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Analysis and Test of Concrete Surface Crack of Railway Bridge Based on Deep Learning and Machine Learning

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Abstract - High-speed railway construction has recently become more effective and large-scale. And a significant factor in determining the safety of railway operation is now bridge safety detection and monitoring. In order to improve, mark, and learn the crack photos, the characteristics of bridge surface cracks in the prior operational environment are evaluated. YoloV3 deep learning network is then employed.

Keywords: Big Crack, Deep Learning, CNN Algorithm, Image Processing, Feature Extraction, Filtering Techniques, Yolo V3.

I. Introduction

In the process of safety inspection and monitoring of high-speed railway Bridges, it is very important to find and analyse the surface cracks of concrete Bridges. About 70% of high-speed railway lines are designed with concrete Bridges, so the safety inspection and monitoring of Bridges has become an important part of ensuring the safety of railway operation. The existing methods of beam cracking detection are mainly based on manual search, which is difficult, low precision and has some operational risks.

The main difficulties encountered in automatic crack detection methods are variable lighting conditions, random camera/view angles, and random resolution of bridge images. Moreover, we found that 194 S. Chanda crack detection gets even harder where the background texture randomly changes and hence segmentation of background and foreground elements becomes very challenging.

This article proposes a non-trivial method which addresses the above-mentioned challenges efficiently. It relies on a two-stage approach. At first, upon initially analysing the characteristics of the pixel values in 'R' , 'G' and 'B' channels, the image is identified as either a 'complex image' or a 'simple image'.

If the image is identified as a 'complex image' then we need to execute a pre-processing step, otherwise the image is directly processed for feature extraction. Using a non-overlapping sliding window, texture analysis–based features are extracted from the image region beneath the sliding window.

II. Literature Survey

Zelong Shao, Xiangkun Zhang, Jiawei Ren, Yingsong Li., A newly designed radar based on interferometry is proposed and well designed in the paper. The designed radar can detect the vibration of the railway bridge with a super resolution and a high precision, which also has remote sensing ability.

Zeng Zhiping, Liang Fei, Zhang Yong, the different periodic components, locations and reasons in track irregularity can be identified accurately by using wavelet transform and power spectrum density (PSD) analysis.

Dmitry Sedykh, German Osadchy, Dmitry Pristensky, Specialized design of sensor to be attached at the control points on the overhead catenary cables and wires, including the accelerometer of MEMS type and built-in controller is fulfilled.

Lei Zhao, Member, IEEE, Zejia Luo, Zhun Fan, Senior Member, IEEE and Yi Shi, Dual half-bridge (DHB) converter is a recent innovation in a family of full-bridge converts, and it can achieve higher efficiency compared to the traditional converts.

III. Existing System

The existing methods of beam cracking detection are mainly based on manual search, which is difficult, low precision and has some operational risks.

IV. Proposed System

In the system crack in the tracks is detected by means of sensor and Arduino microcontroller, measuring distance for two railroads. In this project we have used ultrasonic sensors to detect the crack. As ambient temperature and crack width increases, the temperature difference between crack and non-crack area shows a growing trend; the wider the crack width is, the greater the increase of the temperature difference will be. The larger the crack width is the more air medium is filled in the crack. Under the influence of different thermal conductivity, the temperature effect of concrete and air medium is more obvious, and the temperature difference between crack area and non-crack area is more prominent.

V. Methodology

Convolutional Neural Network (CNN): CNN or the convolutional neural network (CNN) is a class of deep learning neural networks. In short think of CNN as a machine learning algorithm that can take in an input image, assign importance (learnable weights and biases) to various aspects/objects in the image, and be able to differentiate one from the other. CNN works by extracting features from the images. Any CNN consists of the following:

1. The input layer which is a grayscale image
2. The Output layer which is a binary or multi-class labels
3. Hidden layers consisting of convolution layers, ReLU (rectified linear unit) layers, the pooling layers, and a fully connected Neural Network.

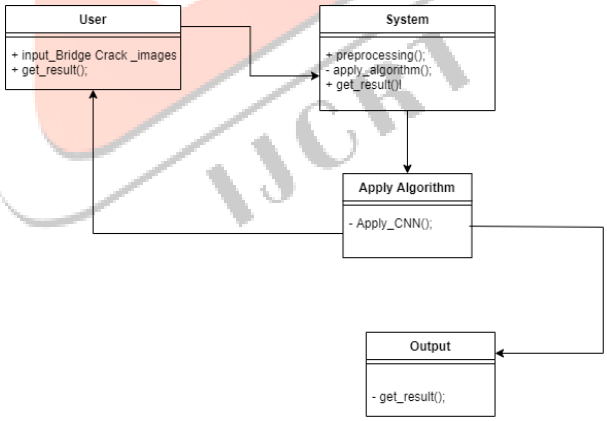

Fig. Block Diagram

This process takes crack image as an input and returns result as an output by applying and CNN Algorithm.

VI. Future Scope

To provide security and reliability to all the users who are using it.

VII. Conclusion

Here we conclude that we are developing a system that is reliable, cheap and more efficient for native Indian bridges. This technique will not only be useful for the road and foot bridges but also for railway bridges. This system will extend the lifespan of numerous structures by enabling earlier damage detection, eliminate the cost of routine inspections and, most critically of all improve public safety.
At present, the deep learning algorithm can obtain a better crack recognition rate than the traditional algorithm, but there are still some cases of false positives and missed positives.
Cracks mainly occur due to : higher axle loads and greater traffic density, poor maintenance policies (deterioration of track geometry), new rolling stock with ABS and anti-spin devices, and new wheel and rail materials.

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