VISUAL CORROSION ASSESSMENT OF STRUCTURAL STEELS USING NEURAL NETWORKS

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Comparison of different semantic segmentation models for visual corrosion assessment of structural steels. The work proposes results of applying Yolov8x and compares results with DeepLabv3+[3] for corrosion segmentation task.

Keywords: steel structures, visual corrosion assessment, machine learning, neural networks, DeepLabV3+, Yolov8x

Introduction. No one can argue the great importance of corrosion assessment of structural steels during operation of the structure. The most tragically famous failures of such structures are: Silver Bridge Collapse (On December 15, 1967) resulting in the deaths of 46 people [1], Genoa, Italy Bridge Collapse In August of 2018, a bridge collapsed in Italy resulting in the death of 43 people, Bhopal, India Incident In December of 1984, one of the world's largest industrial disasters occurred, resulting in the death of nearly 8.000 people [2], to name a few. All those lives could be saved provided an accurate, simple and fast visual corrosion assessment solution. Furthermore, growing computational resources and recent advances in image analysis makes it possible to create one. That's why current work provides comparison of different models results on corrosion segmentation dataset.

Dataset. The following section provides statistics on train and test sets.
Number of images of train set: 396
Number of images of test set: 44

Pixel-wise class mask-represented distribution:

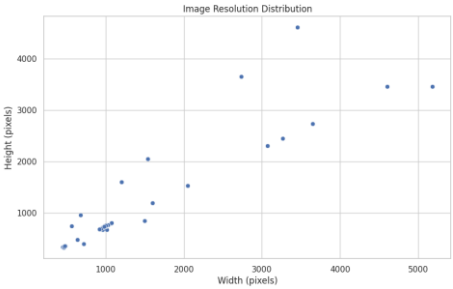
Table 1. Train

background	fair	poor	severe
81.22%	11.8%	5.68%	1.26%

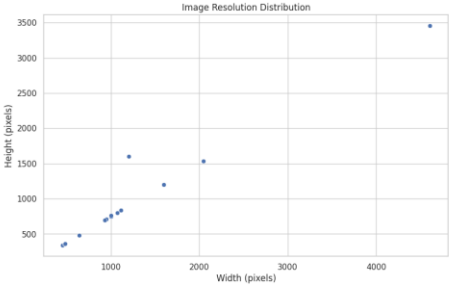
Table 2. Test

background	fair	poor	severe
83.5%	10.06%	5.18%	1.22%

Distribution of image resolutions of train set images.



Distribution of image resolutions of test set images.



Examples:

Table 3. Comparison results

Model	IoU	F1-score
predicting all pixels are background	0.613	0.672
Yolov8x	0.78	0.838
DeepLabv3+(weights_35) [3]	0.796	0.859

Conclusions. The paper demonstrates the seamless training of the latest model, yielding commendable performance on test data. While Yolov8x primarily caters to instance segmentation, it was successfully adapted for semantic segmentation by integrating an extra post-processing stage. The model was efficiently trained for approximately 150 epochs in under 2 hours, utilising the NVIDIA 2070 RTX. Notably, this study introduces insights by presenting statistical analysis on a corrosion dataset [3].

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3. *Bianchi E. and Hebdon M.* Trained model for the semantic segmentation of corrosion condition states. – University Libraries: Virginia Tech., 2021. – Software.