ABSTRACT

SATELLITE IMAGE-BASED ROAD SEMANTIC SEGMENTATION USING DOUBLE U-NET DEEP LEARNING MODEL WITH IMAGE PRE-PROCESSING OF ROTATING AUGMENTATION, CONTRAST STRETCHING AND EDGE ENHANCEMENT

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Roads play an important role in people's lives by providing access to essential facilities such as schools and hospitals, thereby increasing people's productivity. The use of satellite imagery and computer vision technology can speed up and improve the efficiency of road map creation. Deep learning methods such as U-Net have been used for road segmentation from satellite images, but the results have not been optimal. This study aims to examine the performance of DoubleU-Net and the effect of image pre-processing in satellite image-based road segmentation.

This research implements the DoubleU-Net deep learning model for road segmentation based on satellite images. Pre-processing methods such as rotating augmentation, contrast stretching, and edge enhancement are applied to increase the contrast value and clarify the edges in the satellite images used. The results show that combining the two U-Net models into a DoubleU-Net model results in a significant improvement in the IoU and dice coefficient values, achieving an average increase of 2% and integrated with image processing the model performance experiences an average increase in IoU and dice coefficient values of 2-4%. The highest performance was achieved by the DoubleU-Net model with rotating augmentation pre-processing resulting in an IoU performance value of 45.99% and a dice coefficient performance of 61.12%.

Keywords: Satellite Image, Road, Deep Learning, Segmentation, Double-Unet, Land Cover

INTISARI

SEGMENTASI SEMANTIK JALAN BERBASIS CITRA SATELIT MENGGUNAKAN MODEL *DEEP LEARNING* DOUBLE U-NET DENGAN PRA-PEMROSESAN CITRA *ROTATING AUGMENTATION*, *CONTRAST STRETCHING* DAN *EDGE ENHANCEMENT*

Oleh

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Jalan memiliki peran penting dalam kehidupan manusia dengan memberikan akses ke fasilitas penting seperti sekolah dan rumah sakit, sehingga meningkatkan produktivitas masyarakat. Penggunaan teknologi citra satelit dan computer vision, dapat mempercepat dan meningkatkan efisiensi pembuatan peta jalan. Metode deep learning seperti U-Net telah digunakan untuk segmentasi jalan dari citra satelit, tetapi hasilnya belum optimal. Penelitian ini bertujuan untuk menguji performa DoubleU-Net serta pengaruh pra-pemrosesan citra dalam segmentasi jalan berbasis citra satelit.

Penelitian ini mengimplementasikan model deep learning DoubleU-Net untuk segmentasi jalan berbasis citra satelit. Metode pra-pemrosesan seperti *rotating augmentation*, *contrast stretching*, dan *edge enhancement* diterapkan untuk meningkatkan nilai kontras dan memperjelas tepi pada citra satelit yang digunakan. Hasil menunjukkan bahwa penggabungan dua model U-Net menjadi model DoubleU-Net menghasilkan peningkatan yang signifikan dalam nilai IoU dan *dice coefficient*, mencapai rata-rata kenaikan sebesar 2% dan diintegrasikan dengan pemrosesan citra performa model mengalami rata-rata kenaikan nilai IoU dan *dice coefficient* sebesar 2-4%. Performa tertinggi diraih oleh model DoubleU-Net dengan pra-pemrosesan *rotating augmentation* menghasilkan nilai performa IoU sebesar 45.99% dan performa *dice coefficient* sebesar 61,12%.

Kata Kunci: Citra Satelit, Jalan, Pembelajaran Mendalam, Segmentasi, Double-Unet, Tutupan Lahan