ABSTRAK

IMPLEMENTASI MASK R-CNN UNTUK MENDETEKSI AREA DI UNIVERSITAS LAMPUNG DALAM TATA KELOLA LAHAN

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Implementasi teknologi computer vision berbasis deep learning dalam pemetaan area bangunan menjadi salah satu solusi strategis untuk mendukung tata kelola lahan yang lebih efisien. Penelitian ini mengimplementasikan metode Mask Region-Based Convolutional Neural Network (Mask R-CNN) dengan backbone ResNet-50 Feature Pyramid Network (FPN) untuk mendeteksi, men-segmentasi, dan memperkirakan luas bangunan fakultas di Universitas Lampung menggunakan citra udara drone. Dataset yang digunakan terdiri dari 594 citra hasil frame capturing video drone dengan total 5.369 objek bangunan yang dianotasi dalam format COCO JSON. Data dibagi menjadi 70% training, 20% validation, dan 10% testing. Proses pelatihan dilakukan menggunakan transfer learning dengan optimizer AdamW, mekanisme early stopping, serta evaluasi menggunakan COCOeval. Kinerja segmentasi dievaluasi menggunakan metrik mAP, AP50, AP75, dan IoU, sedangkan estimasi luas bangunan dievaluasi menggunakan MAE, MAPE, dan WAPE setelah dilakukan konversi skala dari piksel persegi (px^2) ke meter persegi (m^2) berdasarkan median rasio per kelas. Hasil pengujian menunjukkan bahwa model mencapai mAP sebesar 82,03%, AP50 sebesar 94,52%, AP75 sebesar 89,50%, serta rata-rata IoU sebesar 88,12%. Pada tahap estimasi luas, diperoleh MAE rata-rata sebesar 8,063 m^2, MAPE sebesar 4,205%, dan WAPE sebesar 3,579%. Hasil tersebut menunjukkan bahwa Mask R-CNN mampu melakukan segmentasi bangunan secara presisi serta memberikan estimasi luas area yang akurat dan konsisten. Dengan demikian, pendekatan ini berpotensi mendukung pemetaan detail kampus dan perencanaan tata kelola lahan berbasis citra drone secara lebih efektif.

Kata Kunci: Mask R-CNN, segmentasi instance, citra drone, deteksi bangunan, estimasi luas area, deep learning, computer vision, COCOeval, tata kelola lahan.

ABSTRACT

IMPLEMENTATION OF MASK R-CNN TO DETECT AREAS AT THE UNIVERSITY OF LAMPUNG IN LAND GOVERNANCE

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The implementation of deep learning–based computer vision technology for building area mapping has become a strategic solution to support more efficient land management. This study implements the Mask Region-Based Convolutional Neural Network (Mask R-CNN) method with a ResNet-50 Feature Pyramid Network (FPN) backbone to detect, segment, and estimate the area of faculty buildings at Universitas Lampung using drone aerial imagery. The dataset consists of 594 images extracted from drone video frames, containing a total of 5,369 annotated building objects in COCO JSON format. The data were divided into 70% training, 20% validation, and 10% testing sets. The training process employed transfer learning with the AdamW optimizer, an early stopping mechanism, and evaluation using COCOeval. Segmentation performance was evaluated using mAP, AP50, AP75, and IoU metrics, while building area estimation was assessed using MAE, MAPE, and WAPE after applying a scale conversion from square pixels (px^2) to square meters (m^2) based on the median ratio per class. The experimental results indicate that the model achieved an mAP of 82.03%, AP50 of 94.52%, AP75 of 89.50%, and a mean IoU of 88.12%. In the area estimation stage, the model obtained an average MAE of 8.063 m^2, a MAPE of 4.205%, and a WAPE of 3.579%. These findings demonstrate that Mask R-CNN is capable of performing precise building segmentation while providing accurate and consistent area estimation. Therefore, this approach has strong potential to support detailed campus mapping and drone-based land management planning more effectively.

Keywords: Mask R-CNN, instance segmentation, drone imagery, building detection, area estimation, deep learning, computer vision, COCOeval, land management.