due to which The Indian Road Congress passed a law to implement speed breakers in over traffic areas, school region, etc. Road surfaces can be classified into different categories such as smooth roads, potholes, bumps, contraction joints, man holes, expansion joints etc [3]. The surfaces where one has to slow down his speed are potholes and bumps. So to detect a speed breakers and putting them on to the server can provide the driver prior information about the roads so they could be able to roughly figure out what time would be taken to complete the journey. This project is mainly based on the road safety system which avoids accident due to the above mentioned problems. The task is challenging because there is a small difference between a crack and noise besides the cracks have a strong variance in intensity throughout **[1].** Automatic crack detection and characterization systems are being developed for fast and reliable pavement surface defect analysis, instead of relying solely in the slower and subjective traditional human inspection procedures, also contributing to the development of a safer survey methodology, particularly when monitoring high-speed roads like highways [2]. We propose a safety transportation system which consist detect the presence of speed breakers and cracks on the roads. This system gives the driver a intimation about the presence of the two constrains and it helps the drivers to slow down the engine speed in order to avoid accidents. In addition to the above features an extra feature of name board (pluck cards) are indicated.
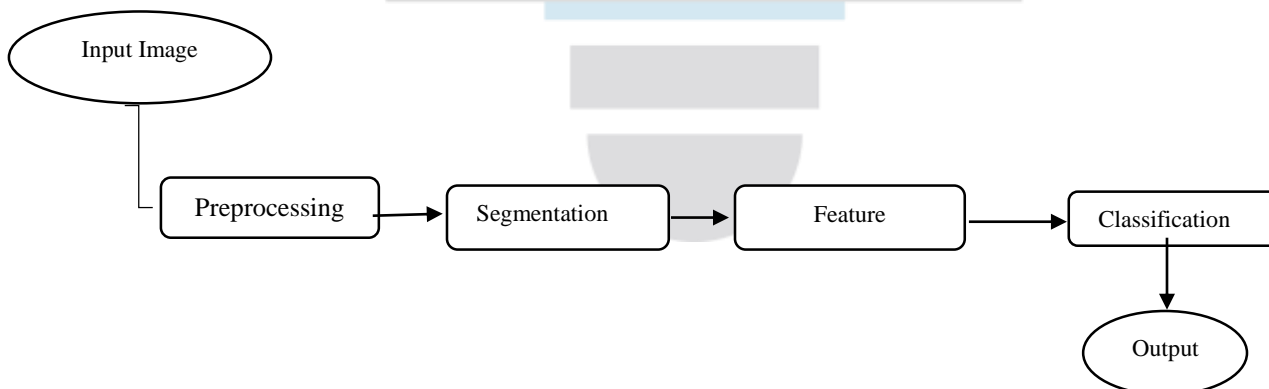

Fig.1 Block Diagram

II. Related Works

[1]. Henrique Oliveira (2013) the first task addressed, i.e., crack detection, is based on a learning from samples paradigm, where a subset of the available image database is automatically selected and used for unsupervised training of the system. To identify this, author classifies non-overlapping image blocks as either containing crack pixels or not. The successive task deals with crack type characterization, for which another classification system is constructed, to characterize the detected cracks' connect components.

[2]. Vinay Rishiwal and Hamshan Khan [2016] Recent studies have shown that road surface monitoring is essential for the municipal corporations as well as for travelers for choosing the best road possible. Such schemes provide the comfort and security to the vehicle travelers. They presents a vibration based approach for automatic detection of potholes and speed breakers along with their co-ordinates. In this approach, a database is maintained for each road, which is made available to the public with the help of global database or through a portal. Potholes and speed breakers are detected along with their severity using android's built-in accelerometer.

[3]. Mahbuba Afrin and co,[2015] The excessive use of speed breakers on national highways distracts vehicle drivers. In addition to that, riders often can't recognize the appearance of unmarked speed breakers and lose control of the vehicle, causing serious accidents and loss of lives. There exist a few methods to warn on-road drivers about the upcoming speed breakers which are highly error-prone and time consuming. Moreover, none of them pay any heed to track the information of infringing speed breakers. In this paper, we come forward with a system that facilitates autonomous speed breaker data collection, dynamic speed breaker detection and warning generation for the on-road drivers. Our system also incorporates real-time tracking of driver, vehicle and timing information for speed breaker rule violations. Authors proposed outperforms the state-of-the-art works with which it is compared to in terms of response time and accuracy.

III. PROPOSED SYSYTEM

Conventional approach is used to first segment and recognizes each character and then to predict a word based on a language model or a combination of heuristic rules. These approaches are highly sensitive to various distortions in images causing character-level segmentation imperfections. Our recognition models outperform Methods with handcrafted features and several deep neural-based methods focusing individual characters, indicating the benefits of learning sequential information. It achieves the best results in text retrieval. The model is implemented with the help of HOG and LBP for Extraction. CNN is used for speed breaker detection which gives efficient result by identifying it early so that the speed can of the vehicle can be reduced. Similary for crack detection segmentation process is done by using GMCL algorithm.
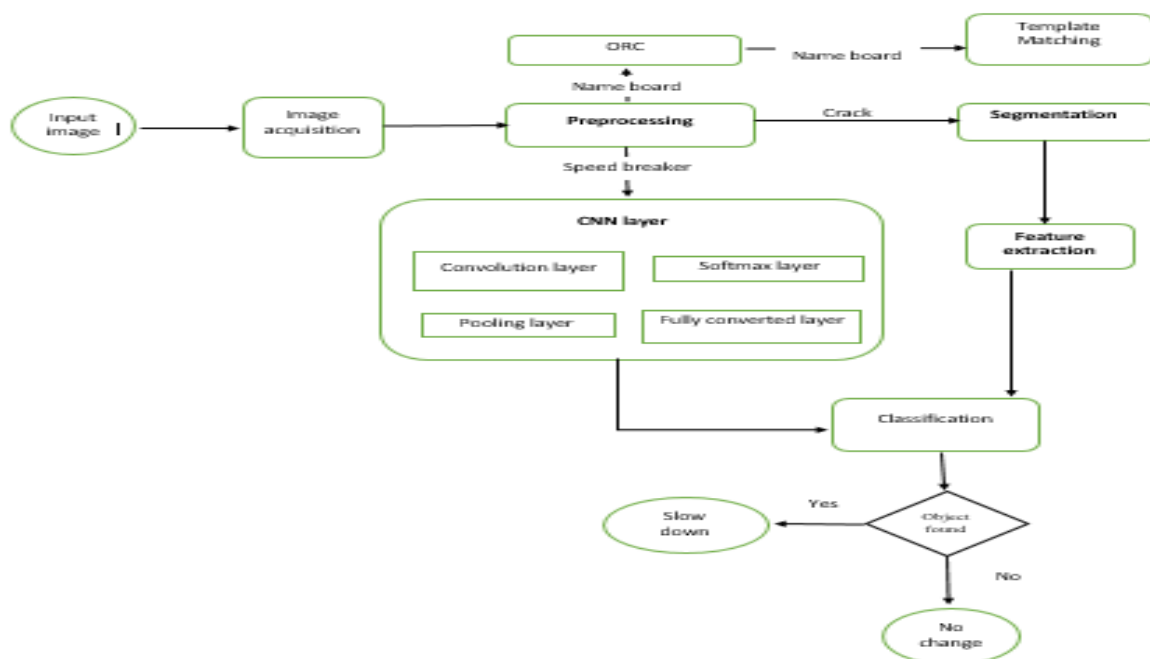

Fig.2 Schematic Overview of the proposed system

MODULE DESCRIPTION

A.SPEED BREAKER DETECTION

Image Acquisition:

Image Acquisition is a process of getting an input image for the detection of speed breaker using digital image processing.

Pre-processing:

Pre-processing is a common name for operations with the images at the lowest level of abstraction both input and output is the input images. The aim of preprocessing is an improvement of image data that suppress unwanted image data distortions or enhance the some image features important for the further processing.

Following categories of image pre-processing methods according to the size of pixel neighborhood that is used for the calculation of new pixel brightness:

1. Pixel brightness transformations
2. Geometric transformations
3. Pre-processing methods that use a native locality of the processed pixel,
4. Image restoration that requires information about the entire image

CREATE CNN LAYERS

Convolution Layer:

Also referred to as Conv. layer, it forms the basis of the CNN and performs the core operations of training and subsequently firing the neurons of the network. It performs the convolution operation over the input volume as specified in the previous section, and consists of a 3-dimensional organization of neurons.

The Pooling Layer

The pooling layer is typically placed after the Convolutional layer. Its primary utility lies in sinking the spatial dimensions (Width x Height) of the Input Volume for the next Convolutional Layer. It does not affect the depth measurement of the Volume.

The Fully Connected Layer

The Fully Connected layer is configured exactly the way its name implies: it is fully connected with the output of the preceding layer. Fully-connected layers are typically used in the last stages of the CNN to connect to the output layer and construct the wanted number of outputs.

B.CRACK DETECTION
Image Acquisition

Image acquisition is a process of getting an input image for the process of automatic detection of cracks using digital image processing.

Pre processing

Pre-processing is a common name for operations with the images at the lowest level of abstraction both input and output is the input images. The aim of pre-processing is an improvement of image data that suppress unwanted image data distortions or enhance the some image features important for the further processing.

Segmentation using Expectation Maximization:

Image segmentation is the process of dividing a digital image into multiple segments (sets of pixels, also known as super-pixels). The goalmouth of segmentation is to simplify and/or change the representation of an image into something that is more meaningful and easier to investigate. Image segmentation is characteristically used to locate objects and boundaries (lines, curves, etc.) in images. More exactly, image segmentation is the process of assigning a label to every pixel in an image such that pixels with the same label share certain features.

Expectation Maximization Segmentation:

The EM algorithm is an efficient iterative procedure to compute the Maximum Likelihood (ML) evaluation in the presence of missing or hidden data. In ML estimation, we wish to estimate the perfect parameter(s) for which the observed data are the most likely. Each iteration of the EM algorithm contains of two processes: The E-step, and the M-step. In the expectation, or E-step, the missing

data are projected given the observed data and current approximation of the model parameters. This is achieved using the conditional expectation, explaining the choice of vocabulary

FEATURE EXTRACTION

Feature extraction is related to dimensionality decrease. When the input data to an algorithm is too large to be processed and it is suspected to be redundant then it can be transformed into a reduced set of features. Defining a subset of the initial features is called feature selection.

Feature extraction designates the appropriate shape information contained in a pattern so that the task of classifying the pattern is made easy by a formal procedure. Feature extraction is done after the preprocessing phase in character gratitude system. The primary task of pattern recognition is to take an input pattern and correctly assign it as one of the possible output lessons. This process can be divided into two general stages: Feature selection and Classification. Feature selection is critical to the whole process since the classifier will not be able to recognize from poorly selected features. Standards to choose features given by Lippman are: "Features should contain information required to distinguish between classes, be indifferent to irrelevant variability in the input, and also be limited in number, to authority, efficient computation of discriminant functions and to boundary the amount of training data required".

Feature selection of a feature extraction method is the single most important factor in achieving high presentation. Feature extraction has been given as "extracting from the raw data information that is most appropriate for classification purposes, while minimizing the within class pattern variability and enhancing the between class pattern variability". Thus, selection of a suitable feature extraction technique conferring to the input to be applied needs to be done with utmost care. Compelling into consideration all these factors, it becomes essential to look at the various available techniques for feature extraction in a given domain, covering vast possibilities of cases.

Different type of features is present for image such as colour based feature, shape feature, histogram, and texture feature, chromatic. In our project we take statistical structures.

Statistical feature of an image:

Statistics is the study of the collection, organization, analysis, and interpretation of data. It deals with all aspects of this, including the planning of data collection in terms of the design of surveys and experiments. This is the meaning of statistics. Statistical feature of image contains

- Mean
- Variance
- Skewness
- Standard deviation

CLASSIFICATION

In order to categorize a set of data into different classes or categories, the relationship between the data and the classes into which they are classified must be well understood.
To achieve this by computer, the computer must be trained
- ♦ Training is important to the success of classification
- ♦ Classification techniques were originally developed
- ♦ Out of research in Pattern Recognition field Computer classification of remotely sensed images involves the process of the computer program learning the relationship between the data and the information classes.

IV. RESULT

In this project, we have presented a convolutional neural network-based object detection system that learns to automatically detect the object using image processing and deep learning techniques. By leveraging large, multi-layer CNNs, we train powerful and robust object detection and recognition modules.
When any objects like speed breaker and crack are detected the engine speed of the vehicle is reduced in order to avoid accidents and vehicle damage.

Result of speed breaker, crack and name board detection.

PERAMETER	MEASURE
Accuracy	9.8
Sensitivity	9.7
Precision	100
False positive rate	0
F1-score	9.84
Mathews correlation sscoefficient	8.5
Kappa	8.4
Error	1.9

The above table represents the result obtained from the speed breaker, crack and name board detection.

V. CONCLUSION

In this paper the text is retrieved from the input image and it is matched with other images in the trained dataset. Similar images are matched based on the feature extracted and displayed in the output. This is done efficiently with several image processing and deep learning techniques. To make this efficient objects like speed breaker and cracks on the road is detected. CNN is used to detect the objects. Compared to other algorithms CNN achieves the best result. As future enhancement GPS can be added to the road safety system.

REFERENCES

[1]. N.Hassan, S.Mathavan, K.Kamal "Road Crack Detection Using the Particle Filter" Proceedings of the 23rd International Conference on Automation & Computing, University of Huddersfield, Huddersfield, UK, 7-8. 2017.

[2]. H. Cheng and M. Miyojim, "Automatic pavement distress detection system," Inf. Sci., vol. 108, no. 1–4, pp. 219–240, Jul. 1998.

[3]. J. Eriksson, L. Girod, B. Hull, R. Newton, S. Maden, and H. Balakrishnan, "The pothole patrol: using a mobile sensor network for road surface monitoring," in Proc. of the 6th International Conference on Mobile Systems, Applications, and Services, ser. MobiSys'08, pp. 29–39, 2008.

[4]. M. Salman, S. Mathavan, K. Kamal and M. Rahman, "Pavement crack detection using the Gabor filter," 16th International IEEE Conference on Intelligent Transportation Systems (ITSC 2013), The Hague, 2013, pp. 2039-2044.

[4] Q. Zou, Cao. Yu, L. Qingquan, M. Qingzhou and W. Song, "CrackTree: Automatic crack detection from pavement images." Pattern Recognition Letters 33, no. 3 (2012): 227-238.

[5]. Y. Huang and Y. Tsai, "Enhanced pavement distress segmentation algorithm using dynamic programming and connected component analysis," in Proc. 90th Meeting Transp. Res. Board, 2011.

[6]. Mohammad R. Jahanshahi, Farrokh Jazizadeh, Sami F. Masri, Burcin Becerik-Gerber, "A Novel System for Road Surface Monitoring using an Inexpensive Infrared Laser Sensor", Proc. SPIE 8345, Sensors and Smart Structures Technologies for Civil, Mechanical, and Aerospace Systems, 2012.