PENGEMBANGAN SISTEM EVALUASI PENGELOLAAN LAHAN PADI (Oryza sativa) BERBASIS MACHINE LEARNING
MENGGUNAKAN UAV VTOL MULTISPECTRAL
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PENGEMBANGAN SISTEM EVALUASI PENGELOLAAN LAHAN PADI (*Oryza sativa* L.) BERBASIS *MACHINE LEARNING* MENGGUNAKAN *UNMANNED AERIAL VEHICLE VERTICAL TAKE-OFF AND LANDING MULTISPECTRAL*

INTISARI

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Penelitian ini bertujuan mengembangkan sistem evaluasi efektivitas pengelolaan lahan padi berbasis *machine learning* menggunakan citra multispektral UAV VTOL. Data citra multispektral diekstraksi menjadi indeks vegetasi (NDVI, NDRE, GNDVI, OSAVI, dan CIRE) pada 93 petak sawah, kemudian diintegrasikan dengan data pengelolaan lahan yang dihitung menggunakan *Land Management Index* (LMI). Dataset selanjutnya digunakan untuk mengklasifikasikan tingkat efektivitas pengelolaan lahan menggunakan algoritma Random Forest, XGBoost, LightGBM, dan SVM. Evaluasi model dilakukan menggunakan *confusion matrix* dan *performance metrics* berupa *accuracy*, *precision, recall*, dan F1-score. Hasil menunjukkan bahwa model LightGBM memberikan performa terbaik dengan nilai *accuracy* sebesar 0,789, *precision* 0,809, *recall* 0,789, dan F1-score 0,791. Secara umum, pendekatan berbasis *machine learning* dan data multispektral UAV mampu merepresentasikan variasi kondisi tanaman dan mengklasifikasikan efektivitas pengelolaan lahan secara spasial dan objektif.

Kata kunci: Citra Multispektral, Indeks Vegetasi, *Machine learning*, Pengelolaan lahan, Pertanian Presisi, UAV VTOL.

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DEVELOPMENT OF A *MACHINE LEARNING*-BASED EVALUATION SYSTEM FOR RICE (*Oryza sativa*) FIELD MANAGEMENT USING A *MULTISPECTRAL VERICAL TAKE-OFF AND LANDING UNMANED AERIAL VEHICLE*

ABSTRACT

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This study aims to develop a *machine learning*-based evaluation system for paddy field management effectiveness using multispectral imagery from a VTOL UAV. Multispectral data were processed into vegetation indices (NDVI, NDRE, GNDVI, OSAVI, and CIRE) across 93 paddy field plots and integrated with land management data quantified using the *Land Management Index* (LMI). The dataset was then used to classify management effectiveness levels using Random Forest, XGBoost, LightGBM, and Support Vector Machine (SVM) algorithms. Model performance was evaluated using *confusion matrix* and performance metrics, including *accuracy*, precision, recall, and F1-score. The study revealed that LightGBM achieved the best performance with an *accuracy* of 0.789, precision of 0.809, recall of 0.789, and F1-score of 0.791. Overall, the integration of UAV multispectral data and *machine learning* effectively captures spatial variability and enables objective classification of land management effectiveness.

Keywords: Multispectral Imagery, Vegetation Index, *Machine learning*, Land Management, Precision Agriculture, UAV VTOL.