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Estimation of Heading Date of Paddy Rice from Slanted View Images Using Deep Learning Classification Model

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[Abstract]

Estimation of heading date of paddy rice is laborious and time consuming. Therefore, automatic estimation of heading date of paddy rice is highly essential. In this experiment, deep learning classification models were used to classify two difference categories of rice (vegetative and reproductive stage) based on the panicle initiation of paddy field. Specifically, the dataset includes 444 slanted view images belonging to two categories and was then expanded to include 1,497 images via IMGAUG data augmentation technique. We adopt two transfer learning strategies: (First, used transferring model weights already trained on ImageNet to six classification network models: VGGNet, ResNet, DenseNet, InceptionV3, Xception and MobileNet, Second, fine-tuned some layers of the network according to our dataset). After training the CNN model, we used several evaluation metrics commonly used for classification tasks, including Accuracy, Precision, Recall, and F1-score. In addition, GradCAM was used to generate visual explanations for each image patch. Experimental results showed that the InceptionV3 is the best performing model in terms of the accuracy, average recall, precision, and F1-score. The fine-tuned InceptionV3 model achieved an overall classification accuracy of 0.95 with a high F1-score of 0.95. Our CNN model also represented the change of rice heading date under different date of transplanting. This study demonstrated that image based deep learning model can reliably be used as an automatic monitoring system to detect the heading date of rice crops using CCTV camera.

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