Mahindra University Research Symposium 2k20

A Study on Vision Based Method for Damage Detection in Structures

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Introduction:

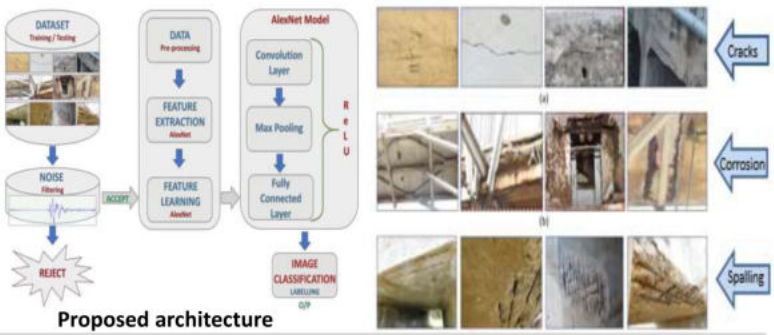
- The deterioration of the structure depends on the geographical location like sea shore which are most effected by corrosion and spalling , e.g. harbors, shipyards and bridges .
- Maintenance of structures in countries like India with huge infrastructure commonly depends on Human visual inspection, which requires subject expertise in structural health assessment, types and severity of damages.
- Currently, human visual inspectors are replaced by self-navigating robots with the help of AI to assess all kinds of damages in structures.
- Computer's vision in the form of Artificial Intelligence (AI) is playing a vital role to address the mentioned limitations. This study is motivated to find solutions through images using AI for robust and faster visual inspection techniques.

Literature:

- Lee et al., has proposed a methodology based on a morphological technique that automatically detects and analyzes the cracks from the digital image and gives length, width, and orientation apart from pattern recognition.
- Choi and Kim carried research to identify the corrosion type based on the morphology of the corroded surface and for training and testing the classifier, 150 to 200 images were taken under optical microscope considering the features like color, texture and shape.
- Hutchison and Chen worked on automatic detection of concrete surface damages like cracks and spalling from images using a statistical based method and relied on a Bayesian method.

Methods:

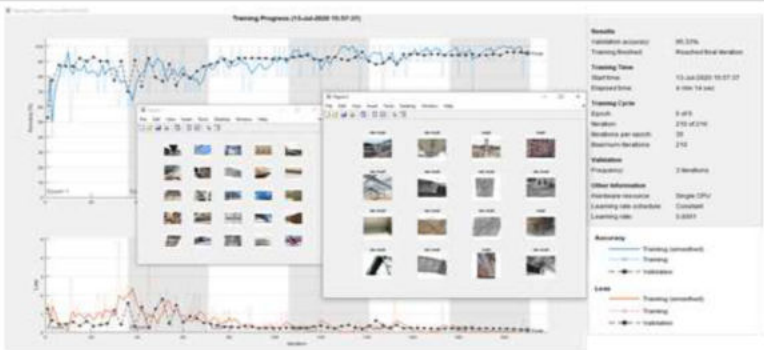
- Majority of the images related to crack are obtained from the visual inspection carried out for four hundred national highway bridges and residential buildings, as they have single crack to multiple cracks on the surfaces .
- Images used to build the dataset for this study are collected during the visual inspections of various structures carried in the last four years. Even though images have been captured from different devices, they are standardized into the resolution of 227 x 227 x 3 RGB before importing into the model..
- The dataset is loaded into the model, and it automatically names the trained images based on their folder names and stores it as an Image Datastore object. It can even store the data that does not fit in the memory and reads all the images as batches during the CNN training.
- Image classification results in images with the labels as Crack/No crack. spalling/no spalling, corrosion/no corrosion. The results are influenced based on the dataset's size and the variety of images in the dataset.

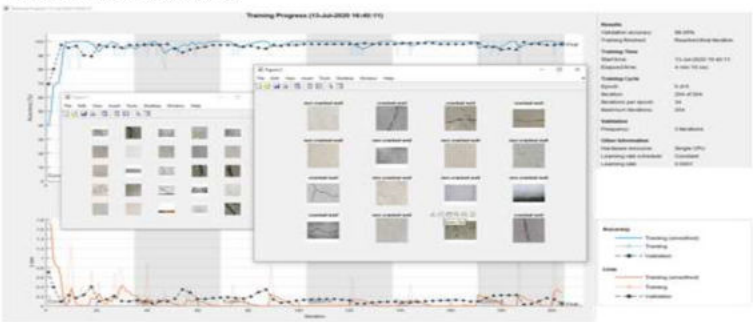


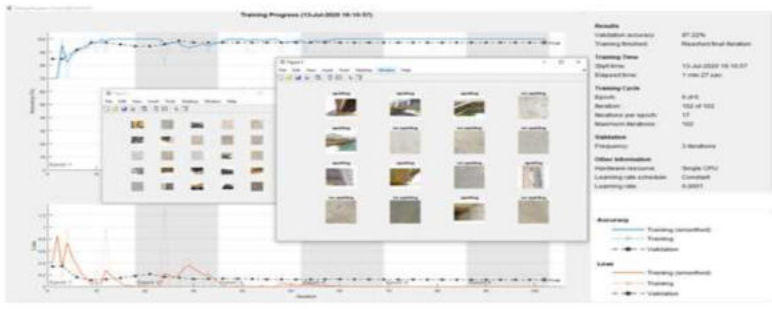
Proposed architecture

Results:

- The proposed methodology has resulted in good accuracies even though the dataset is small.
- Identification of crack, Spalling and corrosion at early stage is important as it effects the strength and stiffness of the structure.
- Demonstrates the outcome of the proposed architecture using AlexNet which was successful in identifying as Crack/No crack, spalling/no spalling, corrosion/no corrosion for various given scenarios.
- Increased dataset can lead to higher accuracy and more types of damages can be detected. Can attempt in using different software architectures to observe the accuracies.







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Internship/research carried at organization (name)