# RINGKASAN

Pemantauan karakteristik tanaman melalui *remote sensing* dilakukan untuk meningkatkan produktivitas pertanian dengan memanfaatkan citra satelit. Citra satelit Sentinel-2 menyediakan band yang cukup sensitif terhadap perubahan tanaman, sedangkan citra Sentinel-1 SAR band C merepresentasikan struktur kanopi tanaman. Tujuan penelitian yaitu (i) mengidentifikasi jenis dan fase pertumbuhan tanaman (padi dan palawija) dari citra sentinel-1 dengan sentinel-2; (ii) mendapatkan akurasi prediksi penggunaan algoritma CNN; dan (iii) mengetahui performa algoritma CNN berbasis Sistem Informasi Geografis pada beberapa daerah irigasi.

Penelitian menggunakan algoritma *Convolutional Neural Network* (CNN) dalam mengidentifikasi jenis dan fase pertumbuhan tanaman. Area kajian meliputi 3 Daerah Irigasi (DI) yaitu Karangnangka, Banjaran dan Serayu. Penelitian memanfaatkan platform Google Colab dan GEE dalam mengolah indeks spektral dan membangun model CNN. Variabel yang digunakan meliputi NDVI, GNDVI, TNDVI, SAVI, IRECI, S2REP, dan PSSRa dari citra Sentinel-2. Sedangkan dari citra Sentinel-1 menggunakan 3 *feature* radar yakni RVI, Diff, dan Ratio. Indeks spektral dari Sentinel-1 merupakan turunan dari polarisasi tunggal VV dan VH dengan orbit *descending.* Uji akurasi model berupa *Usser Accuracy* (UA), *Producer Accuracy* (PA), *Overall Accuracy* (OA), dan *Kappa Coefficient* (KC) dari *confusion matrix.*

Hasil penelitian menunjukkan bahwa model CNN berhasil mengidentifikasi jenis tanaman pada citra Sentinel-1, Sentinel-2 dan citra kombinasi kedua satelit. Selain itu, hasil *confusion matrix* menunjukkan bahwa kombinasi citra Sentinel-1 dan Sentinel-2 memberikan performa prediksi yang lebih unggul dibandingkan penggunaan citra tunggal. Akurasi model CNN dengan citra kombinasi mendapatkan *Overall Accuracy* tertinggi yakni 66,2%. Angka tersebut lebih baik dari penggunaan Sentinel-2 (OA 59,1%) dan Sentinel-1 (OA 44,9%). Visual hasil identifikasi algoritma menunjukkan luasan tanaman padi 49,81 Ha lebih besar dari luasan tanaman palawija 86,15 Ha pada citra kombinasi DI Karangnangka. Sementara itu, tanaman palawija yang teridentifikasi pada DI Banjaran seluas 74,94 Ha dari Sentinel-1, 84,74 Ha dari Sentinel-2, dan 86,15 Ha dari citra kombinasi. Fase pertumbuhan tanaman teridentifikasi melalui nilai indeks spektral yang diperoleh dari citra Sentinel-1 dan Sentinel-2. Dengan demikian, harapannya penelitian dapat memberikan kontribusi nyata dalam mengembangkan strategi menjaga ketahanan pangan nasional melalui identifikasi jenis dan fase pertumbuhan tanaman pangan. Selain itu, memungkinkan model untuk dikembangkan lebih lanjut dalam memprediksi hasil panen, kebutuhan air tanaman dan pola pertumbuhan abnormal tanaman terutama di daerah irigasi.

## *SUMMARY*

*Monitoring plant characteristics through remote sensing is carried out to increase agricultural productivity by utilizing satellite imagery. Sentinel-2 satellite imagery provides bands that are sufficiently sensitive to changes in plants, while Sentinel-1 SAR band C imagery represents plant canopy structure. The objectives of the study are (i) to identify the types and growth phases of crops (rice and corn) from Sentinel-1 and Sentinel-2 images; (ii) to obtain the prediction accuracy of the CNN algorithm; and (iii) to determine the performance of the CNN algorithm based on Geographic Information Systems in several irrigation areas.*

*The study uses the Convolutional Neural Network (CNN) algorithm to identify crop types and growth stages. The study area covers three irrigation areas (DI): Karangnangka, Banjaran, and Serayu. The study utilizes the Google Colab and GEE platforms to process spectral indices and build the CNN model. The variables used include NDVI, GNDVI, TNDVI, SAVI, IRECI, S2REP, and PSSRa from Sentinel-2 imagery. From Sentinel-1 imagery, three radar features were used: RVI, Diff, and Ratio. The spectral indices from Sentinel-1 are derived from single polarization VV and VH with a descending orbit. The model accuracy test consists of Usser Accuracy (UA), Producer Accuracy (PA), Overall Accuracy (OA), and Kappa Coefficient (KC) from the confusion matrix.*

*The results of the study show that the CNN model successfully identified crop types in Sentinel-1, Sentinel-2, and combined satellite images. Additionally, the confusion matrix results indicate that the combination of Sentinel-1 and Sentinel-2 images provides superior prediction performance compared to using single images. The CNN model's accuracy with combined images achieved the highest Overall Accuracy of 66.2%. This figure is better than the use of Sentinel-2 (OA 59.1%) and Sentinel-1 (OA 44.9%). The visual results of the algorithm identification show that the area of rice crops (49.81 Ha) is larger than the area of cash crops (86.15 Ha) in the combined DI Karangnangka image. Meanwhile, the identified non-rice crops in the Banjaran DI area covered 74.94 hectares from Sentinel-1, 84.74 hectares from Sentinel-2, and 86.15 hectares from the combined image. The growth phase of the crops was identified through spectral index values obtained from Sentinel-1 and Sentinel-2 imagery. Thus, it is hoped that this research can make a tangible contribution to developing strategies for maintaining national food security through the identification of crop types and growth phases. Additionally, it enables the model to be further developed to predict crop yields, water requirements, and abnormal growth patterns, particularly in irrigated areas.*