iJRASET
International Journal For Research in
Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 11 **Issue:** XI **Month of publication:** November 2023

DOI: https://doi.org/10.22214/ijraset.2023.56531

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 11 Issue XI Nov 2023- Available at www.ijraset.com

Road Damage Detection and Classification

Mr. Swacchand Kasar[1], Miss. Manali Mankar[2], Miss. Sakshi Hargude[3], Miss. Sangramsinh Bhusnar[4], Prof. P. R. Desai[#5]
Information Technology, Shivaji University, Kolhapur

Abstract: This is a road damage detection desktop application. In the subject of transportation engineering, identifying road damage early on is essential because it can save maintenance costs and avoid accidents. Deep learning methods have demonstrated encouraging performance in a number of computer vision tasks recently, including the detection of road damage. In this study, we suggest a region-based convolutional neural network (R-CNN)-based method for detecting road degradation. Using a publicly accessible dataset of road photos with different kinds of damage, such as cracks, potholes, and patches, we trained our R-CNN. Our approach outperformed cutting-edge techniques with an accuracy of 85% in identifying road damage.
Keywords: Road Damage, Machine learning, R-CNN, Project.

I. INTRODUCTION

The goal of the project is to create an automated system that can correctly identify and categorize various forms of surface imperfections, including cracks and potholes, using photos or videos of road surfaces. The goal of utilizing CNN for road damage identification is to create an approach that minimizes false positives and false negatives while effectively detecting and classifying road problems. This can assist in promptly locating and fixing damage to the road, enhancing road safety and lowering maintenance expenses. CNN has the potential to greatly enhance road maintenance and safety, in addition to being a large tool for detecting road deterioration. The act of locating and evaluating different kinds of deterioration or damage on road surfaces, such as cracks, potholes, and structural: Road Damage, R-CNN, Project, Machine Learning. The goal of using Convolutional Neural Networks (CNN) for road damage detection is to increase the efficiency and accuracy of identifying road damages, such as cracks, potholes, and other surface defects. Road damage detection is an essential part of infrastructure maintenance and safety, with the potential to improve transportation efficiency, lower accident rates, and save repair costs. This cutting-edge field uses cutting-edge technologies like computer vision, machine learning, and remote sensing to automatically identify and assess various types of road damage, such as surface degradation, cracks, and potholes. Road damage identification offers advantages beyond cost reductions and increased safety. Additionally, it increases the resilience of transportation as a whole by making sure that roads are better prepared to handle the demands of time, traffic, and weather. Road damage identification can be automated and improved in accuracy and efficiency with the use of R-CNNs. R-CNNs are strong machine learning algorithms that have demonstrated exceptional performance in challenges involving image recognition. They can be trained to identify particular characteristics or flaws in road surfaces and are intended to identify patterns in photographs. In conclusion, detecting road damage is essential to keeping road networks effective and safe. It has changed as a result of the use of cutting-edge technologies and is essential to maintaining the durability and security of road infrastructure.

II. RELEVANCE OF WORK

A machine learning-based road damage detection project is relevant because it has the potential to increase road efficiency and safety. Machine learning can assist in the faster and more accurate identification and repair of road flaws by automating the process of road damage detection. All drivers may benefit from better driving conditions and a decrease in traffic accidents as a result.
The following are some particular advantages of machine learning-based road damage detection:

1) *Increased Accuracy:* Even under difficult circumstances like dim light or bad weather, machine learning algorithms may be trained to identify road damage with a high degree of accuracy. This can guarantee that flaws in the road are found and fixed before they result in collisions.
2) *Enhanced Efficiency:* The time it takes to find and fix road flaws can be decreased by using machine learning algorithms to scan vast stretches of road surface rapidly and effectively. This can free up staff that maintain roads to work on other projects.
3) *Saved Expenses:* Machine learning can assist in lowering the price of road repair by automating the process of detecting road deterioration. This is because personnel who maintain roads can work more effectively and productively.
4) *Increased Road Safety:* Machine learning has the potential to lower the probability of accidents and increase road safety by promptly detecting and fixing problems in the road. This is due to the possibility of vehicles losing control and skidding due to road faults, which can result in catastrophic accidents.

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 11 Issue XI Nov 2023- Available at www.ijraset.com

III. LITERATURE REVIEW

In addition to being an annoyance, road degradation, particularly potholes and cracks, poses a safety risk [1]. Qualified inspectors routinely find damage to roads [2]. However, this procedure is laborious, expensive, and time-consuming [3]. Furthermore, because the results of road damage identification are solely based on the inspectors' experience, they are inherently subjective [4]. Consequently, the demand for automated road condition assessment systems that can accurately and efficiently identify and pinpoint road damage is always growing [5]. This section's remaining content outlines the current status of road damage detecting technology as well as the purpose, significance, and organization of this work.

The implementation of automated road damage assessment is a goal shared by many road agencies and municipalities. Nevertheless, they frequently lack the resources, expertise, and technology necessary to purchase cutting-edge machinery for gathering and analysing data on road damage. In this perspective, the work contributes the following ways. It evaluates the Japanese model's suitability for use in other nations first. Second, it suggests creating a sizable heterogeneous road damage dataset of 26620 photos taken using smartphones across several nations. Thirdly, we suggest generalized models that can identify and categorize road damage across national borders. Finally, we offer suggestions for readers, foreign agencies, and municipalities when another nation releases its data and model for automated road damage identification and categorization. We can be reached at (https://github.com/sekilab/RoadDamageDetector/) with our dataset.

IV. PROPOSED SYSTEM

Process flow for a machine learning-based road damage detection project proposed:

1) *Collect Data:* Gathering a dataset of road photos with different kinds of damage, like cracks, potholes, and patches, is the initial step in the process. To guarantee that the machine learning model is able to generalize well to new data, the dataset should be as big and varied as feasible.
2) *Label the Data:* After the data has been gathered, it must be labelled in order for the machine learning model to be able to recognize the various kinds of damage. Either a semi-supervised learning strategy or manual labor can be used for this.
3) *Train the Machine Learning Model:* After an algorithm is selected, it must be trained using the labelled data. The model must be trained on a sizable enough dataset to guarantee that it can generalize well to new data, even if this can be a time-consuming procedure.
4) *Examine the Machine Learning Model:* After training, the model must be tested on a hold-out test set in order to gauge its effectiveness. This will assist in determining any areas in which the model requires
5) *Deploy the Machine Learning:* The model can be put into production after it has been judged adequate and evaluated. This could entail incorporating the model into a web service, smartphone app, or other software program.

Here are some more things to think about when putting a machine learning project for road damage identification into action:

a) *Hardware Requirements:* Training and using machine learning algorithms can be computationally costly.
b) *Data Quality:* Any machine learning project's success depends on the quality of the data. Making sure the data is error-free and properly labelled is crucial.
c) *Interpretability of the Model:* It's critical to be able to understand the machine learning model's predictions. This will guarantee that the model is producing accurate predictions and assist in locating any potential biases in it.

V. OBJECTIVES

1) *Objective 1:* To collect the data in the form of images captured by smart phone, vehicles or drones. To implement the dataset.
2) *Objective 2:* The Data Pre-processing
3) *Objective 3:* R-CNN Model creation using classification.
4) *Objective 4:* To Calculate the accuracy.
5) *Objective 5:* Detect Road Damage Detection.

VI. METHODOLOGY

The road damage detection process may be automated and maintenance more efficiently by using R-CNN. R- CNNs are strong machine learning algorithms that have shown to be very successful in tasks involving image recognition. They can be trained to detect certain features or defects in road surfaces and are intended to recognize patterns in images. R-CNNs can be used for road damage detection and have a lot of advantages. Overall, R-CNNs road damage detection is a promising approach with the potential to improve road maintenance and repair operations' efficacy and accuracy.

A. Input the Dataset

Gather as many pictures and videos of road surfaces as you can. Videos are able to record dynamic or temporal changes in road conditions, whilst images are excellent for static damage identifications to your text that are highlighted in orange. You can alter the content further by clicking on words and changing them to synonyms. Do try it out!

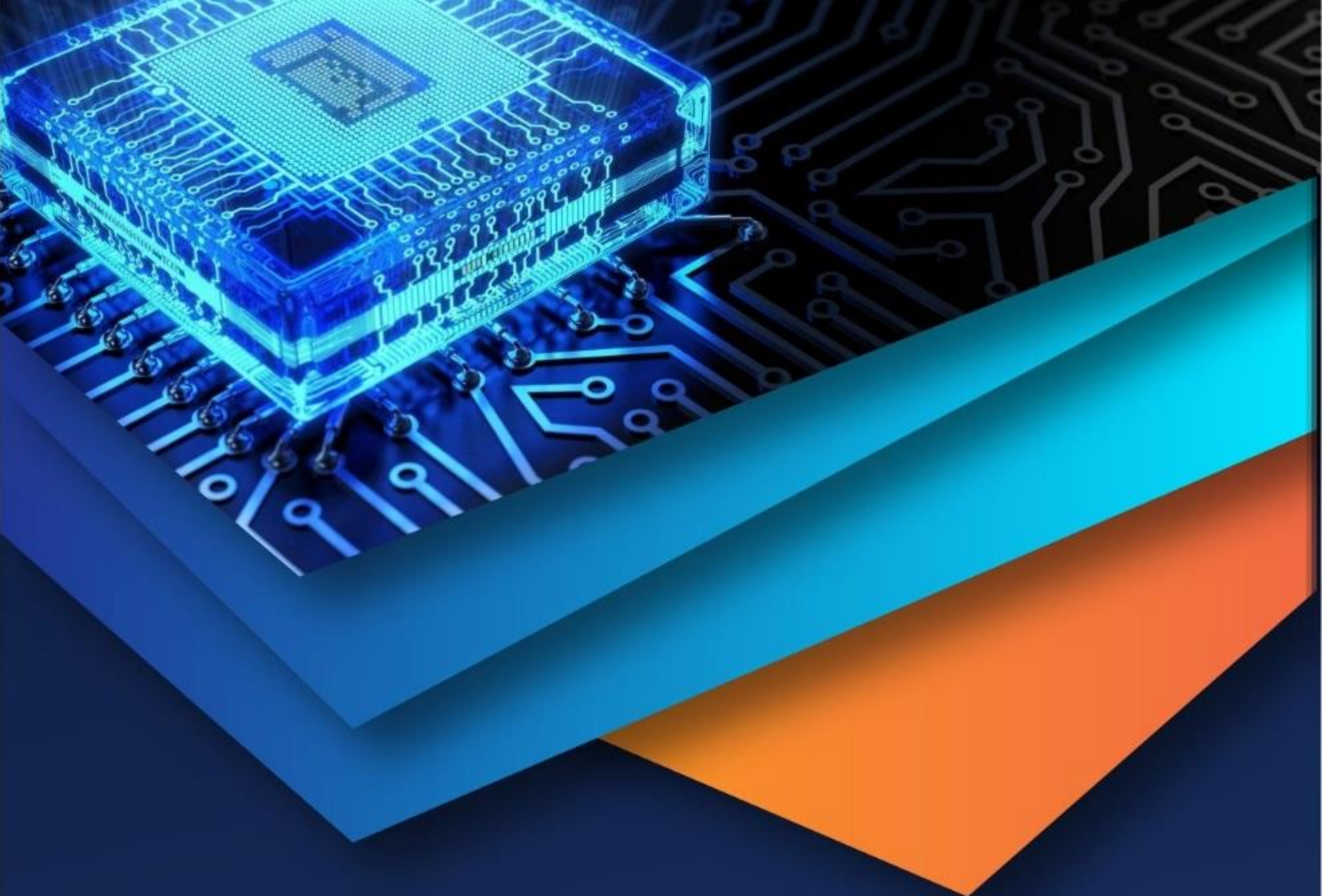
1) *Data Preprocessing:* Adjust the dimensions and align the picture or video frame to a common format. To improve model generality and diversity, augment the dataset. This can involve actions like brightness modifications, scaling, and rotation.
2) *Segmentation:* Divide the picture into sections, assigning a backdrop or road damage classification to each pixel. This is useful for comprehending damage at the pixel level, but it might not be as accurate at pinpointing specific cases.
3) *Future Extraction:* To help with the identification and analysis of road damage, future extraction in road damage detection entails locating and extracting pertinent data or features from pictures or videos of road surfaces.
4) *R-CNN Model Import:* We must install the necessary libraries and prerequisites before you can import the R-CNN model for road damage detection. The Faster R-CNN model is the R-CNN model that is most frequently employed for object detection.
5) *Export R-CNN Model:* Getting Ready the Dataset for Assemble and annotate a road damage image dataset. Add bounding boxes to the photos to indicate the damaged regions.
6) *Examine any Road Damage:* The method of automatically identifying and locating different types of damage on road surfaces, such as potholes, cracks, and pavement deterioration, in photos or videos is known as "road damage detection." It makes use of computer vision and machine learning

VII. CONCLUSION

This project serves as a catalyst for improving our methods for managing road infrastructure. Because of its many benefits, which include resilience, cost-effectiveness, sustainability, and safety, it is regarded as a major force behind advancements in the fields of infrastructure and transportation. Road damage detection systems' accuracy can vary greatly based on a number of variables, such as the technology utilized, the data quality, the algorithms used, and the surrounding circumstances.

REFERENCES

[1] 2018 Hiroya Maeda, Yashihide Sekimoto, Toshikazu Seto, Takehiro Kashiyama, Hiroshi Omata. Road Damage Detection Using Deep Neural Networks with Images Captured Through a Smartphone
[2] 18 Nov 2020 · Sadra Naddaf-sh, M-Mahdi Naddaf-Sh, Amir R. Kashani, Hassan Zargarzadeh. n Efficient and Scalable Deep Learning Approach for Road Damage Detection
[3] 12 Nov 2018 · Janpreet Singh, Shashank Shekhar. Road Damage Detection And Classification In Smartphone Captured Images Using Mask R-CNN.
[4] 30 Aug 2020 · Deeksha Arya, Hiroya Maeda, Sanjay Kumar Ghosh, Durga Toshniwal, Alexander Mraz, Takehiro Kashiyama, Yoshihide Sekimoto . Transfer Learning-based Road Damage Detection for Multiple Countries
[5] 28 Oct 2020 · Vung Pham, Chau Pham, Tommy Dang . Road Damage Detection and Classification with Detectron2 and Faster R-CNN
[6] Article in Computer-Aided Civil and Infrastructure Engineering · June 2018. Road Damage Detection and Classification Using Deep Neural Networks with Smartphone Images: Road damage detection and classification



10.22214/IJRASET

45.98

IMPACT FACTOR: 7.129

IMPACT FACTOR: 7.429

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY