

KLASIFIKASI CACAT MATERIAL PELEK MOBIL DENGAN FASTER R-CNN BERBASIS RESNET101 MENGGUNAKAN CITRA RADIOGRAFI

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INTISARI

Penerapan NDT (*non-destructive testing*) dengan radiografi dalam industri kerap digunakan pada kontrol kualitas cacat produk. Perusahaan pemroduksi pelek mobil membedakan kategori cacat menjadi cacat yang timbul (Cacat 1) dan cacat berongga (Cacat 2) pada citra radiografi. Deteksi cacat menggunakan kecerdasan buatan diperlukan akibat keterbatasan mesin radiografi otomatis yang dimiliki serta untuk meningkatkan efektivitas kerja.

Faster R-CNN merupakan model *deep learning* khusus deteksi objek yang dapat bekerja mendekati *real-time* pada pengujian deteksi. Teknik *transfer learning* ResNet101 digunakan sebagai *backbone* CNN untuk membantu proses ekstraksi fitur pada citra pelek. Penggunaan Faster R-CNN berbasis ResNet101 dilatih dan dievaluasi dalam kinerja deteksi sesuai kategori cacat. Dilakukan variasi model untuk menemukan model paling optimal.

Model deteksi terbaik adalah variasi non-augmentasi yang mendapat mAP dan mAR sama-sama sebesar 0,775. Berdasar hasil pengujian, model mencapai *accuracy* 0,833. Performa Cacat 1 mendapat nilai *precision* sebesar 0,974 dan *recall* sebesar 0,844. Performa Cacat 2 memperoleh *precision* 0,222 dan *recall* sebesar 0,667. Hasil Cacat 1 dapat dikatakan sangat baik, sedangkan hasil Cacat 2 belum dapat dibuktikan akibat terbatasnya sampel pengujian.

Kata kunci: NDT, radiografi, Faster R-CNN, ResNet101

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CLASSIFICATION ON AUTOMOTIVE WHEEL RIMS MATERIAL USING FASTER R-CNN WITH RESNET101 BASED ON RADIOGRAPHIC IMAGES

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ABSTRACT

Non-destructive testing (NDT) using radiography is widely applied in industry for product defect quality control. A wheel rim manufacturing company classifies radiographic defects into two types: raised defects (Cacat 1) and hollow defects (Cacat 2). Artificial intelligence is needed to overcome limitations of existing radiographic machines and improve work efficiency.

Faster R-CNN is a deep learning model specialized for object detection and is capable of near real-time performance in detection tasks. Transfer learning with ResNet101 is utilized as the CNN backbone to assist in feature extraction from rim images. The Faster R-CNN model based on ResNet101 is trained and evaluated for defect detection performance according to defect categories. Multiple model variations are explored to identify the most optimal configuration.

The best-performing detection model is the non-augmented variation, achieving both mAP and mAR of 0.775. Based on the evaluation results, the model achieved an accuracy of 0.833. The best results were obtained for Cacat 1, with a precision of 0.974 and recall of 0.844. For Cacat 2, the model achieved a precision of 0.222 and recall of 0.667. The results for Defect 1 can be considered highly satisfactory, while Defect 2 remain inconclusive due to the limited number of testing samples.

Keywords: NDT, radiography, Faster R-CNN, ResNet101

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