CLASSIFICATION OF EMPTY LAND AND SETTLEMENT PHOTOS USING SELF ORGANIZING MAP METHOD

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Abstract

Aerial Photos is the result of shooting an area of a certain height, in atmospheric space using a camera. For example shooting using airplanes, helicopters, blimps, drones or UAVs. Close review of aerial photography is to analyze land cover. One way to do the classification of images using the Artificial Neural Network method in aerial photography. ANN is a mathematical model, which imitates the workings of the nervous system of the human brain's nervous system. The way the nervous system of the human brain works is the transmission of signals from one neuron to thousands of other neurons. The Learning Model used is the Self Oganizing Map. SOM (Self Organizing Map), which is sometimes also known as Kohonen neural network system, is an artificial neural network model whose learning is unsupervised. This SOM learning system is grouping units according to a certain pattern with areas in the same class..

Keywords: *Aerial photography, classification, SOM.*

INTRODUCTION

Aerial Photography is the result of shooting an area of a certain height, within the scope of the atmosphere using a camera. For example shooting using airplanes, helicopters, blimps, drones or UAVs. The advantage, the use of aerial photography produces images or images that are more detailed (resolution around 15cm), not constrained by clouds, because it operates at an altitude below the cloud.

Weaknesses in aerial photographs must be accompanied by taking GCP (Ground Control Points in the Field) to make geometric corrections (orthorectification), because if not, it is certain that the geometric accuracy will be very low. In terms of cost, aerial photography is far more expensive compared to satellite imagery, because many things are needed, such as aircraft operating costs, flight permits (for example aircraft, helicopters), personnel costs to the field (taking GCP coordinate points or aircraft operations) , and more [1].

The need for classification in aerial photography is to analyze areas of land cover so as to provide information about changes in land cover. At this time the classification is done by digitizing on screen, it slows down the processing time because when digitizing, the operator must make a visual interpretation of each object [2].

One way is to do image classification using the Artificial Neural Network method in aerial photographs. ANN is an artificial model of the neuron network system found in the human brain network system. The way this ANN works is imitating the working process of the human brain. The human brain consists of billions of neurons, where each neuron is connected to tens of thousands of other neurons to form a complex network [3]. The learning model (Training) that will be carried out is the Self Organizing Map. SOM (Self Organizing Map) Nerve Network or commonly called the Kohonen Nerve Network system is one of the models of unsupervised learning that will classify units based on the similarity of certain patterns with areas in the same class [4].

METHODE

Data Collection

The data used to enter data in this system uses aerial photographs taken using cesna aircraft in the Bandung area. The total data used is 100 data. The data is divided into 78 training data and 22 testing data the following are examples of aerial photographic images:

Fig. 1. Settlement

Fig. 2. Field

Model design

Self Organizing Map (SOM) required list data to be read classification process while the data used are Images. Handling the process of converting image data into a list of data in this system will use the Gray Level Occurance Matrix (GLCM) extraction method. Before taking a feature, the image must be changed to the Grayscale form [5].

After the data has been changed, training is carried out on the image using Self Organizing Map. The following calculations:

1. Initialization of weights, learning rate, the decreasing factor.
2. As long as the stop condition is false, do steps 3-8.
3. For all x input factors, do steps 4-6.
4. Count D(j). $D(j) = \sum_i (w_{ij} - x_i)^2$
5. Determine the index so as to D(j) minimum.
6. For each unit j around J the weight modification:
$$w_{ij}(baru) = w_{ij}(lama) + \alpha(x_i - w_{ij}(lama))$$
7. Modification of the learning rate.
8. Test Conditions stop.

Next is modeling using illustrations from the system that will be developed using DFD.

In Figure 3 shows a context diagram consisting of 1 actor namely User. The user enters the image data then is processed by the system and returned to the user [6].

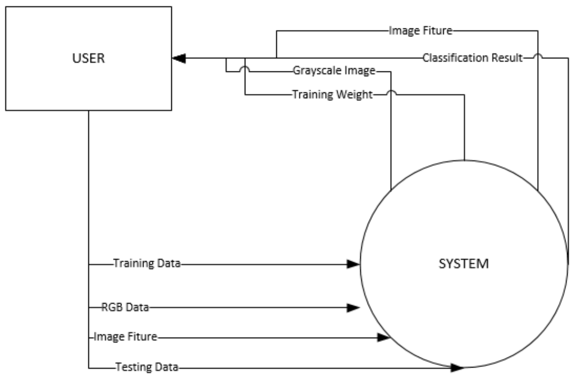

Fig. 3. Context Diagram

In Figure 4 explains the level 0 data flow diagram. The user enters the image and then changes it to the grayscale form, and is trained. After the weight is obtained, the weight becomes the reference for the comparison of vacant land and settlement in the classification process. After comparing the weight data and testing data, the classification results are displayed to the user.

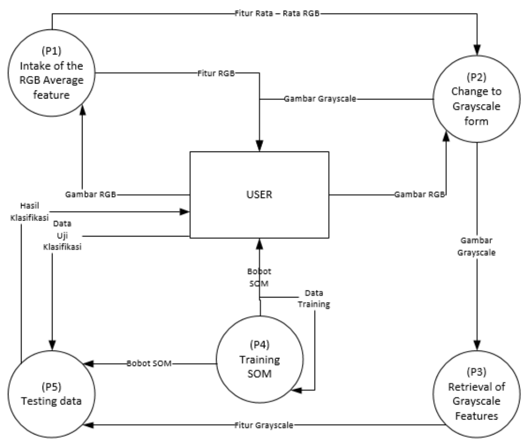

Fig. 4. Data Flow Diagram Level 0

In this P-SpEc section, we will explain about the specification process what happens in each process in the context diagram.

PSPEC Transform Image:
Inputs: Image path of the training image
Outputs: Transform image training
Body: If image_path == nil: print ("invalid image path or does not exist")

PSPEC Building Model:
Inputs: Transform image training
Outputs:
a. Training data generated
b. Data accuracy results
Body:
a. Print ("Model Score:". Classifier_model_score)
b. Return train_model

PSPEC Classification:
Inputs: Training data generated
Outputs: Classification data
Body: Print ("Classification:". Classifier_model_prediction)

III. TESTING AND RESULTS

This system classifies based on files that have been separated between training and testing. The application testing process uses a blackbox scenario.

A. Classification process

The file classification process requires several steps, which must be done before it is run, make sure you enter the image to be classified that has been provided for the classification process aerial photography. Figure 5 is a directory provided for classification:

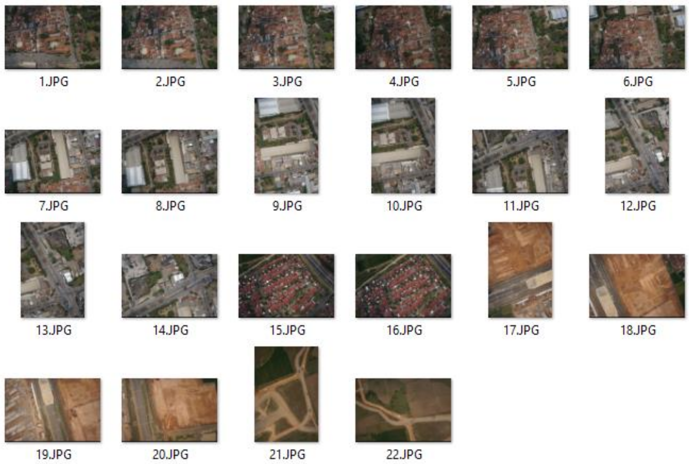

Fig. 5. File Directory

After the file is selected, the file must be converted into grayscale format so that its features can be retrieved. For changes to grayscale and feature retrieval using the following code:

```
image_folder = 'Training';
filenames = dir(fullfile(image_folder, '*.jpg'));
total_images = numel(filenames);
for n = 1:total_images
full_name= fullfile(image_folder, filenames(n).name);
asli=imread(full_name);
our_images = rgb2gray(asli);
%imwrite(our_images,strcat(num2str(n), '.jpg'));
rata_r(n)=mean(mean(asli(:,:,1)));
rata_g(n)=mean(mean(asli(:,:,2)));
rata_b(n)=mean(mean(asli(:,:,3)));
glcm=graycomatrix(our_images,'Offset',[2 0]);
stats                                                                    =
graycoprops(glcm,{'Contrast','Energy','Correlation','Homogeneity'});
standar(n)=std(std(double(our_images)));
korel(n)=stats.Correlation;
homog(n)=stats.Homogeneity;
kontras(n)=stats.Contrast;
energi(n)=stats.Energy;
varian(n)=var(var(double(our_images)));
skew(n)=skewness(skewness(double(our_images)));
entropi(n)=entropy(our_images);
training                                                                 =
[rata_r;rata_g;rata_b;standar;korel;homog;kontras;energi;varian;skew;en
tropi]';
end
xlswrite('fitur.xls',training);
```

The coding line number 7 is used to change the RGB image to grayscale. The 12th and 13th coding lines are used to retrieve the GLCM (Correlation, Homogeneity, Contrast, Energy) features in the grayscale image then the results of the feature capture are stored in the matrix and the matrix results are saved to an excel file.

In Figure 6 below are the results of the change to grayscale:

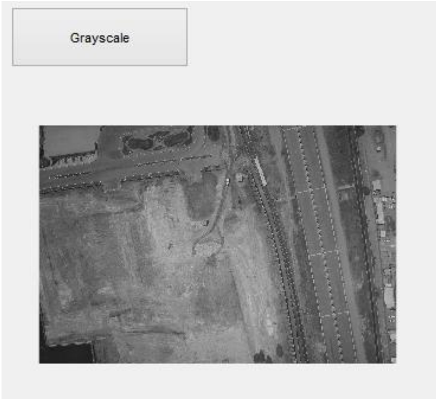

Fig. 6. Grayscale Result

After changing to the grayscale form, training is then performed on the file. The following is the coding line used to carry out the training:

```
1:   x = xlsread('fitur.xls');
2:   x=x';
3:   net = selforgmap([2 1]);
4:   net = train(net,x);
5:   view(net)
6:   bobot_input=cell2mat(net.IW);
7:   xlswrite('bobot.xls',bobot_input);
8:   y = net(x);
9:   classes = vec2ind(y);
10:  classes=classes';
11:  xlswrite('hasil_cluster_fungsi.xls',classes);
```

The first coding line is to read the features of Excel as many as 11 feature columns and 78 lines. The purpose of 78 is the image being trained and 11 are the features taken from each image. file from excel is transposed (reversed) initially row 78 column 11 into row 11 and column 78. Then set the SOM network architecture (where 2 are (settlement and fields) and 1 because only 1 model).

Line coding 4 conducts training between the set of SOM networks with the x feature and then takes the weight of the SOM network that has been trained. Save the weight value to an excel file line 8: sets the training feature to the output line 9: change the shape of the results of the cluster (1 and 2) row 10: re-transposes from 1 row 78 columns to 78 rows and 1 column line 11: save the results of clustering to an excel file.

```
Q=xlsread('fitur_tes.xls');
[n m]=size(Q);
bobot=xlsread('bobot.xls');
for i=1:n
for j=1:m
d1(i)=sqrt(sum((bobot(1,j)-Q(i,j)).^2));
d2(i)=sqrt(sum((bobot(2,j)-Q(i,j)).^2));
if(d1(i)<d2(i))
has(i)="Ladang";
else
has(i)="Permukiman";
end
end
end
has=has';
xlswrite('hasil_cluster_tes.xls',has);
```

Line 1: retrieve files from excel data testing 22 rows and 11 column features

line 2: excel file size 22 rows, 11 columns, line 3: take the file from excel weights training results som_fungsi.m file (file size 2 rows (because there are 2 clusters (settlements and fields)) and 11 feature columns) lines 4-14: used for looping where each row and column Q is calculated the distance to the weight.

The calculation process uses euclidian distance line 6 for the Field cluster and row 7 for the Settlement cluster. Lines 8-11: used to check which distance is smallest. If the smallest distance is a field, then the output is a field, on the contrary if the smallest distance is a settlement, then the output is a settlement. Line 16: the results of the cluster testing are stored in an excel file [7].

B. Testing Black-Box and Accuracy

This testing process will focus on the level of accuracy in all images, the data testing process is carried out using a Black-Box testing scenario. Black-Box testing is performed on 22 data that has been randomized and the following is example of testing data with Black-Box :

No	Image	Classification Ressult	Expected Results	Validation
1.		Settlement	Settlement	Valid
2.		Settlement	Settlement	Valid
3.		Settlement	Settlement	Valid
4.		Settlement	Settlement	Valid
5.		Settlement	Settlement	Valid

From the above table, a manual calculation is performed to obtain an accurate level of system testing with 22 image data as follows:

- To calculate the level of misclassification for system testing with 22 data images as follows:

$$\frac{Incorrect\ total\ image\ data}{Total\ image\ data}\ x\ 100$$

Where,
Total Image Data = 22 image data

Thus, the level of misclassification based on incorrect data for system testing with 22 image data from the Classification of Blank Land and Settlements in Aerial

Photographs Using the Self Organizing Map (SOM) Method is 27%.

- To calculate the accuracy of aerial photography images for system testing with 22 image data as follows:

$$\frac{Correct\ total\ image\ data}{Total\ image\ data}\ x\ 100$$

Where,
Total Image Data = 22 image data

Thus, the level of accuracy of image data is correct for system testing with 22 image data from the Classification of Blank Land and Settlements in Aerial Photographs Using the Self Organizing Map (SOM) Method of 73%.

IV.CONCLUSION

Based on the results of the research that has been done, it can be concluded that:

1. Implementation of the Application of Classification of Blank Land and Settlements in Aerial Photographs Using the Self Organizing Map (SOM) method was successful.
2. The level of accuracy obtained with aerial photographs from the Application of Classification of Blank Land and Settlements in Aerial Photographs Using the Self Organizing Map (SOM) method is 73%.

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