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Detection of Abnormal Area on Paddy Field using K-mean Algorithm

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INTRODUCTION

- Remote sensing with UAV's platforms is a rising solution for agricultural monitoring because of their operating flexibility, high spatial resolution, and low cost for frequent inspection of crop fields (Willkomm et al., 2016).
- Making Green–pixels and red-pixels using k-means clustering algorithm to classify object pixels, in our case based on a set of features into k number of classes. However, k-means clustering is used to partition the paddy field image into four clusters in which one or more clusters contains the disease in case when the paddy image is infected by more than one disease (Otsu, 1979).
- Reducing noise in gradient computations is crucial to detecting accurate features. Compute the magnitude of the gradient, using the in gradient function magnitude and direction.
- Looking at the gradient magnitude, it is clear that image gradient is very noisy (Otsu, 1979).
- The effect of noise can be minimized by smoothing before gradient computation. In gradient already offers this capability for small amounts of noise by using the Sobel gradient operator. Smooth the image (Middleton and Damper, 2004).
- In this paper, we proposed an automatic efficient modified marker based K-means clustering algorithm to reduce noise in image gradient for detection of disease in paddy filed.

EXPERIMENTAL ENVIRONMENT

❖ Autonomous Aerial Platform

Table 1. UAV specifications.	
Parameters	
Class of UAV:	DJI-S1000
Gross Weight:	11 kg
Material:	Fiber glass, aluminum
Motors:	Eight BLDC motors
Length:	550 mm
Altitude	10 m
Battery	Lithium Polymer; 10000 mAh

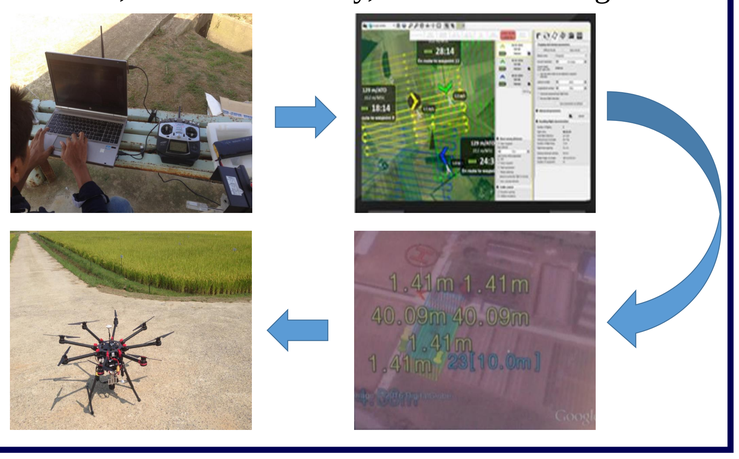
Table 2. Camera specifications.	
Parameters	
Name:	Sony Alpha a5100
Sensor size:	23.5 mm × 15.6 mm
Sensor image area per pixel:	24.3 mega pixels
Focal length:	16 mm

❖ Field Experiment

- Crop: Rice (*Oryza sativa* L.).
- Area: 2,580 m^2.
- Date of rice transplanting: May 25, 2016.
- Image acquisition: about every two weeks (May 25, 2016–October 20, 2016).

❖ Automatic Flying

- Turn on Wi-Fi internet access and turn on notebook. Then connect notebook with the internet source (Wi-Fi).
- Connect the DJI modem with the notebook.
- Then check the lower bar for GPS, Mode and Motor voltage.
- Click preview to check points. Also check the estimated number of photo, total time and total distance.
- After that click generate and it will generate a path and a new pop up window will appear.
- Then click upload to load this path to the drone and click go to start.
- At the same time remote controller throttle should be shifted on the middle position.
- And the end of the simulation path, when drone starts to come back, middle of the way, we should click go home.



PROPOSED METHOD

❖ K-mean clustering algorithm

The pixel-based direct classification method is to statistics to define single or multiple thresholds to classify an image pixel-by-pixel (Juang and Wu, 2010):

$$g(x,y) = \begin{cases} 1 \text{ if } f(x,y) > T \\ 0 \text{ if } f(x,y) \le T \end{cases} \quad \text{.....(1)}$$

An image f (x, y) can be segmented into two classes using a gray value threshold T then. Here, g (x, y) is the segmented image with two class of binary values ‘’1” and ‘’0” and T is the threshold selected at the valley point from the histogram. As our feature space to be clustered is the L*a*b* color space. We simply use with this estimation for densities of data points, we use an empirical method to choose the initial seeds set, which is a subset of data with the highest densities its definition is (Juang and Wu, 2010):

$$X_{seeds} = \{x_i | den(x_i) > T, x_i \in X\} \quad \text{.....(2)}$$

Where T is a threshold which is used to determine the number data point in the initial seeds set. It's choice depends on the total number of data to be clustered. In this paper, we fix T to be 98% of the densities $\{den(x_i)\}_i^m$ of all data in set X.

❖ Reducing Noise in Image Gradients

The effect of noise can be minimized by smoothing before gradient computation. In gradient already offers this capability for small amounts of noise by using the Sobel gradient operator smooth the image. This step involves computation of the gradient image. Ig is gradient magnitude image generated by filtering algorithm along with Prewitt masks and calculation of magnitude (Juang and Wu, 2010):

$$I_g = \sqrt{|I_h|^2 + |I_o|^2} \quad \text{..... (3)}$$

Where, I_h and I_o are images filtered by horizontal and vertical Prewitt mask, respectively.

RESULTS AND CONCLUSION

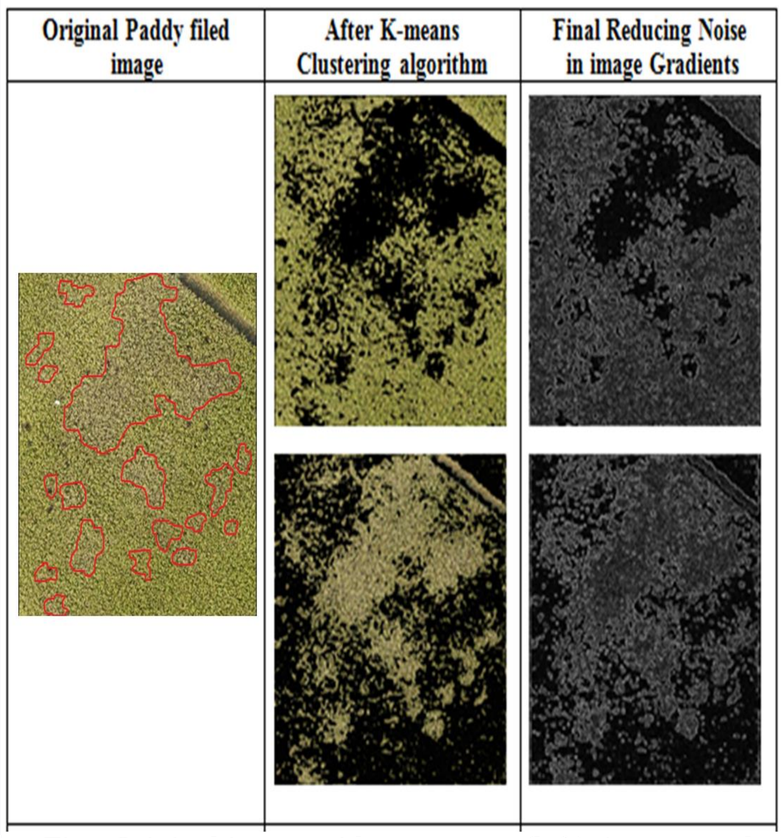


Fig.: Original image with target area (left), image result using k-means (middle), image result with reduced noise gradient (right).

- In this paper, we proposed an automatic efficient modified marker based K-means clustering algorithm to reduce noise in image gradient for detection of disease in paddy filed.
- From these pixels matrices, the texture statistics for each image were generated. Concisely, the features set were c omputed only to pixels inside the boundary of the infect ed areas of the paddy filed image.
- In other words, healthy areas inside the infected areas were also removed. And also feature gradient gaussian noise to the image green-pixels and red-pixels areas on paddy field. Those pixels, we added noise to the image on green-pixels for healthy and red-pixels for unhealthy, because, red-pixels means parts of disease, biomass, insects and damage.
- The experiment results indicate that the proposed approach is valuable, which can significantly support an accurate detection of diseased areas in a paddy filed.
- This research is the initial trial and dedicate our future works on automatic detection of paddy field diseases.

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