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Road Pothole Detection using Convolutional Neural Networks

VasalaAmulya, Dr. V. Bapuji

Vaageswari College of Engineering,Karimnagar – 505 527, India

A B S T R A C T

One of the leading causes of both vehicle breakdowns and accidents on the road is the prevalence of potholes. A rise in both vehicle traffic and pollution has led to an increase in both large and small potholes on roads across the country. Here, we introduce a Convolutional Neural Network for classifying road potholes using the Tensor Flow and Keras libraries. The proposed system uses images of potholes in the road to categorise them using convolutional neural networks. In order to find potholes, the system employs a convolutional neural network model. If the CNN method is bolstered by additional feature extraction strategies, it is expected that the resulting pothole classification accuracy will improve. Using deep convolutional neural networks, we have shown their utility and potential for analysing images of potholes. With the goal of releasing this model on the Django framework running on a local host.

Keywords: Road Pothole,Deep Learning,Tensor Flow,Keras,CNN

1. INTRODUCTION

1.1 Introduction of project

Specifically, we propose employing Deep CNN (convolutional neural network) for deep learning on the problem of road potholes. As a novel approach to this problem space, we have adopted the CNN approach to deep learning after collecting a sufficient amount of data containing images of potholes under different conditions and weather. Moreover, a contrast was made between the custom-made convolutional neural model and some of the pre-rained models.

This project proposes a method for detecting potholes in roads by training a Deep Learning algorithm suitable for such a classification problem. Implementing Convolutional **Neural Networks in Tensor Flow.**

To help engineers devise a classification strategy for avoiding potholes in roads, we proposed using a dataset informed by deep learning (dl). The research employed Convolutional neural networks, a type of deep learning (CNN). If the CNN approach is bolstered by additional feature extraction methods, it is expected that roadpothole classification accuracy will improve.

2. LITERATURESURVEY

A literature review is a piece of writing that summarises the most important findings and methods related to a specific topic. Secondary sources are those that discuss previously published data and knowledge in a specific field and, in some cases, time frame.

The purpose of a literature review is to bring the reader up to speed on the state of the art in a given field, but it also lays the groundwork for other endeavours, such as potential future research in the field, and thus precedes a research proposal. It typically follows a specific structure and combines elements of summary and synthesis.

Outline of The Project:

- Define a problem
- Gathering image data set
- Evaluating algorithms
- Detecting results

The steps involved in Building the data model is depicted below.

:

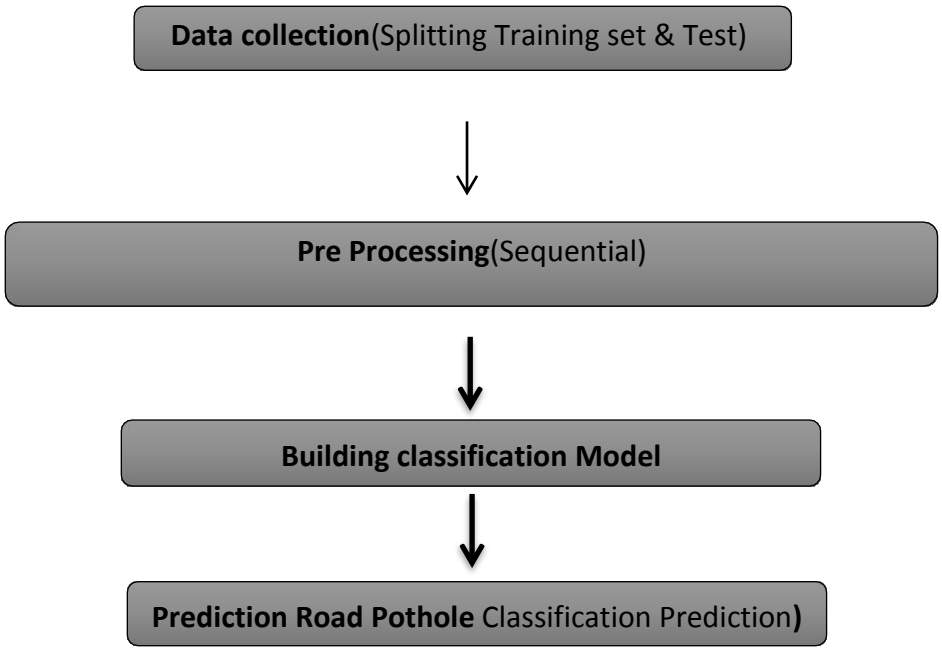

Fig: data flow diagram for CNN model

3. PROPOSED WORK

We are proposing road pothole using Deep CNN (convolutional neural network) for deep learning technique. After collecting a suitable amount of data containing the images of potholes under various conditions and weather, and implementing CNN approach of deep learning has been adopted, that is a new approach in this problem domain using pothole imaging. Also, a comparison between the self-built convolutional neural model and some of the pre-rained models has been done.

The proposed method for this project is to train a Deep Learning algorithm capable of road pothole classification, This particular classification problem can be useful for road pothole detection. The using Deep Learning with the help of Convolution Neural Networks based on TensorFlow and Keras..

4. DATASET DESCRIPTION

The search for potholes is a vital part of road maintenance.
Most computer vision methods either analyse roads in two dimensions or model them in three. But these two classes are always deployed separately. Even more so, the effectiveness of the pothole detection is not yet satisfactory. In this paper, we present a computationally efficient and highly accurate pothole detection algorithm. In order to better distinguish damaged from undamaged road areas, a dense disparitymap is first transformed. When estimating the parameters of the transformation, we use a combination of golden-section search and dynamic programming to improve the efficiency with which we deal with disparity. Otsu'sthresholdingmethodisthenusedtoextractpotentialundamagedroadareasfromthetransformeddisparitymap. Least-squares fitting is used to model a quadratic surface that fits the extracted area differences. The surface normal is also integrated into the surface modelling process to increase the robustness of the disparity map modelling. Outliers can have a smaller impact thanks to the use of random sample consensus. Potholes can be detected accurately by comparing the difference between the observed and predicted disparity maps.

5. METHODOLOGY

DUTIES: Import necessary libraries and packages Load the data

Ø Pre-processthedata
• Reshape,dataaugmentations

Ø Definemodel \s• SequentialorFunctional \s• Numberoflayerstobeused,Numberofnodestobeusedinthemodel,Evaluationmetrics
Ø Compilethemodel \s• Definelossfunction,optimizer,weightsandbias

Ø Fitthemodel \s• Traindata,Testdata,epoch,Batchsize.

The goal is to create a deep learning model for road pothole classification using a convolutional neural network algorithm and then classify the results with the highest possible accuracy.

6.LISTOFMODULES

1. Manual Net

2. Alex Net

3. LeNet

4. Deploy

MODULEDESCRIPTION

IMPORTTHEGIVENIMAGEFROMDATASET:

Using the keraspreprocessing image datageneratorfunctionalsowecreatesize,rescale,range,zoomrange,horizontalflip, we must import our data set. Thenweimportourimagedatasetfromfolderthroughthedatageneratorfunction. In this section, we configure the training, testing, and validation phases, as well as the target size, batch size, and class mode from which we will train using the CNN we have built.

POTHOLEROAD:

```
Trainned data for pothole:

 ====== Images in:  data/train/pothole
images_count:   357
min_width:      169
max_width:      3840
min_height:     168
max_height:     3840
```

PLAINROAD

```
Trainned data for plain :

 ====== Images in:  data/train/plain
images_count:   367
min_width:      160
max_width:      3840
min_height:     120
max_height:     3840
```

TO TRAIN THE MODULE BY GIVEN IMAGE DATASET:

We use a classifier and a fit generator function, along with training steps per epoch, epoch total, validation data, and validation steps, to train our dataset.

```
Model: "sequential"
_________________________________________________________________
Layer (type)                 Output Shape              Param #
=================================================================
conv2d (Conv2D)              (None, 75, 75, 32)        896
_________________________________________________________________
max_pooling2d (MaxPooling2D) (None, 37, 37, 32)        0
_________________________________________________________________
conv2d_1 (Conv2D)            (None, 12, 12, 128)       36992
_________________________________________________________________
max_pooling2d_1 (MaxPooling2 (None, 6, 6, 128)         0
_________________________________________________________________
flatten (Flatten)            (None, 4608)              0
_________________________________________________________________
dense (Dense)                (None, 256)               1179904
_________________________________________________________________
dense_1 (Dense)              (None, 4)                 1028
=================================================================
Total params: 1,218,820
Trainable params: 1,218,820
Non-trainable params: 0
```

CNN Model Summary details

6. CONCLUSION

It looked at how images from a given dataset (the trained dataset) can be used to identify road potholes using a convolutional neural network. This allows for the anticipation of the following varieties of gestures. We tried several distinct CNNs, compared their classification accuracy, and concluded that LeNet produced the most reliable results.

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