PENGEMBANGAN MODEL SEGMENTASI SEMANTIK BERBASIS *DEEPLABV3+* UNTUK PEMANTAUAN SAMPAH DI PERAIRAN SUNGAI

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ABSTRAK

Penelitian ini mengembangkan model segmentasi semantik berbasis *DeepLabv3+* untuk pemantauan sampah di perairan sungai menggunakan citra dari *Unmanned Aerial Vehicle* (UAV). Latar belakang penelitian ini berasal dari permasalahan pencemaran sungai yang disebabkan oleh penanganan sampah yang tidak optimal karena kebiasaan masyarakat membuang sampah oleh masyarakat yang membuat sampah ke sungai. Metode yang dijalankan terdiri dari finalisasi *dataset*, persiapan data, membangun model dan simulasi segmentasi. *Dataset* dibuat secara mandiri dengan merekam menggunakan perangkat UAV yang bergerak, ektraksi *frame*, pembersihan data dan anotasi manual dengan *binary mask* yang kemudian dikategorikan ke dalam kategori sampah-nonsampah dan sungai-nonsungai. *Dataset* berjumlah 95 citra dan diperluas melalui augmentasi hingga berjumlah 2,470, kemudian dibagi menjadi *Training* 80% (1,976), *Validation* 10% (247) dan *Test* 10% (247). Untuk menghasilkan peta segmentasi objek sampah di perairan sungai, penelitian ini melatih dua model secara terpisah menggunakan Arsitektur *DeepLabv3+* dengan pengaturan pelatihan yang serupa pada *hyperparameter*. Hasil peta segmentasi dari masing-masing model diintegrasikan menggunakan operasi logika *AND*. Model kategori sampah-nonsampah dengan performa terbaik adalah dengan menggunakan *Dice Coeficient Loss,* dengan rata-rata *Pixel Accuracy* 98.68%, *Precision* 87.6%, *Recall* 74.96%, *F1-Score* 79.38%, dan IoU 68.89%. Sementara, pada model sungai-nonsungai, performa terbaik adalah *Jaccard Loss* dengan menerapkan *Regularization Dropout,* memperoleh rata-rata *Pixel Accuracy* 99.93%, *Precision* 99.94%, *Recall* 99.96%, F1-*Score* 99.95%, dan IoU 99.9%. Penelitian ini menyajikan pendekatan dua model dengan tugas yang berbeda dan bekerja secara paralel dengan menggunakan Arsitektur *DeepLabv3+*, mampu diintegrasikan dengan baik untuk memetakan area sampah di perairan sungai. Dengan demikian, berkontribusi dalam upaya pencegahan banjir lebih dini serta mendeteksi pencemaran sampah di sungai secara optimal.

Kata-kata kunci: segmentasi semantik, sementasi citra, pencemaran sungai, citra UAV, *DeepLabv3+,* integrasi model, *streamlit*, CNN, *deep learning*.

DEVELOPMENT OF DEEPLABV3+
BASED SEMANTICSEGMENTATION MODEL
FORLITTER MONITORING IN RIVER WATERS

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ABSTRACT

This study develops a DeepLabv3+ based semantic segmentation model for monitoring waste in river waters using images from an Unmanned Aerial Vehicle (UAV). The background of this study stems from the problem of river pollution caused by suboptimal waste management due to the habit of people disposing of waste into rivers. The methods employed include dataset finalization, data preparation, model building, and segmentation simulation. The dataset was created independently by recording using a moving UAV device, frame extraction, data cleaning, and manual annotation with a binary mask, which was then categorized into waste-non-waste and river-non-river categories. The dataset consists of 95 images and was expanded through augmentation to 2,470 images, then divided into Training 80% (1,976), Validation 10% (247), and Test 10% (247). To generate a segmentation map of trash objects in river waters, this study trained two models separately using the DeepLabv3+ architecture with similar training settings on hyperparameters. The segmentation maps from each model were integrated using the AND logical operation. The best-performing model for the waste-non-waste category used Dice Coefficient Loss, achieving an average Pixel Accuracy of 98.68%, Precision of 87.6%, Recall of 74.96%, F1-Score of 79.38%, and IoU of 68.89%. Meanwhile, for the river-non-river model, the best performance was achieved using Jaccard Loss with Dropout Regularization, yielding an average Pixel Accuracy of 99.93%, Precision of 99.94%, Recall of 99.96%, F1-Score of 99.95%, and IoU of 99.9%. This study presents a two-model approach with different tasks that operate in parallel using the DeepLabv3+ architecture, which can be effectively integrated to map waste areas in river waters. Thus, it contributes to efforts for earlier flood prevention and optimal detection of waste pollution in rivers.

Keywords: semantic segmentation, image segmentation, river pollution, UAV image, DeepLabv3+, model integration, streamlit, CNN, deep learning.