

Road Damage Detection and Classification with Faster R-CNN

The work on this paper was done as a solution to Road Damage Detection and Classification Challenge, 2018 IEEE International Conference on Big Data Cup. Their method can detect damages in road captured by smartphones. Faster R-CNN method and data augmentation techniques were used here. The detection model achieved an F1 score of 0.6255.

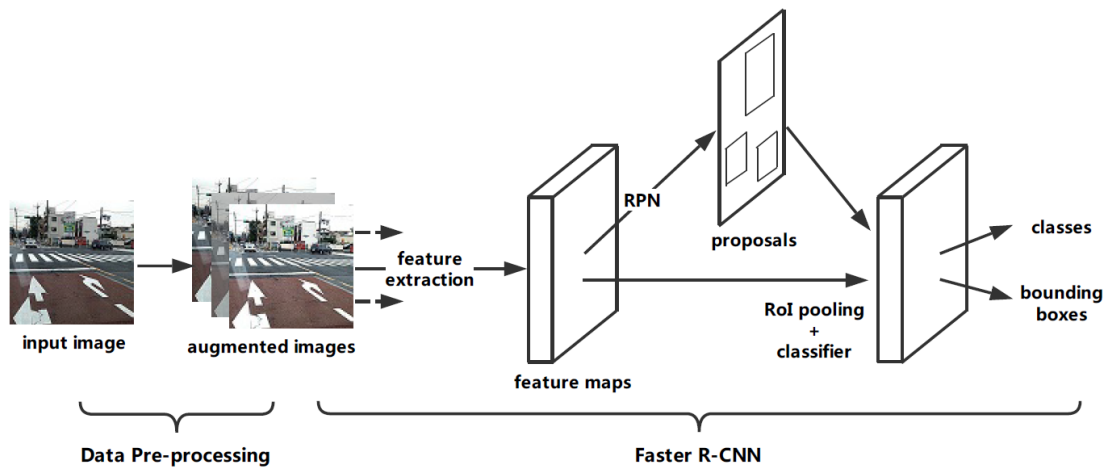


Figure 1. Architecture of The Proposed Method

Fast R-CNN frame was used here as the detection method. Initially, images were processed by a feature extractor. The Region Proposal Network uses those feature maps as input and gives a group of rectangular object regions, including their scores. Then, from the feature maps, the Region of Interest (RoI) pooling layer extracts a fixed-length feature vector. Every feature vector is fed into a Fully Convolutional Network for classification and predicting bounding boxes.

The dataset used here contains 9053 images and eight kinds of damages. After annotation, it gets 15,435 bounding boxes. The training set includes 7,240 images, and the rest of the images were used as test samples. For detection, Intersection over Union threshold was set to 0.5. For class imbalance issues, images were augmented by adjusting contrast, brightness, and Gaussian blur. Also, every image was Horizontal flipped during training.

ResNet-152 was used as the backbone of Faster R-CNN and implemented on TensorFlow on a Linux PC with graphics card Nvidia GTX 1080Ti.

In the experiment, optimized parameters ResNet-152 gives F1 score of 0.6255, where ResNet-101 gave 0.6099.

The authors wanted to try other methods such as cascaded detection, multiscale inference, model ensembling for performance improvement. Also, state-of-the-art for instance segmentation, Mask R-CNN, can be used here for the exact shape of the damaged regions.

References:

- [1] Wang, W., Wu, B., Yang, S., & Wang, Z. (2018, December). Road damage detection and classification with Faster R-CNN. In *2018 IEEE International Conference on Big Data (Big Data)* (pp. 5220-5223). IEEE.