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Pothole Detection Using Yolo V3 A Deep Learning Approach

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A B S T R A C T

To apply different YOLO models for pothole detection. The state-of-the-art object detection framework (YOLOv3) are experimented to measure their performance involved in real-time responsiveness and detection accuracy using the image set. Every year several road accidents take place solely credited to the potholes. Technology in transportation becomes important now a days and must be developed overtime. In the era of development, there are so many roads extensions to balance the significant additions of motorized vehicles. The increasing number of vehicles caused problems such as damaged roads and lack of maintenance to the road itself. Lack of awareness to repair the damaged roads, especially potholes, make it more dangerous for riders to drive safely. This issues are more concerning right now because the increasing number of accident and mortality. To prevent accident to happen, the pothole detection system can be used. In this project, a prototype software/hardware implementation of VADD technology is being carried out. The application area is smart city solutions for better governance. On the software side, the project employs image processing algorithm YOLO for image detection. Training is carried out for YOLO algorithm using neural network software darknet. Real-time Detection and using Python language. Vehicle assisted data delivery system is an alternative to IOT based technique to monitor large areas of interest using public transport vehicle. The technique depends on installing cameras in public transport vehicles and using the feed from the camera, large places can be monitored as the vehicle travels the city on its route. The captured image is processed using embedded hardware and the processed data is hardware over to a central hub by the vehicle.

Keywords: Pothole, Yolo Algorithm

INTRODUCTION

Roads are an essential means of transportation. It carries a major percentage of passenger traffic of any country. It is known that most of the roads in developing countries would be congested and narrow resulting in poor surface quality and the maintenance of the roads is not satisfactory. Due to poor maintenance, poor surface quality or due to a variety of other reasons a pothole could be formed on roads. A pothole is a kind of disruption in the surface of a road in which a portion of the road material is damaged. In rainy seasons, if these potholes are covered by water, it might lead to accidents which might be fatal too. It gets difficult to track all the potholes by the concerned authorities. The aim of this paper is to develop a Pothole Detection System, which assists the concerned authorities to find and fix the potholes. In this work, an effort is being made to identify the potholes and report them to the relevant authorities which can help them take action. The project uses a camera as to scan the roads and detect potholes. Images and videos are captured in real-time and the YOLOv3 image processing algorithm is used. This can help to take caution while traveling on roads with potholes, this helps in enhancing the public safety and enables the concerned authorities to fix the potholes faster.while speaking about road safety, potholes play a crucial role. In India, over a period, there have been over 9300 deaths and 25000 injuries exclusively only due to potholes not taking into

consideration any other object that caused accidents.when driving for prolonged hours or under stress or tension, the driver tends to miss out concentration. One of the primary reasons behind such accidents is the driver's inability to pay attention to every single detail on the road and that's when the ADAS comes into the picture.the data can either be directly reported to the driver by giving an alert symbol in the cabin of the vehicle or the data can be used by the autonomous driverless system where the system decides on what action it needs to mete out in order to prevent a collision and ensure a safe and comfortable riding experience for the passengers.

METHODOLOGY

1. Identify potential applications like detect Pothole, report maintenance condition of roads and many more.
2. Capture images or get images from internet for the above applications. In real-time, these images will be from the camera. But for initial implementation, already available images will be used.
3. Image processing task:
   - Method or algorithm to detect or identify frames that satisfy the task or goal. For ex, if pothole is the task to be identified, then the algorithm should be able to differentiate/separate images into ones with pothole and neglect other images.
   - This image processing task can be done by image classification, object detection and other techniques.
   - In this work, we are employing YOLO object detection for our tasks.

4. YOLO object detection:
   - Using YOLO has two steps namely (1) training and (2) detection.
   - Training is giving the YOLO algorithm with sample images and training the algorithm to identify the task
   - Detection is when you give a new image (not present in the sample image), it should be able to perform the identification task on this unknown image.
   - In this project, this training and detection steps will be student task. This will be done in Keras or TensorFlow or similar software.
   - The output of training step will be weights and config file for the task at hand.

5. Implementation:
   - This step is a major student task which is an important step.
   - The YOLO algorithm needs to be written in Python by the students (Currently the students have only a MS Visual studio C version).
   - Then the weights and config file from previous step (YOLO training) will be used in the Python code and random images will be given as input.
   - The image processing Python code running on will identify the tasks in real-time and give outputs.
   - If more time is available, then a small camera can be bought, interfaced to the RTI and real-time images can also be taken to show the output. This step will be carried out if time is available.

MODELING AND ANALYSIS

IMAGE PROCESSOR:

An image processor does the functions of image acquisition, storage, preprocessing, segmentation, representation, recognition and interpretation and finally displays or records the resulting image. The following block diagram gives the fundamental sequence involved in an image processing system.

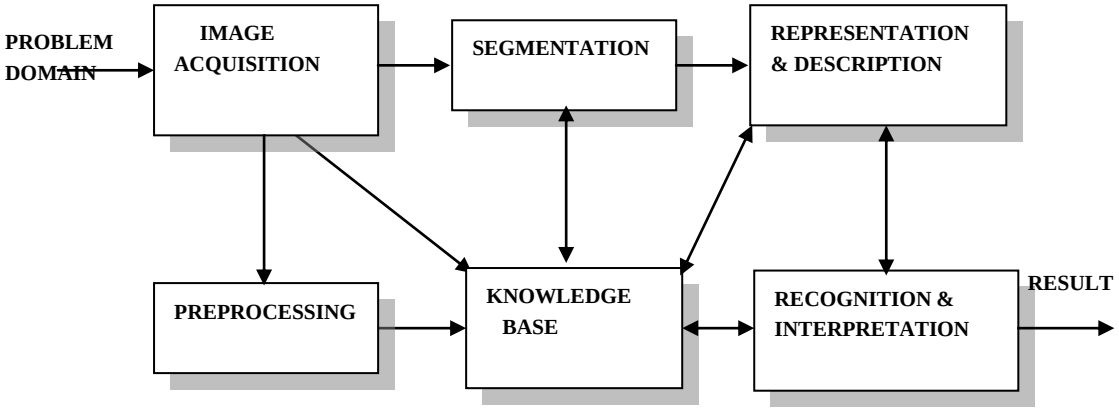

FIG 1.1 BLOCK DIAGRAM OF FUNDAMENTAL SEQUENCE INVOLVED IN AN IMAGE PROCESSING SYSTEM

As detailed in the diagram, the first step in the process is image acquisition by an imaging sensor in conjunction with a digitizer to digitize the image. The

next step is the preprocessing step where the image is improved being fed as an input to the other processes. Preprocessing typically deals with enhancing, removing noise, isolating regions, etc. Segmentation partitions an image into its constituent parts or objects. The output of segmentation is usually raw pixel data, which consists of either the boundary of the region or the pixels in the region themselves. Representation is the process of transforming the raw pixel data into a form useful for subsequent processing by the computer. Description deals with extracting features that are basic in differentiating one class of objects from another. Recognition assigns a label to an object based on the information provided by its descriptors. Interpretation involves assigning meaning to an ensemble of recognized objects. The knowledge about a problem domain is incorporated into the knowledge base. The knowledge base guides the operation of each processing module and also controls the interaction between the modules. Not all modules need be necessarily present for a specific function. The composition of the image processing system depends on its application. The frame rate of the image processor is normally around 25 frames per second.

IMAGE PREPROCESSING:

In preprocessing section, the input image may be in different size, contains noise and it may be in different colour combination. These parameters need to be modified according to the requirement of the process. Image noise is most apparent in image regions with low signal level such as shadow regions or under exposed images. There are so many types of noise like salt and pepper noise, film grains etc., All these noise are removed by using filtering algorithms. Among the several filters, weiner filter is used. In preprocessing module image acquired will be processed for correct output. Pre-processing was done by using some algorithm. For all images the pre-processing should be done so that the result can be obtained in the better way.

FEATURE EXTRACTION:

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

Texture Analysis Using the Gray-Level Co-Occurrence Matrix (GLCM). A statistical method of examining texture that considers the spatial relationship of pixels is the gray-level co-occurrence matrix (GLCM), also known as the gray-level spatial dependence matrix. Typical compromise: 16 gray levels and window size of 30 or 50 pixels on each side.

CLASSIFICATION :

In order to classify 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 key to the success of classification Classification techniques were originally developed Features are attributes of the data elements based on which the elements are assigned to various classes.

1).The image classifier performs the role of a discriminant - discriminates one class against others.

2).Discriminant value highest for one class, lower for other classes (multiclass)

3).Discriminant value positive for one class, negative for another class (two class).

RESULTS AND DISCUSSION

EXISTING SYSTEM

- Several attempts have been made to develop a method for analysing road properties by using a combination of recordings by in-vehicle cameras and image processing technology to more efficiently inspect a road surface.For example, a previous study proposed an automated asphalt pavement crack detection method using image processing techniques and a naive Bayes based machine-learning approach. In addition, a pothole detection system using a commercial black-box camera has been previously proposed.
- Internet of things (IOT) technology has been proposed in the past as a viable solution for making greener, smarter cities in India. However, there are concerns in using IOT technology such as bandwidth occupied for huge data transfer of millions of nodes, cost of deploying millions of remote nodes, maintenance issues, security and privacy concerns etc. On the other hand, an alternative technology that can support green

and smarter cities for better city governance is vehicle assisted data delivery (VADD). This solution does not overload the network bandwidth as it relies on public transport vehicles to cover large areas without using wireless network.

PROPOSED SYSTEM

- The method used for training and testing model is by YOLO Algorithm. The YOLOv3 algorithm is trained on creating labelled training set which detects objects. Camera capture the object as the input image where, video process in frame by frames with determined object created by capturing the traffic in city after collecting the image each boundary box is marked with Labelimg labelled tool of interest in each image respectively. Captured frame from the scene, predicted object are resized then it's forwarded to the YOLO node through the neural network with more efficient Darknet 53 convolutional layer for object detection. The detected object is assised with class co-ordinates and its boundary box. This system divides the image into an SxS grid. Each of these grid cells predicts B bounding boxes and confidence Scores for the boxes. Each bounding boxes consist of five predictions: X,Y,W,H and confidence. X,Y,W,H should be used in where they are locate in image.

- In recent trends, many approaches in applying deep learning for different object detection. Convolutional Neural Networks (CNNs) have the ability to learn the art of extracting features from an Image Detection of potholes is much difficult when compared to other objects such as a pedestrian, vehicles, traffic signs, etc. because the former has a wide range of geometrics.When comparing the recognition algorithms, Convolutional Neural Networks (CNN) has proven to be one of the best. In this project, potholes detection is implemented using one of the CNN family's unique representatives YOLO to a newly created dataset for Indian roads.

CONCLUSION

In this paper, method of object detection in self-driving vehicle which is classified for detecting the objects using YOLO algorithm and its configured to detect pothole with increased computation power with more resources.This solves many real world problems and improves the impact on detecting objects. Knowing pothole detection for self-driving vehicle is needed badly to solve the road lay problems like: accident, slowing down the transport system these are solved by deep learning. This provide more benefits, to drive the vehicle in safer ways with solid base of object detection module in self-driving cars. İn future more objects like building , ambulance, auto rickshaw, rocks in the road, heavy load plastic bag on roadway can be trained for object detection for making the autonomous driving system more efficient and travelling on a saver ways.

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