IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.301
Volume 3, Issue 1, June 2023

Convolutional Neural Network based Pothole and Driver Drowsiness Detection for Monitoring Road Condition

Parth P. Patwardhan[1], Krishna Ruparel[2], Pratik Kale[3] Prof. Ms Veena M. Lomte[4]
Students, Department of Computer Engineering[1,2,3]
HOD, Department of Computer Engineering[4]
RMD Technical Institutes, Pune, India

Abstract: *Monitoring city road and traffic conditions is a well-studied issue. Several approaches to addressing this issue have been proposed. Potholes and Drowsiness Detection is a common annoyance that most people have encountered. These bowl-shaped holes in the road cause a significant number of automobile accidents, either directly or indirectly. Starting the process of getting a pothole covered/fixed takes time because it involves notifying the appropriate authorities and having them take action. What is envisioned is the implementation of a system that involves citizens in the process of detecting potholes. Many image processing techniques (IPTs) have been proposed to inspect pavement defects in order to improve the precision and efficiency of human on-site inspections. However, the various pavement conditions resulted in IPTs with unacceptable stability. As a result, in this study, a convolutional neural network (CNN) application for pothole detection using digital images is presented. The CNNs, known as conventional CNN and pre-pooling CNN, were created, trained, and tested using 96,000 images of pavement. Based on the testing results, a stability study and a comparative study were also conducted. The results showed that the optimized pre-pooling CNN had a recognition precision of 98.95% in the testing. The stability study revealed that the optimized CNN model was robust in a variety of real-world scenarios. When compared to traditional IPT methods, CNN had a higher precision for autonomously extracting pothole features. In today's fast-paced world, a safe commute is not only everyone's priority; it is also the government's responsibility to provide a hassle-free shuttle between locations. In this paper, we propose a system for detecting road potholes. Because we all know that prevention is better than cure, we design and implement a system that not only detects potholes but also stores this data on a cloud platform that can serve as a database for future reference and allows us to analyze the data. The proposed system has two important functions: the first is to detect the pothole using an input video subsystem, and the second is to detect the driver's drowsiness and store this information on a cloud base that other users can access to help them detect potholes on their route. Once the location of the potholes is known, government officials can be notified.*

Keywords: Potholes Detection, Congested Traffic, Drowsiness Detection, Convolutional Neural Network (CNN), etc.

I. INTRODUCTION

Road traffic accidents, in particular, claimed nearly 1.25 million lives each year. It demonstrates that the majority of road accidents are caused by poor road conditions. Bad roads are a major issue for vehicles and drivers because road deterioration leads to more expensive maintenance, not only for the road but also for vehicles. As a result, road surface condition monitoring systems are critical solutions for improving traffic safety, reducing accidents, and protecting vehicles from damage caused by poor road conditions. Both road managers and drivers want accurate information about the quality of road infrastructure. Consolidated approaches to monitoring road surface conditions include the use of expensive and sophisticated hardware, such as ultrasonic sensors and data acquisition systems. These approaches are expensive to install and maintain, and they necessitate a lotof manual labour, which can lead to errors when deploying

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.301
Volume 3, Issue 1, June 2023

or collecting data. Another option is to use sensing technologies to obtain this information in order to solve theproblem of monitoring road surface condition. Smartphones are widely used nowadays. The majority of them are outfitted with various machine learning techniques such as CNN, Eye Blink Detection Algorithm, and so on. Thus, one of such useful applications for monitoring street conditions is real-time system-based road condition monitoring.

II. RELATED WORK

In this section, we first introduce the dangers caused by poor road conditions. We thengive the drawbacks of traditional monitoring systems and explain why it cannot be applied to keep roads in good conditions. Finally, we discuss our motivation.

Dangers Caused by Poor Road Conditions:

The U.S. Congress passed in a rare bipartisan effort the Surface Transportation Reauthorization and Reform Act of 2015, which provides $233 billion for federal highway maintenance over five years. That is $46 billion peryear [10]. The fact shows that every year governments need to spend much money on maintaining road conditions. However, the road conditions of U.S are still poor even though it has cots government so much to maintain road conditions. According to the research, in the cities with worst road conditions in U.S, the ration of poor roads is over 50%. It is a really challenging task to keep roads in good conditions but governments need to do this because poor road conditionscan cause many dangers.

There are several dangers that may cause by poor road conditions. First of all, hitting a pothole may cause damages to vehicles. The damages may not only occur in automotive chassis but also in tire puncture and wire rim. In most cases, these damages may just make you pay for repair charge. However, the worse case is traffic accidents. According to statics, one-third accidents involve poor road conditions of approximately 33,000 traffic fatalities each year [10]. Moreover, the number of accidents is predicted to become larger with increases in vehicle traffic in next years.

Drawbacks of Traditional Monitoring Systems:

A traditional monitoring system is not useful in helping road maintainers fix road surfaces rapidly. These systems are designed to do an overall check on roads. Therefore, it will include many unnecessary check for just fixing the road surface and result in long latency. Moreover, traditional monitoring system often usesensors placed on roads or specific monitoring cars. Limited by the cost, tradition monitoring systems are hard to scale up and then cannot monitor most roads in cities. For example, one current equipment used in measuring road condition, which is composed by accelerometers, distance measuring instruments and graphic displays is quite expensive [11]. These road condition systems may cost 8,000 to 220,000 dollars. These two drawbacks determine that traditional road monitoring system cannot be applied in fixing road surfaces rapidly to keep roads in good conditions

III. MOTIVATION

Private vehicles have been more and more popular in recent years. To guarantee driving safety, governments take frequent repairs to keep roads in good conditions. Therefore, how to identify roads in poor conditions quickly is important since road maintainers cannot repair any poor conditions roads without identifying them. Fortunately, a road monitoring system may help road maintainers achieve this goal. However, traditional road monitoring systems are long-latency and high-cost. Therefore, they cannot be applied to identify poor condition roads quickly. This motivates us to propose a reliable pothole detecting with low latency in detecting potholes. To reduce the cost, we choose two main modules as our data-collecting equipment. First we take real input video and preprocessing using CNN and detect the potholes and second one is detect Driver Drowsiness with the help of real camera. To improve detection accuracy, we use machine learning methods to compute a more accurate threshold in identifying potholes and Driver Drowsiness.

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.301
Volume 3, Issue 1, June 2023

IV. PROPOSED SYSTEM

Propose system is a real-time Web Based Application that predicts road quality based on tri-axial CNN and Eye Blinking Algorithm, displays the road condition trace on a, and saves all recorded workout entries. To classify road segments and build our model, we use a classifier on training data.

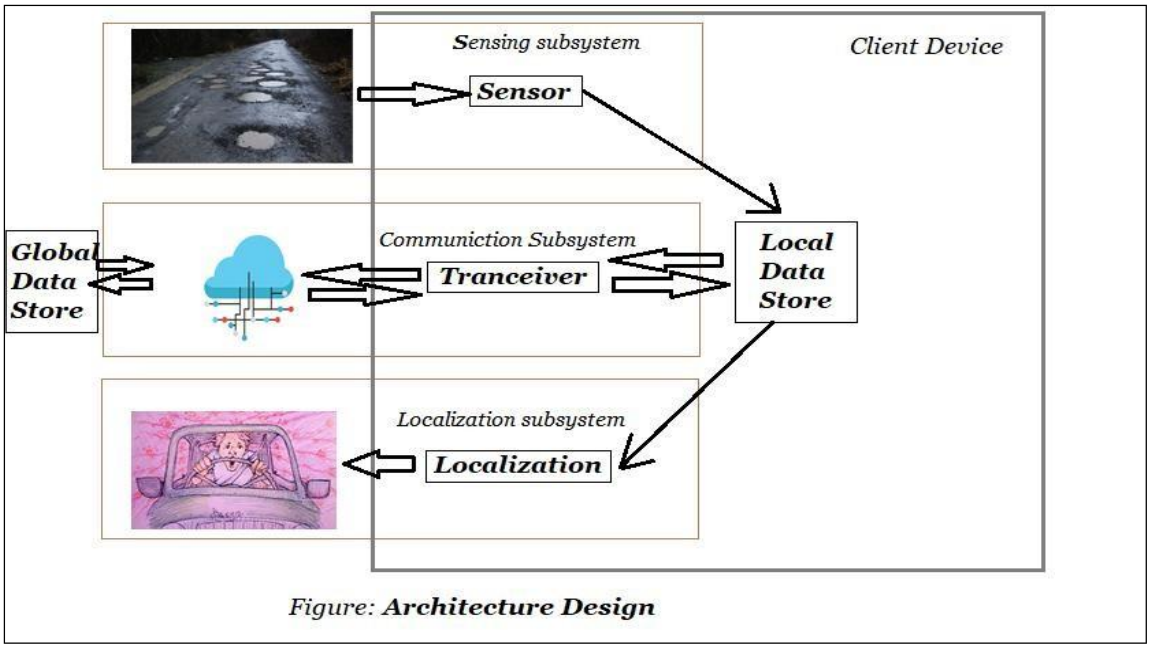

Fig.1: Proposed System Architecture

Using ML techniques, we hope to create a road condition recognition system that detects, analyzes, identifies, and predicts the state of road segments. Our system is not reliant on any pre-existing infrastructures or additional hardware. ML Techniques could detect and identify road conditions in our system based on input video readings. The proposed system has two important functions: the first is to detect the pothole using an input video subsystem, and the second is to detect the driver's drowsiness and store this information on a cloud base that other users can access to help them detect potholes on their route. Once the location of the potholes is known, government officials can be notified.

V. ALGORITHM

Convolutional Neural Network

CNN is one of the main categories to do image recognition, image classification. Object detection, face recognition, etc., are some of the areas where CNN are widely used. CNN image classification takes an input image, process it and classify it under certain categories (happy, sad, angry, fear, neutral, disgust). CNN is a neural network that has one or more convolutional layers.

Step 1: Dataset containing images along with reference potholes is fed into the System. The name of dataset is potholes and face detection which is an open – source data set that was made publicly available on a Kaggle.

Step 2: Now import the required libraries and build the model.

Step 3: The convolutional neural network is used which extracts image features f pixel by pixel.

Step 4: Matrix factorization is performed on the extracted pixels. The matrix is of m x n.

Step 5: Max pooling is performed on this matrix where maximum value is selected and again fifixed into matrix.

Step 6: Normalization is performed where the every negative value is converted to zero.

Step 7: To convert values to zero rectifified linear units are used where each value is ffiltered and negative value is set to zero.

Step 8: The hidden layers take the input values from the visible layers and assign the weights after calculating maximum probability.

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.301
Volume 3, Issue 1, June 2023

VI. CONCLUSION AND FUTURE WORK

Finally, we investigated a machine-learning algorithm for predicting road quality. For object detection, a unified model and convolutional neural network are used. To modify and predict potholes and detect drowsiness, the deep learning model is trained with pothole images. A Deformable parts model or CNN model can be trained with images to predict potholes, but when compared, CNN and Eye Blinking perform better and produce promising results in terms of time, speed, and accuracy. Better training data could help the model perform better. This model can be packaged as an API in Flask and integrated with a mobile application to report potholes to the government, thereby closing the communication gap between the government and its citizens. This model can also be used in real-time to predict potholes in autonomous vehicles, allowing them to avoid or implement a strategy to reduce passenger discomfort. The Road Sense application aims to provide its users with more information about the routes they take. With more work in this area, this project could play a proactive role in improving road conditions in developing countries. To that end, our system can be used to develop a personal road warning system that keeps a historical record of road conditions. In the future, we hope to improve the road type detection algorithm by detecting other road anomalies and experimenting with different machine learning classifiers.

VII. ACKNOWLEDGMENT

We would prefer to give thanks the researchers likewise publishers for creating their resources available. We are conjointly grateful to guide, reviewer for their valuable suggestions and also thank the college authorities for providing the required infrastructureand support

REFERENCES

[1]. W. H. Organization. (2015) Global status report on road safety. [Online]. Available: http://www.who.int/violence injury prevention/road safetystatus/2015/en.pdf/

[2]. R. Madli, S. Hebbar, P. Pattar, and V. Golla, "Automatic detection and notification of potholes and humps on roads to aid drivers," IEEE Sensors Journal, vol. 15, no. 8, pp. 4313–4318, 2015.

[3]. P. Mohan, V. N. Padmanabhan, and R. Ramjee, "Nericell: rich monitoring of road and traffic conditions using mobile smartphones," in Proc. 6th ACM Conf. Embedded Netw. Sensor Syst, Raleigh, NC, USA, 2011, pp. 323–336.

[4]. J. Eriksson, L. Girod, B. Hull, R. Newton, S. Madden, and H. Balakrishnan, "The pothole patrol: using a mobile sensor network for road surface monitoring," in Proc. 6th Int. Conf. Mobile Syst.Appl. Services, New York, NY, USA, 2008, pp. 29–39.

[5]. A. Mednis, G. Strazdins, R. Zviedris, G. Kanonirs, and L. Selavo, "Real time pothole detection using android smartphones with accelerometers," in Proc. Int. Conf. Distrib. Comput. Sensor Syst.Workshops, Barcelona, 2011, pp. 1–6.

[6]. M. Perttunen, O. Mazhelis, F. Cong, M. Kauppila, T. Leppnen, J. Kantola, J. Collin, S. Pirttikangas, J. Haverinen, and T. Ristaniemi, "Distributed road surface condition monitoring using mobile phones," in Proc. Int. Conf. Ubiquitous Intell. Comput, Berlin, Heidelberg, 2011, pp. 64–78.

[7]. A. Kulkarni, N. Mhalgi, D. Sagar Gurnani, and N. Giri, "Pothole detection system using machine learning on android," International Journal of Emerging Technology and Advanced Engineering, vol. 5, no. 7, pp. 360–364, July 2014.

[8]. F. Seraj, B. J. van der Zwaag, A. Dilo, T. Luarasi, and P. Havinga, "Roads: A road pavement monitoring system for anomaly detection using smart phones," in Proc. Int. Workshop Modeling Social Media, Cham, 2014, pp. 128–146.

[9]. F. Seraj, K. Zhang, O. Turkes, N. Meratnia, and P. J. Havinga, "A smartphone based method to enhance road pavement anomaly detection by analyzing the driver behavior," in in Proc. ACM Int. Conf. Pervasive Ubiquitous Comput, Osaka, Japan, 2015, pp. 1169–1177.

[10]. Moazzam, K. Kamal, S. Mathavan, S. Usman, and M. Rahman, "Metrology and visualization of potholes using the microsoft kinect sensor," in Proc. 16th Int. IEEE Conf. Intell. Transp. Syst, Netherlands, 2013, pp. 1284–1291.