# Surface Crack Detection and Segmentation Using Visual and Combined RGB and IR Images

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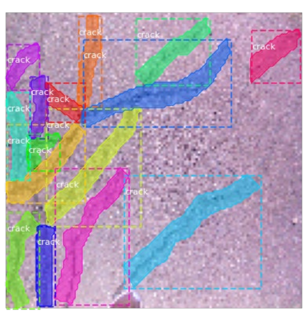
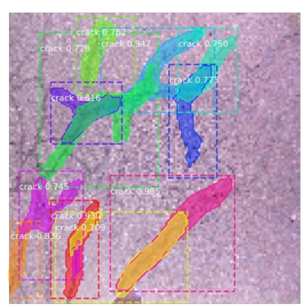
**Abstract**

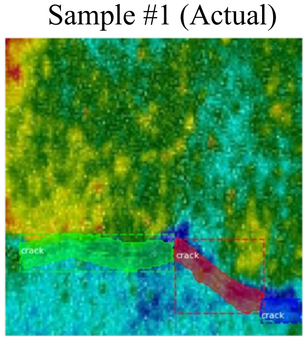
Accurately locating and quantifying surface cracks is essential for decision making in the repair and replacement of bridge decks. Infrared (IR) and RGB sensors mounted on unmanned aerial vehicles (UAVs) are typically used to inspect the bridge. Since these techniques collect spectral reflection from different wavelengths with different imaging mechanisms, each of them has its own advantages and limitations. Fusion of infrared and visible images to produce a single image can help to overcome the limitations. In this project, a FLIR C5 camera is used to capture RGB and IR images simultaneously from the bridge surface cracks. These images are combined to a single image called combined RGB and thermal image. Mask R-CNN, a region-based CNN classifier is used to process the images. Mask R-CNN not only detects targets in the image but also gives the predicted mask for each target, making it useful for further processing. Two set of images (RGB and combined) are fed into the classifier to detect the cracks. Here we use it to detect cracks on concrete surfaces, and we obtain their corresponding masks to aid with extracting more of their properties such as length and width. Model performance is evaluated using performance measure metrics such as precision, recall and mAP. Mask R-CNN performs decently on our RGB dataset for crack detection, and it could be utilized as a real-time crack detector on a site equipped with advanced UAVs. It shows less accuracy on the combined IR and RGB images. Lack of contrast in the IR images since the images are captured during winter which sun energy was not enough could be a reason for that. Also, quantity of the captured images to train the model could be another reason which we will try to eliminate it by capturing more images in the future studies. Fig. 1 shows two samples of the actual RGB and combined images and their corresponding mask.



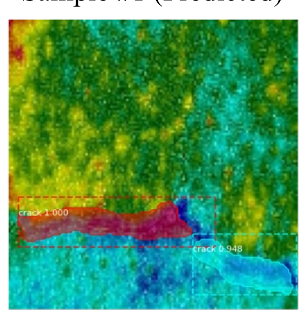
Sample #1 (Actual)



Sample #1 (Predicted)



Sample #2 (Actual)



Sample #2 (Predicted)

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**References**

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