Efficient, Low-cost Bridge Cracking Detection and Quantification Using Deep-learning and UAV Images Dataset

Dataset available at: https://digitalcommons.lsu.edu/transet_data/124

(This dataset supports report **Efficient, Low-cost Bridge Cracking Detection and Quantification Using Deep-learning and UAV Images**)

This U.S. Department of Transportation-funded dataset is preserved by the Transportation Consortium of South-Central States (TRAN-SET) in the LSU Digital Commons Repository (https://digitalcommons.lsu.edu), and is available at https://digitalcommons.lsu.edu/transet_data/124

The related final report **Efficient, Low-cost Bridge Cracking Detection and Quantification Using Deep-learning and UAV Images**, is available from the National Transportation Library's Digital Repository at https://rosap.ntl.bts.gov/view/dot/61825.

Metadata from the LSU Digital Commons Repository record:

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Abstract: Many bridges in the State of Louisiana and the United States are working under serious degradation conditions where cracks on bridges threaten structural integrity and public security. To ensure structural integrity and public security, it is required that bridges in the US be inspected and rated every two years. Currently, this biannual assessment is largely implemented using manual visual inspection methods, which is slow and costly. In addition, it is challenging for workers to detect cracks in regions that are hard to reach, e.g., the top part of the bridge tower, cables, mid-span of the bridge girders, and decks. This research develops an efficient low-cost deep learning-based methodology to identify cracks on bridges using computer vision-based techniques and deep learning. The Convolutional Neural Networks (CNN) deep learning method is used to identify cracks from images. In this research, a programmable drone is developed that can fly along a pre-defined trajectory. A large volume of images was collected from local bridges and pavements using drones. The collected images were preprocessed and divided into around forty thousand 256 by 256-pixel sub-images and fed into the CNN model. Data augmentation techniques are applied to increase the number of images in some cases. Parameters of the selected CNN model were optimized to obtain the best configuration. To evaluate the performance of the method, images from a different local bridge were used for testing. Research results show that with the optimized CNN model, cracks in the images can be identified efficiently and accurately. The developed methodology can also category the cracked image as slight, moderate, or severe cracking based on a pre-defined quantification index. The research outcome of this project has the potential to automate crack damage identification of bridge key components in a cost-effective manner. Also, the developed methodology is expected to facilitate

crack damage identification for other transportation infrastructures, e.g., pavement and traffic sign structures.
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Dataset description:
This dataset contains 1 file collection described below.

Dataset.zip:

- UAV-Waypoint-Following.zip
    - This file collection contains 1,184 files, organized into multiple folders.
- Codes for computer vision framework.zip
    - Codes for computer vision framework Folder
        - deep-net-main Folder
            - README.md
            - main.py
            - funcs.py
            - train Folder
                - fit.py
                - __init_.py
            - predict Folder
                - predict.py
                - __init_.py
            - model Folder
                - vgg_net.py
                - t_net.py
                - resnet.py
                - residual_net.py
                - model_tools.py
                - inception_net.py
                - alex_net.py
                - __init_.py
            - jobscript Folder
                - single-node.sh
                - multi-node.sh
            - data Folder
                - datamodule.py
                - datamodule-init.py
                - __init_.py

File Type Descriptions:

- File extension .md is among others related to texts and source codes in Markdown markup language. Markdown is a lightweight markup language, to write using an easy-to-read, easy-to-write plain text format, then convert it to structurally valid XHTML (or HTML) (for more information on .md files and software, please visit https://www.file-extensions.org/md-file-extension).
- The .py file extension is commonly used for files containing source code written in Python programming language. Python is a dynamic object-oriented programming language that can be used for many kinds of software development (for more information on .py files and software, please visit https://www.file-extensions.org/py-file-extension).
- The .sh file extension is commonly used for Unix shell files. Bash is a free software Unix shell written for the GNU Project (for more information on .sh files and software, please visit https://www.file-extensions.org/sh-file-extension).

National Transportation Library (NTL) Curation Note:
As this dataset is preserved in a repository outside U.S. DOT control, as allowed by the U.S. DOT's Public Access Plan (https://ntl.bts.gov/public-access) Section 7.4.2 Data, the NTL staff has performed ***NO*** additional curation actions on this dataset. NTL staff last accessed this dataset at https://digitalcommons.lsu.edu/transet_data/124 on 2022-05-24. If, in the future, you have trouble accessing this dataset at the host repository, please email NTLDataCurator@dot.gov describing your problem. NTL staff will do its best to assist you at that time.