Detection of Common Diseases of Taro in Japan and the Philippines ~Using machine learning

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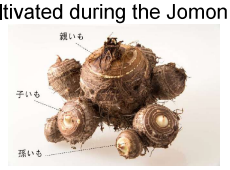
1.Introduction ～ About Taro (Sato-imo) ～

It is believed that satoimo originated in eastern India and the tropics, and was introduced to Japan from China, They were already cultivated during the Jomon period.It is believed to have been a staple food before rice was introduced. A sato-imo is a fattened stem. A seed taro is planted and grown. The seed taro produces a parent taro, around which grows a baby taro, and around that grows a grandchild taro. Then, thick petioles and large leaves grow on the ground.



https://amanoshokudo.jp/season/7467/

We have learned that there are several kinds of diseases of sato-imo, which is commonly eaten in both the Philippines and Japan, and we are developing an application that anyone can use to identify the diseases.

2.Purpose of our study

This is a joint research project with high school students in the Philippines.
We have been trying **to develop an app to diagnose taro leaf disease using a smartphone** . We plan to create an android version of the app so that we will be able to allow farmers in Japan and the Philippines to easily diagnose diseases with their smartphones, and also would like to contribute to the development of the agricultural sector in this field.

3.Types of Taro (sato-imo) Diseases

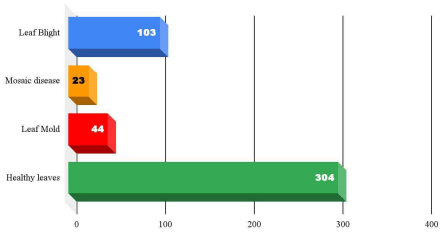
The three disease targets for which we will create an application to diagnose diseases are as follows: **leaf blight, mosaic, and leaf mold**. This is because disease symptoms appear on the leaves, making it easy to collect photos.

taro leaf blight　taro mosaic　taro leaf mold　cf. healthy leaves

4.Study Ⅰ【Collecting pictures】

We went out to the site or contacted all parties involved to collect photos. Unfortunately we were not able to collect the diseased leaves ourselves, but we did go out and photograph the healthy ones.
Our target number of photos is 100 for each disease.

The number of photos collected so far is as follows

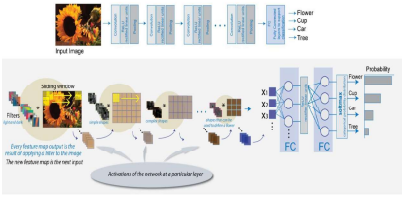


Research institutes and people that provided photos for us.
Mr Kimura, a Farmer in Ryugasaki City /Kagoshima Agricultural Development Center/ Gifu University / **University of Hawaii** / Kyushu University
Mr. Arai's Crop Pests and Diseases Picture Collection in Saitama
Okayama Prefectural Agriculture, Forestry and Fisheries Research Center
Ishikawa Prefectural Agriculture and Forestry Research Center

5.Study Ⅱ【Programming with Python】

Image recognition using python
Determine whether or not the leaf is sick and what kind of disease it has using **the CNN method.**

1. Collect "teacher data" for **CNN image recognition.**
2. **Increase the number of pictures in the database by a factor of 18 using geometric transformation on the pictures collected.**
3. Let the program learn.
4. Run the program.
5. Calculate the percentage of correct answers.



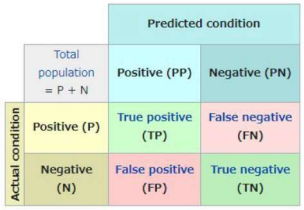
https://towardsdatascience.com/demystifying-convolutional-neural-networks-384785791596ata Science

6.Pilot study for Study Ⅱ

As a first step, we have already created a program that learns from **a database of photos from the Internet.** We have created a prototype program that can hopefully identify two diseases, **leaf mold and leaf blight**, when a photo to be judged is loaded.
We determined the success rate of identifying leaf blight and leaf mold by testing the program with the photos received from each research institute.

		Program decisions	
		leaf mold	leaf blight
real leaves	leaf mold	8	15
	leaf blight	5	18

The success rate of identifying leaf blight was 78.3% and that of leaf mold was 34.7%. The accuracy of this program was 56.5%.
The problem with this program was the poor quality of the Internet photographs used for the database. **It seems necessary to use only photos from reliable research institutions for the database.**

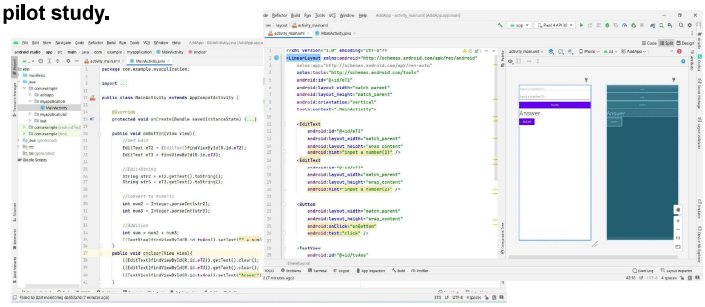


hhttps://en.wikipedia.org/wiki/Confusion_matrix

$$accuracy = \frac{TP+TN}{TP+TN+FP+FN}$$

7.Study Ⅲ【Application Creation】

We are learning **Java** in order to work with the language. **We need to convert Python programming code in Study Ⅱ into Javascript to develop an app.**
Also, we are learning about application creation with Android Studio through reference books. **We were actually able to create a calculator app as a pilot study.**



8.Limitations

①The diseases in our study are limited to the ones which appears on the leaves because it is easy to take pictures with a smartphone. .
②The program is currently limited to geometric transformation, so we plan to increase the number of image transformation patterns and let the program learn from them.
③As for the database of the program, only reliable photos collected from research institutions will be used to increase the authenticity of the photos.
④We are still lacking photos of leaf mold and mosaic disease. Now we will focus on asking universities and other research institutions to provide us with photos.

9.References

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