Korean Melon Disease Detection

- Korean melon disease diagnosis using CycleGAN, Compare between CNN and SVM

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BACKGROUND

Plant disease is one of the causes of reducing crop yields. In Korea, people like to eat korean melon, but yiels of korean melon also is decreasing because of plant disease. Thus, for solving this problems, we suggest the plant disease diagnosis model using machine learning.

Healthy | Downy mildew | Powdery mildew

OBJECTIVES

This sutdy was conducted to find the effective model in performance and to improve the accuracy of plant disease diagnosis using three machine learning models (CycleGAN, CNN, SVM).

1. Generating fake disease images with CycleGAN in order to overcome the limitation of deficien data.
2. Comparing the model accuracy between CNN and SVM in performance

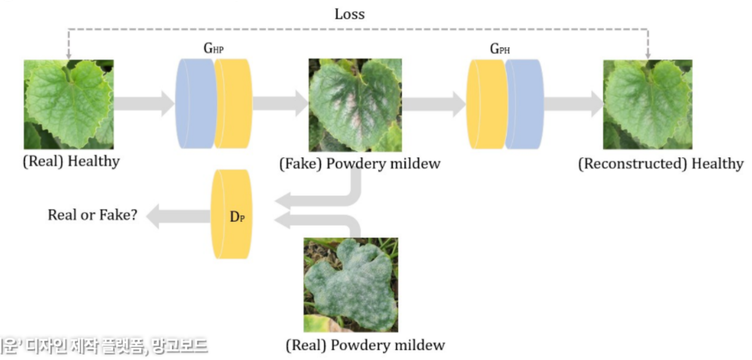
METHODS

Data & Data Augmentation

Dataset A is korean melon images of plant disease diagnosis data from AI Hub. Healthy leaf images are more than milions, but two types of diseases image were offered images about 400(Downy mildew, White powdery mildew).

Class	Dataset A			CycleGAN
	Training	Validation	Testing	Training
Healthy	360	45	45	-
Downy mildew(D)	360	45	45	128
Powdery mildew(P)	360	45	45	128

Each class used 450 images in order to prevent imbalance data problem. For data augmentation, we designed CycleGAN model and generated the fake plant disease.

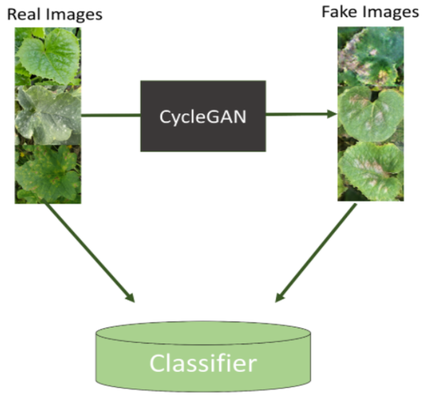


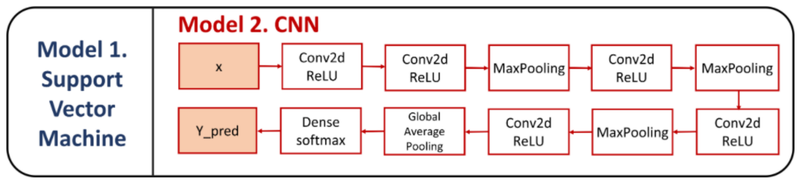
'쉬운' 디자인 제작 플랫폼, 망고보드

Previous figure is model structure of CycleGAN. Training the model with imbalance data paired with normal leaves and disease leaves creates a fake image with a lesion site while having the shape of a leaf.

Classification Model

SVM and CNN model were selected as classification model. After designing each model, it was trained with the original dataset and with the dataset that added fake image data generated by CycleGAN. The CNN model was trained 100 times, and the verification method was not used in the SVM model, validation data are supplanted test data





CONCLUSION

DISSCUSIONS

- CNN models show significantly better performance than SVM models.
- When trained by adding fake disease images generated by -CycleGAN, performance was significantly improved in both SVM and CNN models.
- Data augmentation techniques through fake image generation can be seen as a factor in improving the performance of the melon disease classification model.

FUTURE WORK

- For data augmentation, utilizes controllable image generation models that take into account 3D such as GIRAFFE and MVCGAN
- Make and test the model that detects only the lesion site by drawing a Bounding Box that displays only the area of interest

REFERENCES

[1] Sharma, P., Berwal, Y. P. S., & Ghai, W. (2020). Performance analysis of deep learning CNN models for disease detection in plants using image segmentation. Information Processing in Agriculture, 7(4), 566-574.
[2] Zhu, J. Y., Park, T., Isola, P., & Efros, A. A. (2017). Unpaired image-to-image translation using cycle-consistent adversarial networks. In Proceedings of the IEEE international conference on computer vision (pp. 2223-2232).

RESULTS

Generated images by CycleGAN

(Real) Healthy | (Fake) Downy | (Real) Healthy | (Fake) Powdery

Test Accuracy

The table below shows the test accuracy. CNN models show higher accuracy than SVM models. Comparing trained with the original image and the model trained with the data augmented using CycleGAN, the accuracy increased by more than 6%

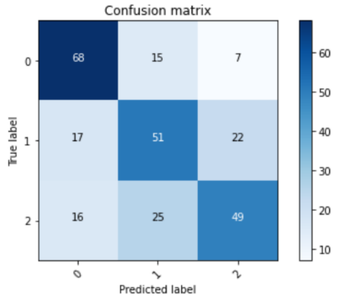
	Test Accuracy
SVM	62.96%
CNN	81.48%
SVM with CycleGAN data	67.72%
CNN with CycleGAN data	89.63%

Confusion Matrix

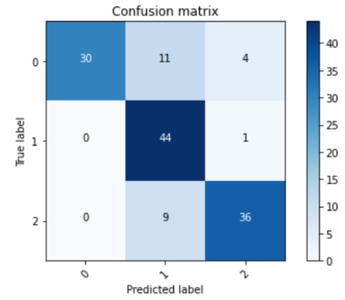
Below is the confusion matrix of the four models.
(0: Healthy, 1: Downy mildew, 2: Powdery mildew)

In the case of CNN, the case of confusion of normal leaves with korean melon downy mildew disease was greatly reduced.

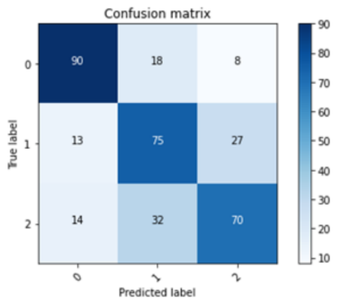
SVM model



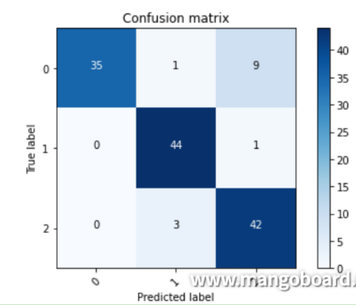
CNN model



SVM with CycleGAN data



CNN with CycleGAN data



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