

DETEKSI CITRA SAWAH PADI UNTUK REKOMENDASI LOKASI PENANAMAN TAMBAHAN (NYUSUB) PADI

Oleh

I Made Deon Virgananta., NIM 1915051035

Program Studi Pendidikan Teknik Informatika

Fakultas Teknik Dan Kejuruan

Universitas Pendidikan Ganesha

Singaraja

Email: deon@undiksha.ac.id

ABSTRAK

Pertanian padi merupakan sektor vital, dan Indonesia sebagai produsen terbesar keempat dunia menghadapi tantangan dalam optimalisasi lahan. Kerapatan tanam yang tidak merata berpotensi memberikan dampak negatif pada hasil panen, sehingga membutuhkan proses penyulaman benih atau nyusub. Praktik pemantauan area rumpang secara manual dinilai sangat tidak efisien, sehingga penggunaan teknologi Unmanned Aerial Vehicle (UAV) dari sudut pandang atas menjadi solusi modern. Penelitian ini bertujuan untuk mengembangkan metode pendeteksian area rumpang pada citra UAV sawah padi guna merekomendasikan titik koordinat penanaman tambahan. Pendekatan komputasional dibangun menggunakan pengolahan citra digital deterministik tanpa proses pelatihan model, yang meliputi segmentasi ruang warna HSV, operasi morfologi biner, dan filter adaptif median area. Estimasi jarak tanam diekstraksi secara otomatis menggunakan analisis spasial K-Nearest Neighbors (KNN). Pusat area rumpang kemudian dilokalisasi menggunakan Distance Transform, dan disaring dari redundansi prediksi ganda melalui algoritma Spatial Non-Maximum Suppression (NMS) serta Border Margin Exclusion. Hasil pengujian akhir (blind testing) menghasilkan tingkat Precision sebesar 66,74%, Recall 63,73%, dan F1-Score 65,20%. Tingkat presisi yang tergolong moderat membuktikan bahwa algoritma prapemrosesan bekerja efektif dalam menyaring derau dan anomali pada area tepi terpotong. Namun, nilai Recall menunjukkan adanya limitasi arsitektur akibat penggunaan operator Local Maxima yang bersifat density-agnostic (buta

kerapatan lokal) dan line-agnostic. Karakteristik matematis ini menyebabkan algoritma gagal merekonstruksi densitas rumpang secara proporsional pada area genangan kosong yang luas dan asimetris.

Kata Kunci: UAV, Pengolahan Citra, Jarak Tanam, *Distance Transform*, *Nyusub*



PADDY FIELD IMAGE DETECTION FOR ADDITIONAL RICE PLANTING (NYUSUB) LOCATION RECOMMENDATION

By

I Made Deon Virgananta, NIM 1915051035

Informatics Engineering Education Study Program

Faculty of Engineering and Vocational

Universitas Pendidikan Ganesha

Singaraja

Email: deon@undiksha.ac.id

ABSTRACT

Rice agriculture is a vital sector, and Indonesia, as the fourth-largest producer globally, faces land optimization challenges. Uneven planting density can potentially yield a negative impact on crop harvests, necessitating the interseeding process, locally known as nyusub. Manual monitoring of gap areas is highly inefficient; thus, the utilization of Unmanned Aerial Vehicle (UAV) technology providing a top-down view serves as a modern solution. This study aims to develop a gap area detection method on UAV images of paddy fields to recommend coordinate points for additional planting. The computational approach is built using deterministic digital image processing without model training, comprising HSV color space segmentation, binary morphological operations, and an adaptive median area filter. Planting distance estimation is automatically extracted using K-Nearest Neighbors (KNN) spatial analysis. The center of the gap areas is then localized using Distance Transform and filtered from double prediction redundancies through the Spatial Non-Maximum Suppression (NMS) algorithm and Border Margin Exclusion. Blind testing evaluation resulted in a Precision of 66.74%, a Recall of 63.73%, and an F1-Score of 65.20%. The moderate precision rate proves that the pre-processing algorithm works effectively in filtering noise and anomalies on cropped edge areas. However, the Recall value indicates architectural limitations due to the use of the Local Maxima operator, which is density-agnostic and line-agnostic. This mathematical

characteristic causes the algorithm to fail in proportionally reconstructing the gap density in large and asymmetrical empty puddle areas.

Keywords: UAV, Image Processing, Planting Distance, Distance Transform, Nyusub

