POTHOLE DETECTION USING MACHINE LEARNING

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Abstract:

Potholes are a structural damage to the road with hollow which can cause severe traffic accidents and impact road efficiency. In this paper, we propose an efficient pothole detection system using machine learning algorithms which can detect potholeson the road automatically. AI model are trained and tested with pre-processed dataset, including YOLO V5. In the phase one, initial images with potholes and non-potholes are collected and labelled. In the phase two, the model is trained and tested for the accuracy and loss comparison with the processed image dataset. In this method we use Google collab, Roboflow, ClearML,Comet by this end of this paper we can detect pothole using YOLO V5 and save many lives.

INTRODUCTION:

Robotics is a branch of engineering that involves the conception, design, manufacture andoperation of robots. The objective of the roboticsfield is to create intelligent machines that can assist humans in a variety of ways. The Internet of things (IoT) describes physical objects with sensors, processing ability, software, and other technologies that connect and exchange data withother devices and systems over the Internet or other communications networks. The Internet of things (IoT) and Robotics have been hand holdingeach other contributing to individual growth and development.

In modern time robots are playing an important rolein life of mankind with their advance technologies, making the human life easier and comfortable. In this YOLO V5 Object Detection we use Google Collab for training this model for pothole detection.As we can see mostly accidents occurs due to unmaintained road so we are training this model to detect pothole in the road and to alert the driver before approaching the pothole and this could prevent the vehicle breakdown and this also helps the government by providing the information aboutthe damaged road and then to repair the roads for. The benefit of the travellers. Training this modeltakes a huge task of creating the dataset and training the YOLO V5 for pothole detection.

SCOPE OF WORK:

The Model is developed to detect pothole andprevent accidents and also used for the development and maintenance of those roads.

A. PROBLEM STATEMENT:

To develop a model to prevent road accidentsand ensure road safety.

B. OBJECTIVES:

The objectives of the project are as follows:

1. To automatically detect the potholes.
2. To collect the data and use it for thoseroad management.
3. To detect the pothole on its own usingMachine Learning.

C. COMPONENTS :

- Dataset for training the model.
- Google Collab for training YOLO V5.
- Roboflow software or Makesense.ai website for labellingthe dataset.
- ClearML and Comet for visualizingand managing the dataset.
- Additionally we use PyTorch fordetecting pothole.

This paper is arranged into four sections. section I discusses the brief introduction of Robotics and IoT,section II discusses the literature survey, section III deals with methodology use for YOLO V5 pothole detection, section IV Results of the project and section V conclusion.

LITERATURE SURVEY:

S. Hegde, H. V. Mekali and G. Varaprasad, "Pothole detection and inter vehicular communication". they have proposed a pothole detection model, which can detect the potholes witha minimum depth of 1 inch and share the information within 100 m range. This idea can be extended to design vehicles capable of detecting the humps or other irregularities on the roads. The application illustrated in this work can be effectively used to reduce the problem of increasing accidents caused due to potholes.

There is also a paper which discuss on pothole detection using deep learning. P. Ping, X. Yang and Z. Gao, "A Deep Learning Approach forStreet Pothole Detection," they have discussed on training the YOLO V3 model for pothole detectionusing a custom dataset which is more or less similar to our paper.

There are many existing paper on pothole detectionwhich can be used for the further beneficial studies.

METHODOLOGY:

A. *Dataset:*

The creation of dataset plays a huge role in training the model for any custom data detection for example: we have taken pothole detection so we have to create a dataset which contains images of potholes to train the modeland to detect the images. for the YOLO V5 to detect the data should have images for trainingthe model as well as validating the images to find the output whether its detecting the pothole. For dataset we have gathered a maximum of 500 plus images of different shapes and size and structure of potholes to train and validate the yolo model.

B. *Labelling the Dataset:*

This labelling the dataset part is the most important part of the this paper we have to manually detect the potholes my placing thesquare or rectangle markers in the images present in the dataset by using Roboflow or Makesense.ai websites which are open source javascript websites to label the pothole in the given image of the custom dataset for potholedetection.

C. *Goggle Collab for training YOLO V5:*

Here to train the YOLO V5 we use afree online GPU performer to train the model which is google collab it is a python notebook where pothole detection model is trained for pothole detection. First step is to upload the dataset to collab and then unzip the data using python. then run the (custom_data.yaml) wherethe paths of the images for training and validating images of the dataset is present to train the model and its better to give more epochs because we can get more precise outputafter detection. So after training the model the output is generated there itself in yolo v5 dataset where our validating images of our own custom data set of validating images are generated with pothole detected on them. after this we try to detect the potholes in the video which we uploaded in the collab. This the work done in the Google collab.

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D. *ClearML and Comet for visualizing andmanaging the dataset:*

ClearML is completely integrated into yolo v5 to track our experimentation, managedataset version and even remotely execute trainingruns.

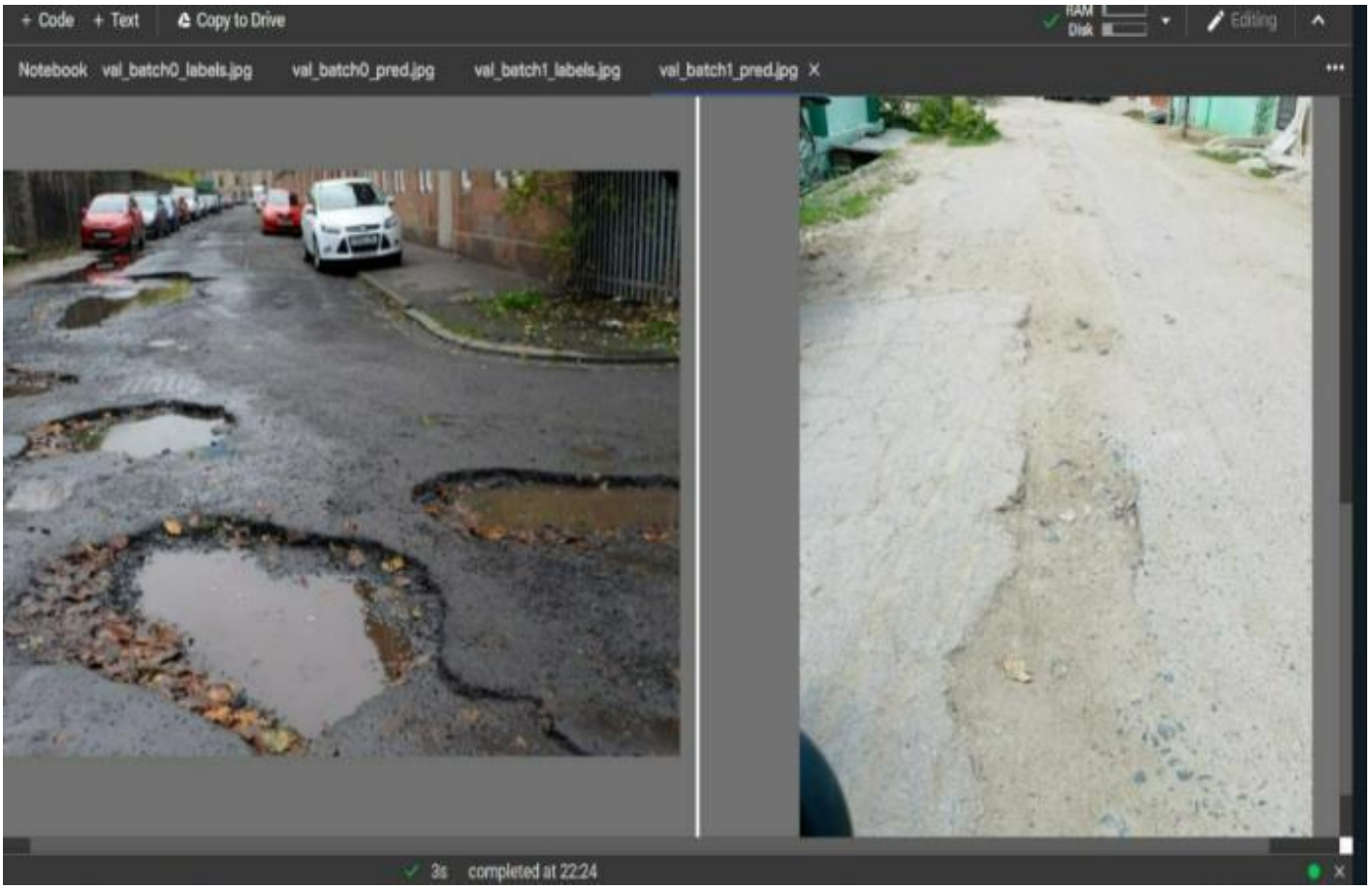
Comet track and visualize model metrics in real time, save your hyperparameters, datasets, and model checkpoints, and visualize ourmodel predictions.

E. *Additionally we use PyTorch for potholedetection:*

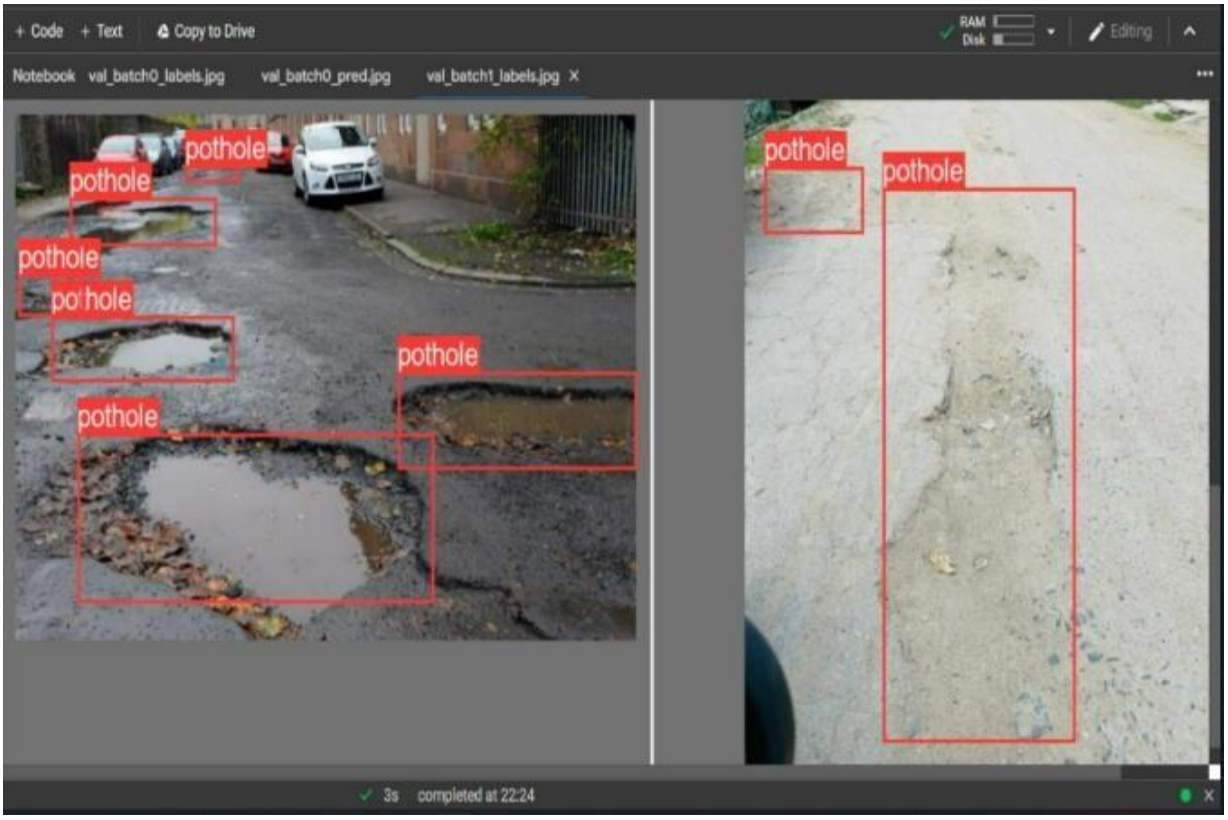
Here we use the PyTorch library of python which is used in training the python forcustom object Detection.

RESULTS:

Here is the image what we gave in ourdataset for validation



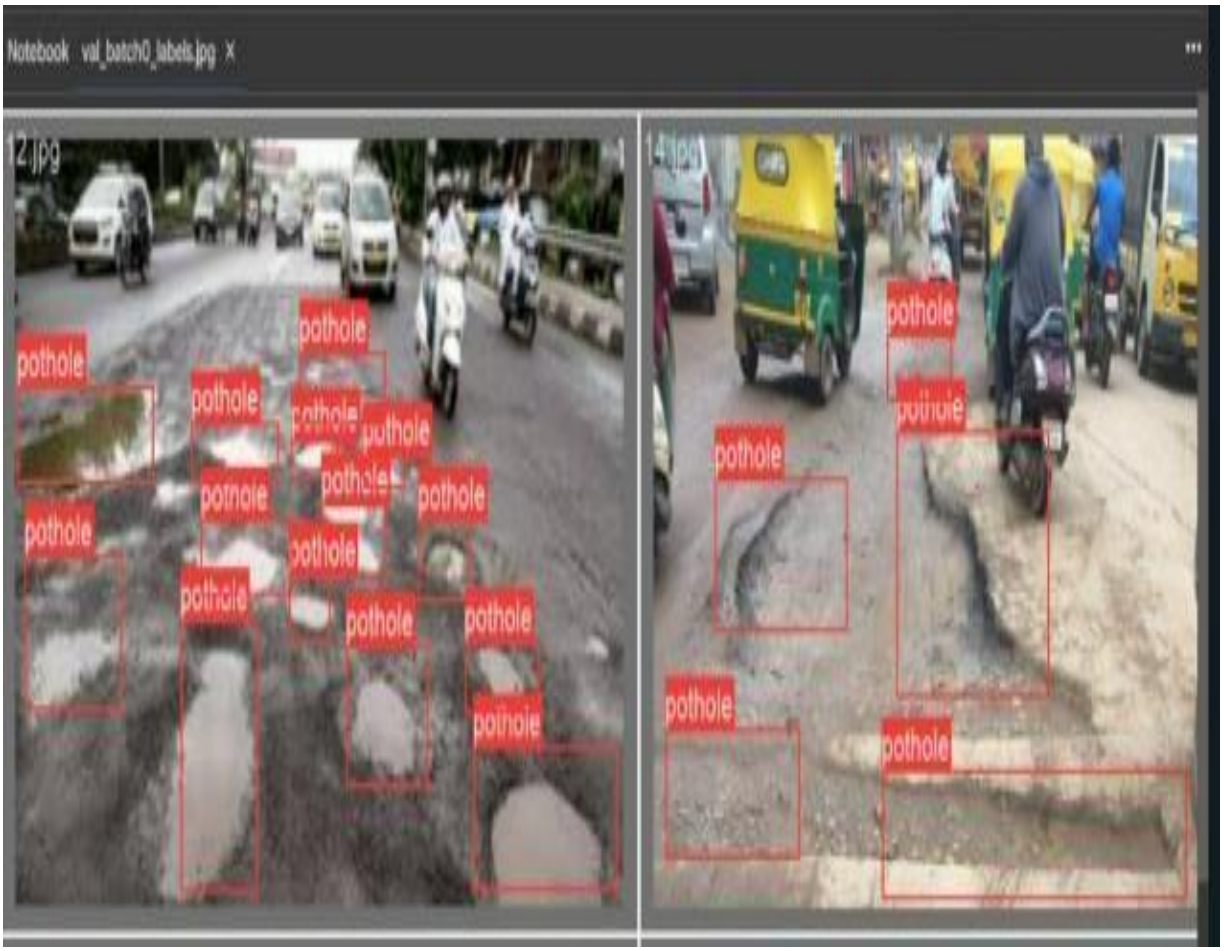
And here is the output image we got aftertraining the YOLO V5 model which has detected the potholes in the image.



And here are the results of the other validatedimages too.

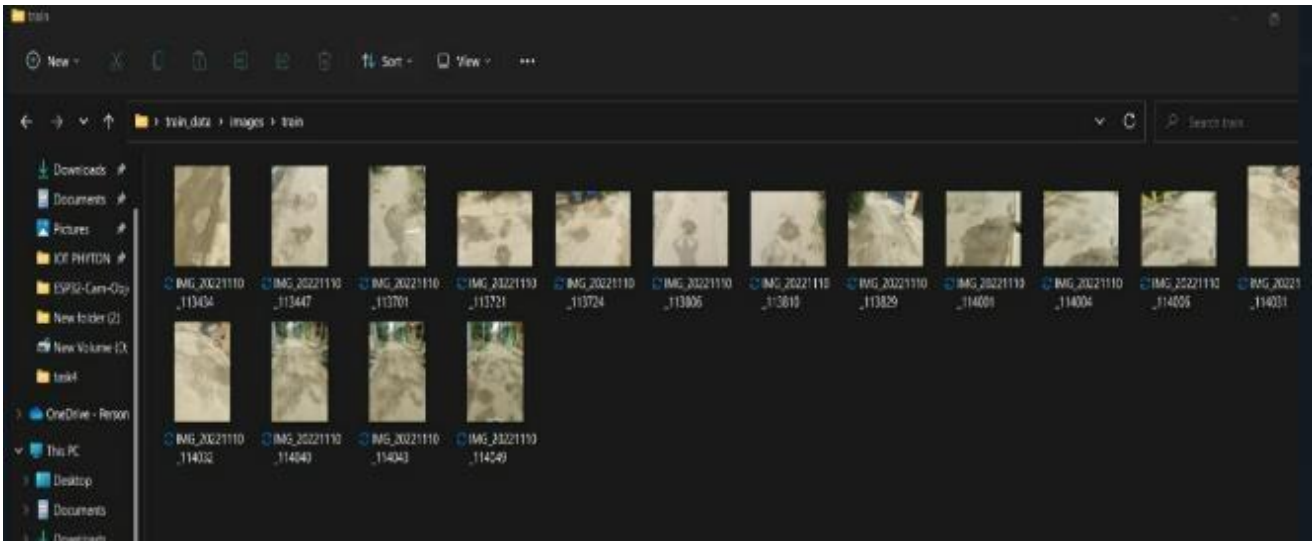
Validation image:

Labelled validated image:

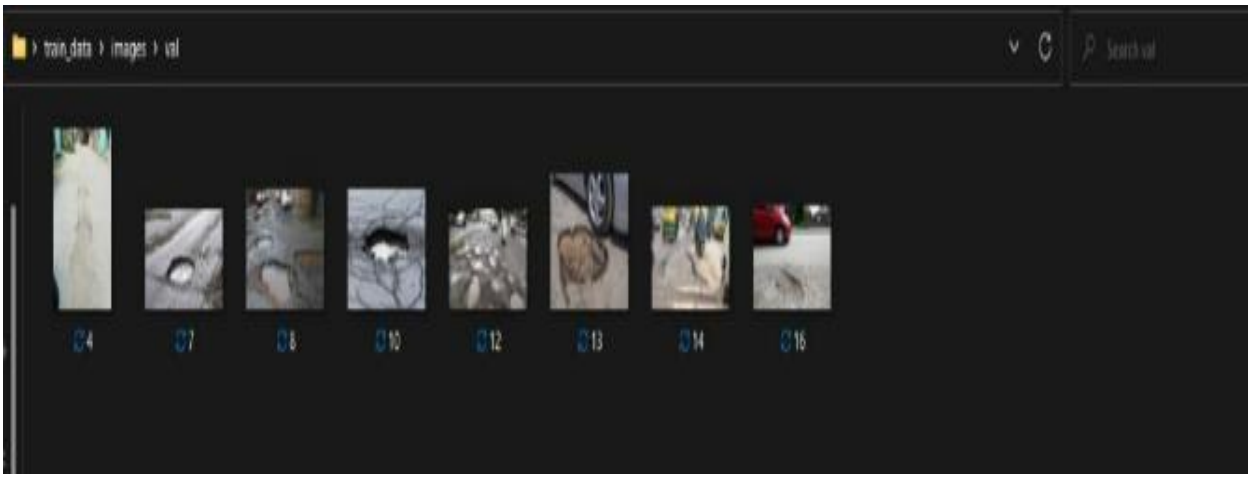


And here are the images which have been used to create the dataset for both training and validating of pothole by the YOLO V5 model.

Images used for training model: (small portion)



Images used for validating by the model:



(small portion of Dataset provided for validation)

These are the results which are produced by training the YOLO V5 model forpothole detection.

CONCLUSION:

This is the model which is been trained to detect pothole which is been developed bytraining the model using machine learning algorithms. This can prevent road accidents, improve road safety and management.

This model is developed mainly to detect the pothole and alert the driver about the pothole aheadof him and thus reduces road accidents.

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