



## **Rotated Bounding Box Faster RCNN for Fracture Detection in X-Ray CT Image of Rocks**

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### **Abstract**

Quantitative evaluation of rock fracture properties including aperture, roughness and orientation is very important for rock mass characterization as the fractures properties control hydraulic and mechanical behavior of the rock. In an X-Ray CT slice, fractures are appeared as arbitrary-oriented curve-like object with low gray-scale intensity. Fracture geometry information can be obtained after manually segmentation or automatically intensity-based segmentation. In intensity-based segmentation method, curve-like enhancement filter (i.e. Hessian-based filter) is usually adopted to enhance the contrast of the fractures, which however also amplifies the edge of non-fracture objects. Therefore, fracture segmentation is still a challenging task. To overcome this difficulty, we propose to use oriented bounding boxes as the basis anchor of the Faster RCNN algorithm to automatically detect fractures in CT images. In comparison with axis-aligned bounding box, the rotated bounding box significantly improves the ratio of object-of-interest to background within the bounding box and also handles arbitrary-oriented elongated objects more effectively. The primary result shows that rotated bounding box outperforms axis-aligned bounding box in the fracture detection task. Furthermore, different segmentation schemes including Hessian-based filter, U-Net and segmentation branch like Mask RCNN will be investigated and compared in order to determine the most effective method for fracture segmentation within the detected bounding box.