

**SEGMENTASI SEMANTIK DATA CITRA SENTINEL-2 PADA
PEMETAAN PENGGUNAAN LAHAN DAN PENUTUPAN LAHAN
MENGUNAKAN MODIFIKASI U-SEGNET**

SKRIPSI



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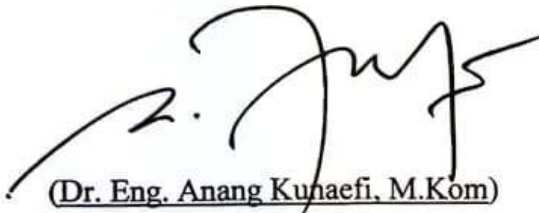
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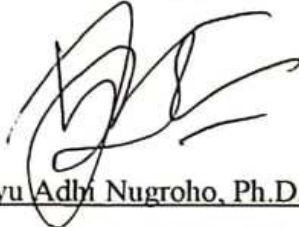
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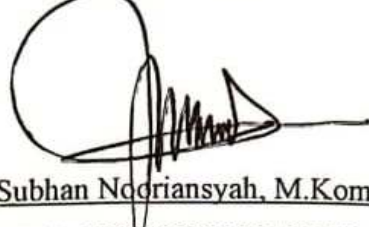
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ABSTRAK

SEGMENTASI SEMANTIK DATA CITRA SENTINEL-2 PADA PEMETAAN PENGGUNAAN LAHAN DAN PENUTUPAN LAHAN MENGUNAKAN MODIFIKASI U-SEGNET

Oleh:

Tiara Melati Putri Wiryawanto

Pemantauan lingkungan, perencanaan kota, dan pengelolaan sumber daya merupakan bentuk dari implementasi SDG 15 (*Sustainable Development Goals*) yang berfokus untuk melindungi, memulihkan, dan mendorong pemanfaatan hutan dan ekosistem darat secara efisien dan berkelanjutan. Pada faktanya, hal tersebut terhambat dengan adanya fenomena urbanisasi yang semakin meningkat dan menyebabkan kerusakan ekosistem alam. Untuk dapat melakukan pemantauan berkala dibutuhkan adanya pemetaan penggunaan lahan dan tutupan lahan (LULC) secara otomatis sebagai upaya mencegah kerusakan ekosistem alam. Namun, lanskap yang kompleks dan transisi yang halus antara berbagai kelas LULC menjadi tantangan besar untuk melakukan segmentasi yang optimal. Penelitian ini mengusulkan sebuah modifikasi dari arsitektir U-SegNet yang merupakan gabungan dari dua arsitektur segmentasi *deep learning* yang banyak digunakan, SegNet dan U-Net, untuk meningkatkan pemetaan LULC. Arsitektur ini memiliki arsitektur *encoder-decoder* yang menggabungkan *pooling indices* (SegNet) dan *skip connection* (U-Net) untuk menghasilkan dan mengirimkan informasi gambar spasial. Penelitian ini berhasil membangun arsitektur dan menunjukkan bahwa arsitektur modifikasi U-SegNet yang diusulkan meningkatkan kinerja segmentasi, mencapai akurasi sebesar 82% dan mIoU sebesar 42% pada *dataset* Sen-2 LULC. Dibandingkan arsitektur *baseline* U-SegNet, hasil ini mengungguli dari seluruh metrik evaluasi *recall*, *precision*, *F1-score*, *accuracy*, dan mIoU secara berturut-turut, yaitu 19%, 13%, 19%, 11%, dan 16%.

Kata Kunci: Penggunaan dan Penutupan Lahan, Segmentasi Semantik, *Deep Learning*, U-Net, SegNet

ABSTRACT

SEMANTIC SEGMENTATION OF SENTINEL-2 IMAGERY IN LAND USE AND LAND COVER MAPPING USING MODIFIED U-SEGNET

By:

Tiara Melati Putri Wiryawanto

Environmental monitoring, urban planning, and resource management are forms of implementing SDG 15 (Sustainable Development Goals), which focus on protecting, restoring, and promoting the sustainable and efficient use of forests and terrestrial ecosystems. However, these efforts are hindered by the increasing phenomenon of urbanization, which causes damage to natural ecosystems. To conduct regular monitoring, it is necessary to have automated land use and land cover (LULC) mapping to prevent ecosystem damage. Nevertheless, the complex landscape and the subtle transitions between various LULC classes pose significant challenges for optimal segmentation. This research proposes a modification of the U-SegNet architecture, which combines two widely used deep learning segmentation architectures, SegNet and U-Net, to improve LULC mapping. This architecture features an encoder-decoder structure that integrates pooling indices (from SegNet) and skip connections (from U-Net) to generate and transmit spatial image information. The study successfully built the architecture and demonstrated that the proposed modified U-SegNet architecture improves segmentation performance, achieving an accuracy of 82% and an mIoU of 42% on the Sen-2 LULC dataset. Compared to the baseline U-SegNet architecture, these results outperform across all evaluation metrics: recall, precision, F1-score, accuracy, and mIoU by 19%, 13%, 19%, 11%, and 16%, respectively.

Keywords: Land Use Land Cover, Semantic Segmentation, Deep Learning, U-Net, SegNet

DAFTAR ISI

LEMBAR PERNYATAAN KEASLIAN	ii
LEMBAR PERSETUJUAN PEMBIMBING	iii
LEMBAR PENGESAHAN TIM PENGUJI SKRIPSI	iv
LEMBAR PERNYATAAN PERSETUJUAN PUBLIKASI	v
MOTTO	vi
KATA PENGANTAR	vii
ABSTRAK	ix
DAFTAR ISI	xi
DAFTAR TABEL	xiii
DAFTAR GAMBAR	xiv
BAB I PENDAHULUAN	1
1.1. Latar Belakang	1
1.2. Perumusan Masalah	5
2.3. Batasan Masalah	5
2.4. Tujuan Penelitian	5
2.5. Manfaat Penelitian	6
2.6. Sistematika Penelitian	7
BAB II TINJAUAN PUSTAKA	8
2.1. Tinjauan Penelitian Terdahulu	8
2.2. Teori Dasar	15
2.2.1. <i>Land-use Land-cover (LULC)</i>	15
2.2.2. Segmentasi Semantik	16
2.2.3. Citra Satelit Sentinel-2	17
2.2.4. <i>Deep Learning</i>	19
2.2.5. Metode <i>Pooling</i>	19
2.2.6. <i>SegNet Architecture</i>	22
2.2.7. <i>Pooling Indices</i>	24
2.2.8. <i>Skip Connection</i>	24
2.2.9. <i>U-Net Architecture</i>	25
2.2.10. <i>Python</i>	27

2.2.11. <i>Evaluation Matrix</i>	28
2.3. Integrasi Keilmuan	30
BAB III METODOLOGI PENELITIAN.....	32
3.1. Desain Penelitian	32
3.1.1. Perumusan Masalah	33
3.1.2. Studi Literatur	33
3.1.3. Pengumpulan Data	34
3.1.4. <i>Data Sampling</i>	35
3.1.5. <i>Data Augmentation</i>	35
3.1.6. Pemodelan.....	36
3.1.7. Penulisan Laporan.....	47
BAB IV HASIL DAN PEMBAHASAN	48
4.1. <i>Data Preprocessing</i>	48
4.1.1. <i>Data Sampling</i>	48
4.1.2. <i>Data Augmentation</i>	49
4.2. Pemodelan	52
4.3. Pelatihan dan Validasi Model.....	55
4.3.1. Hasil Parameter dan <i>Running Time</i>	55
4.3.2. Grafik <i>Loss</i> pada <i>Dataset Training</i> dan <i>Validation</i>	56
4.3.3. Grafik Akurasi pada <i>Dataset Training</i> dan <i>Validation</i>	57
4.4. Pengujian	58
4.5. Peta Segmentasi.....	60
4.5.1. Model U-SegNet (Skenario 1)	61
4.5.2. Model Modifikasi U-SegNet (Skenario 2).....	63
4.5.3. Model Modifikasi U-SegNet dengan Augmentasi (Skenario 3).....	66
4.6. Evaluasi dan Analisis	67
BAB V KESIMPULAN	72
5.1. Kesimpulan.....	72
5.2. Saran	72
DAFTAR PUSTAKA	74

DAFTAR TABEL

Tabel 2.1. Kajian literatur penelitian terdahulu	8
Tabel 2.2. Confusion matrix yang digunakan dalam penelitian ini	28
Tabel 3.1. Pelabelan kelas LULC	34
Tabel 3.2. Arsitektur U-SegNet	39
Tabel 3.3. Modifikasi arsitektur U-SegNet	40
Tabel 3.4. Skenario pengujian.....	45
Tabel 4.1. Jumlah dataset sebelum dan sesudah sampling.....	49
Tabel 4.2. Komposisi dataset pada setiap kelas	49
Tabel 4.3. Pseudocode convolution block	52
Tabel 4.4. Pseudocode bottleneck.....	53
Tabel 4.5. Konfigurasi hyperparameter arsitektur modifikasi U-SegNet	54
Tabel 4.6. Hasil performa training dan validation dataset	55
Tabel 4.7. Hasil F1-score setelah pengujian	59
Tabel 4.8. Evaluasi metrik hasil pengujian	60
Tabel 4.9. Keterangan warna per kelas	61
Tabel 4.10. Evaluasi dan analisis pada gambar kompleks.....	68
Tabel 4.11. Evaluasi dan analisis pada gambar dengan dominasi kelas	69

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S U R A B A Y A

DAFTAR GAMBAR

Gambar 2.1. Dataset LULC berdasarkan label	15
Gambar 2.2. Segmentasi semantik pada pemetaan LULC.....	17
Gambar 2.3. Citra Sentinel-2 pada berbagai resolusi.....	18
Gambar 2.4. Contoh operasi max pooling	20
Gambar 2.5. Contoh operasi average pooling.....	21
Gambar 2.6. Max pooling dan average pooling berukuran 9 x 9 ketika diimplementasikan	21
Gambar 2.7. Perbedaan ketajaman max pooling dan average pooling	22
Gambar 2.8. Arsitektur model SegNet.....	23
Gambar 2.9. Ilustrasi proses pooling indices	24
Gambar 2.10. Proses skip connection	25
Gambar 2.11. Arsitektur model U-Net.....	26
Gambar 2.12. Intersection over Union dalam segmentasi semantik.....	30
Gambar 3.1. Diagram alur penelitian skripsi	32
Gambar 3.2. Contoh feature dan label pada dataset.....	35
Gambar 3.3. Sharpness transformation	36
Gambar 3.4. Penggabungan U-Net dan SegNet.....	37
Gambar 3.5. Arsitektur model U-SegNet yang diusulkan	38
Gambar 3.6. Alur convolution block	38
Gambar 3.7. Early stopping: pelatihan segera dihentikan setelah performa pada validation loss berhenti menurun meskipun training loss menurun.....	43
Gambar 3.8. Proses penjadwalan learning rate pada ReduceLRonPlateau	44
Gambar 3.9. Peta segmentasi semantik.....	47
Gambar 4.1. Hasil augmentasi data pada gambar yang didominasi oleh suatu kelas	50
Gambar 4.2. Hasil augmentasi data pada gambar kompleks	51
Gambar 4.3. Grafik loss pada dataset training dan validation	56
Gambar 4.4. Grafik akurasi pada dataset training dan validation	58
Gambar 4.5. Peta segmentasi U-SegNet yang kesulitan memprediksi Hutan yang Jarang	61
Gambar 4.6. Peta segmentasi U-SegNet yang kesulitan memprediksi Lahan Terbangun dan Lahan Pertanian.....	62
Gambar 4.7. Peta segmentasi U-SegNet yang kesulitan memprediksi gambar kompleks	63

Gambar 4.8. Peta segmentasi modifikasi U-SegNet pada gambar dengan dominasi kelas	64
Gambar 4.9. Peta segmentasi modifikasi U-SegNet pada gambar kompleks	65
Gambar 4.10. Peta segmentasi modifikasi U-SegNet dengan augmentasi pada gambar kompleks	66
Gambar 4.11. Peta segmentasi modifikasi U-SegNet dengan augmentasi pada gambar dengan dominasi kelas	67
Gambar 4.12. Histogram evaluasi metrik hasil pengujian	70



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S U R A B A Y A

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