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THE 2nd EAST INDONESIA CONFERENCE ON COMPUTER AND INFORMATION TECHNOLOGY (EIConCIT) 2018

"Internet of Things for Industry"

MAKASSAR, 6-7 NOVEMBER 2018

Hosted by:

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PREFACE

Assalamu alaikum warahmatullahi wabarakatuh.
Bismillahir Rahmanir Raheem
(Peace be upon you. In the name of Allah, the Entirely Merciful, the Especially Merciful)

Praises be to Allah *Subhanahu wa ta'ala*, the Almighty Lord, the Alive, the Eternal, the Creator, the Owner of all lives in this universe. We thank Him for the countless blessings which have been bestowed upon us.

On behalf of the committee, I am honored and pleased to welcome you all to the 2018 East Indonesia Conference on Computer and Information Technology (EIConCIT). Whether you have traveled a significant distance to be here, it is my great honor to welcome you to Makassar, the capital city of South Sulawesi Province, located in the heart of Indonesia cruise line, the gateway to Eastern region of Indonesia.

EIConCIT is an international conference organized by EIC (East Indonesia Consortium). Considering the successful of the first conference which was held on December 1-2, 2017 in Balikpapan (Borneo Island, Indonesia) hosted by Universitas Mulawarman of Indonesia, this year the 2nd EIConCIT is held in Makassar (Celebes Island, Indonesia) at Novotel Hotel and hosted by Faculty of Computer Science Universitas Muslim Indonesia and takes on the theme of "***Internet of Things for Industry***".

The conference aims to keep abreast of the latest development and innovation in the advanced of research area on Engineering, Computing and Applied Technology. We proudly host this international forum to encourage students, university lecturers, and practitioners to share knowledge, thoughts, expertise, latest information, and developments on related issues. This is simply an exciting chance that allows us to celebrate our past accomplishments, renew and extend our friendships, and explore current and future research directions.

The conference generally attracts more than 300 authors from 12 countries. The number of papers accepted to be published is 78 papers of 143 papers submitted with 54.54% of acceptance rate. This would not have another new record without the generous and unrestricted supports and assistances from all our partners and sponsors.

I would like to express my sincere appreciation and gratitude to IEEE Indonesia section and IEEE headquarter USA as the main support partners for this conference. Lastly, please accept my deepest thanks to the conference participants for the contributions which are the foundation of this conference and all of committee members who have worked on putting this successful conference together. I hope that you will find the conference and your stay in Makassar both valuable and enjoyable.

Wassalamu'alaikum warahmatullah wabarakatuh
(Peace be upon you)

Makassar, 6 November 2018
Sincerely,

Huzain Azis, S.Kom., M.Cs.
General Chair of EIConCIT 2018

WELCOME MESSAGE FROM THE ADVISORY COMMITTEE OF EICONCIT UNIVERSITAS MUSLIM INDONESIA

Assalamu alaikum warahmatullahi wabarakatuh.
Bismillahir Rahmanir Raheem
(Peace be upon you. In the name of Allah, the Entirely Merciful, the Especially Merciful)

Praises be to *Allah subhanahu wa ta'ala*, the Owner of all lives in this universe. We thank Him for the countless blessing which has been bestowed upon us.

Back in November 2016, Faculty of Computer Science Universitas Muslim Indonesia together with Universitas Mulawarman and several universities from East Indonesia discussed about education equity in Indonesia and it ended up by developing a collaboration called EIC as the most effective approach. EIC stands for East Indonesia Consortium established in Bali, Indonesia. It is aimed to increase the qualified research of lecturers and students as well as to publish the research in international scope.

As one of the initiators of EIC and EIConCIT, it is a privilege and an honor for me to welcome you all to the 2nd East Indonesia Conference on Computer and Information Technology (EIConCIT) 2018. I would like to express my pleasure at our increasing development and contribution to be an international player in the computer and information technology field.

This is one of our concrete ways to support Universitas Muslim Indonesia toward World Class University and deliver a remarkable trigger to academic atmosphere in East Indonesia. As the advisory of Faculty of Computer Science Universitas Muslim Indonesia, sincere thanks to all EIC members for selecting us to host this year event! Together we share, together we learn. It is undeniable that we have learnt a lot of things and tried getting out of our comfort zone so we can present our best. However, we do realize that nothing is perfect. I deeply apologize if some blunder or mistakes happen during this conference.

I would like to express my sincere appreciation and gratitude to IEEE Indonesia section and IEEE headquarter USA; Ministry of Research, Technology, and Higher Education Indonesia; and KOPERTIS Region IX as the main support partners for this conference.

To all delegates attending the conference, I encourage all of you to keep supporting and attending the EIConCIT in the future. In 2019, the 3rd East Indonesia Conference on Computer and Information Technology will be held in Papua, Indonesia. Join the conference and see Indonesia from the easternmost province.

Once again, I thank you all and wish you an enjoyable and memorable time both in the conference and your stay in Makassar.

Makassar, 6 November 2018
Sincerely,

Dr. Ir. H. A. Dirgahayu Lantara, M.T., IPU., ASEAN.Eng.
Advisory Committee of EIConCIT 2018

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Comparison Analysis of the Artificial Neural Network Algorithm and K-Means Clustering in Gorontalo Herbal Plant Image Identification System

1st Yulita Salim
Faculty of Computer Science
Universitas Muslim Indonesia
Makassar, Indonesia
yulita.salim@umi.ac.id

2nd Mukhlisulfatih Latief
Department of Informatics Engineering
State University of Gorontalo
Gorontalo, Indonesia
mukhlis@ung.ac.id

3rd Novri Kandowangko
Department of Informatics Engineering
State University of Gorontalo
Gorontalo, Indonesia
novri1968@gmail.com

4th Rampi Yusuf
Department of Informatics Engineering
State University of Gorontalo
Gorontalo, Indonesia
rampirender1@gmail.com

Abstract—**The objective of this study was to analyze the comparison between artificial neural network algorithm and k-means clustering to see the extent of the effectiveness of this algorithm on the identification of Gorontalo herbal plant image. This study uses a digital imaging processing method with segmentation and extraction techniques. Segmentation proses used thresholding method. The next process was extraction process of the characteristics of the image of the herbal plant using the shape and color characteristics to obtain the metric, eccentricity, hue, saturation, and value of the plant was carried out. These five parameters were used as parameters to identify the herbal plant image. This study used 91 images which consisted of 80 imagery training and 11 test images. The study revealed that k-means clustering accuracy was 27.27% whereas the artificial neural network algorithm accuracy was 54.54%. In this case artificial neural networks had better accuracy than K-means.**

Keywords— ***artificial neural network, image processing, K-means***

I. INTRODUCTION

Gorontalo is one of the regions with abundant herbal plants. To date, approximately 336 types of herbal plants have been identified [1]. People of Gorontalo often used these plants as traditional medicine as it is readily available, cheap, and can cure diseases.

Identification of herbal plants can be made by knowing the pattern of the leaves [2]. Identification of herbal plant is one of the common problems. This was due to the currently available method to identify the plant is by direct observation of the plant or asking the local traditional healers. This method was subjective. Thus, the identification results often inconsistent.

On the other hand, image processing has been widely applied to tropical fruit plants [3], identification of type and quality of tea [4], and the identification of herbal plants [5].

Digital image processing for identification of tropical fruit plants has been developed using the extraction method of the texture characteristics of Gray Level Co-Occurrence Matrix (GLCM). Types of fruit plants that have been successfully identified were starfruit, guava, jackfruit, mango, and sapodilla fruit. The identification algorithm uses the artificial neural network algorithm with back propagation which produces the highest accuracy [3].

In other research, identification of types and quality of the tea plant has been developed using thresholding segmentation method. Characteristic extraction uses the color characteristics extraction based on the value of red, green, blue, hue, saturation, and intensity. Identification algorithm used was Learning Vector Quantization (LVQ) artificial neural network. This study produces an accuracy of 62.7% during the training process and 42.31% accuracy on the testing process [4].

The next research [5] which designed the application to recognize the leaves pattern was developed by Indrawan. He designed the application to recognize the leaves pattern using the artificial neural network of Learning Vector Quantification (LVQ) to determine the herbal plant's type. The designed application was able to recognize the herbal plants accurately.

Further, implementation of the k-means algorithm can be found in the research of [6] on segmentation of lungs' image using the k-means which can visualize formulation of a more real color compared to the number of other clusters. In addition, research by [7] on Landsat digital image processing has produced good the accuracy.

Based on the above description, this study was aimed at analyzing the comparison of the accuracy of artificial neural network and k-means clustering in the identification of Gorontalo herbal plants.

II. RESEARCH METHOD

A. Image Segmentation

Image segmentation is a process to obtain objects in an image or dividing the image into several objects or segments which have similar attributes [8].

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Threshold is a basic technology that often used in image segmentation. This is one of the most straightforward methods to obtain clear image segmentation [8]. Threshold produces a binary image, where the pixel of the object has the value of 1 and the background image has the value of 0. Therefore, the image will appear consistently clearer or darker than the background. The image segmentation stages are as follow [9].

1) Reading the original image

2) Converting the segment area for the image which was previously on RGB (Red, Green, Blue) into grayscale.

The formula used to convert the RGB image into grayscale is:

$$\text{Grayscale} = 0.2989 * R + 0.5870 * G + 0.1140 * B \quad (1)$$

3) Converting the grayscale image into binary image through thresholding operation.

The binary image from the thresholding process is defined as:

$$G(x,y) = \begin{cases} 1, & \text{if } f(x,y) \geq T \\ 0, & \text{if } f(x,y) < T \end{cases} \quad (2)$$

where $g(x,y)$ is the binary image produced from thresholding, $f(x,y)$ is the grayscale image, and T is the threshold value.

4) conducting the complement operation on the binary image produced from the thresholding, hence.

Object is represented by I pixel1-pixel (white colored) and the background is represented by 0 pixel0-pixel (black colored).

B. Characteristics Extraction

Following the separation of an object within the image with its background, the next process is the characteristics extraction. The extracted characteristics used to differentiate the one type of herbal plant from others. This characteristics extraction is conducted through analysis of shape and color. The analysis is carried out based on the calculation of the metric and eccentricity value. Whereas, the color analysis is carried out based on the hue, saturation, and value (Fig. 1 and Fig.2). These parameters are extracted from each image. The following formulas are used for this process [9].

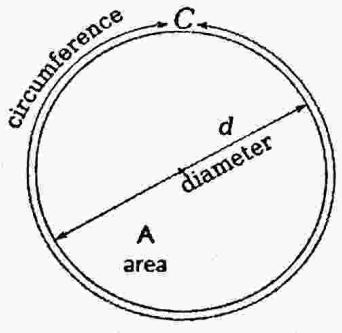
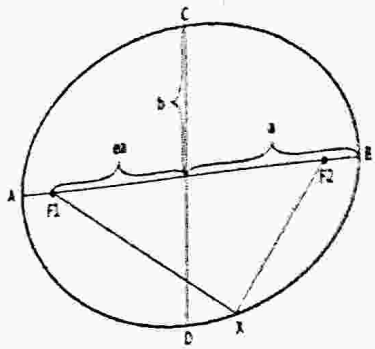


Fig. 1. Eccentricity value

$$M = \frac{4\pi \times A}{C^2} \quad (3)$$

Where,
M = Metric
A = Area
C = Circumfe



$$e = \sqrt{1 - \frac{b^2}{a^2}} \quad (4)$$

Where,
e = eccentricity
a = mayor axis
b = minor axis

Fig. 2. Hue, Saturation, and Value

$$r = \frac{R}{(R+G+B)}, g = \frac{G}{(R+G+B)}, b = \frac{B}{(R+G+B)} \quad (5)$$

$$V = \max(r,g,b) \quad (6)$$

$$S = \begin{cases} 0, & \text{jika V} = 0 \\ 1 - \frac{\min(r,g,b)}{V}, & \text{V} > 0 \end{cases} \quad (7)$$

$$H = \begin{cases} 0, & jika\ S = 0 \\ \frac{60*(g-b)}{S*V}, & jika\ V = r \\ 60 * \left[2 + \frac{b-r}{S*V}\right], & jika\ V = g \\ 60 * \left[4 + \frac{r-g}{S*V}\right], & jika\ V = b \end{cases} \quad (8)$$

$$H = \text{H} + 360 \text{ jika H} < 0 \quad (9)$$

C. K-Means Clustering

K-means is one of the methods in data mining to carry out unsupervised modeling by clustering the data into several clusters based on the similarity of characters. In brief, this k-means algorithm is looking for the N object, based on the parameter into the k-cluster (k≤N). This algorithm serves to cluster image data into several clusters based on the minimum distance. K-means algorithm is widely known for its easiness and ability to quickly cluster the large data and outlier data. Based on partitioning clustering characteristics, each data should be grouped into a specific cluster and made it possible for each data in certain cluster during the specific process to move into another cluster [10].

In general, the K-Means algorithm is carried out with the following basic algorithm [11].

a) the data that would be clustered into k data cluster and the data values are randomized into cluster results which have similar data value numbers.

b) each value of the data is calculated using the Euclidean distance for each cluster.

c) if the value of the data is represented in the data cluster, let it be, and if the value of the data is unrepresented by that data cluster, then move the data into the cluster where the value of the data is represented.

d) Repeat the step until all the data values are properly clustered.

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D. Artificial Neural Network (ANN)

The artificial neural network is a large parallels distributed processor which tends to save knowledge which comes from experience and made it ready to be used. ANN is similar to the human brain in two ways: managing the knowledge obtained by the network through the learning process; the strength of relationship among neuron which known as synaptic values used to store knowledge [12].

The artificial neural network is a computed mechanism which can acquire, represent, and calculate the mapping of a space with large variance of other information, and provided with a set of data which represent that mapping. The objective of the artificial neural network is to develop a model of a data process; hence, a network can generalize and predict the output of previously unseen input. The learning process of the artificial neural network is carried out through adjustment of the value between the neuron in responding toward the error between the actual output value and the output target value [13].

E. Learning Process of the Artificial Neural Network

The learning process of the artificial neural network consists of two learning systems: supervised learning and unsupervised learning. Supervised learning is a learning process which needs a teacher or something which have knowledge of the environment through the representation of input and output sample. The network parameter changes based on the training vector and the error signal between the ANN output and the expected output. This repeated process is carried out in order for the ANN to have knowledge similar to its teacher, or the reference input-output data. This explains that the ANN is trained to map a cluster of input-output samples with high accuracy. On the classification of a landslide area based on reference data previously obtained, the learning process is said to be supervised learning [13].

The supervised learning process has input data that will be trained by the network in the form of a pair of input and target. Thus, the desired value is obtained. The data pair will be treated as a teacher in the training process to train the network with the best form. In each training session, the network will produce output based on the input. The gap between output and the target output is the error that often happens. One of the networks that often used in supervised learning is the back propagation [14].

F. Back propagation

This propagation training minimized the error between the targeted output and the actual output from the actual output from the network. This algorithm is a multilayered neural network which consists of the input layer, hidden layer, and output layer. The process happened in this layer by inserting the input and multiplies it with the appropriate value, using the non-linear transfer function. The end of this training is that the neuron system provides a model or reference that can be used to predict the value of the new target based on the input provided. The more hidden layer used, the easier for the complex problem being inputted and the trained data target to be solved compared to the single screen. The output obtained from this training will have a lower level of error. However, the training process with may hidden layer will provide complex learning and often takes a long time with much iteration to obtain the expected result [15].

G. Research Stage

The materials used in this study are 91 images consist of 80 image training and 11 test images. The image processing stage used in this stage is the image acquisition stage, processing, using the image segmentation, image extraction, characteristic extraction, and identification stage (training and testing), and analysis.

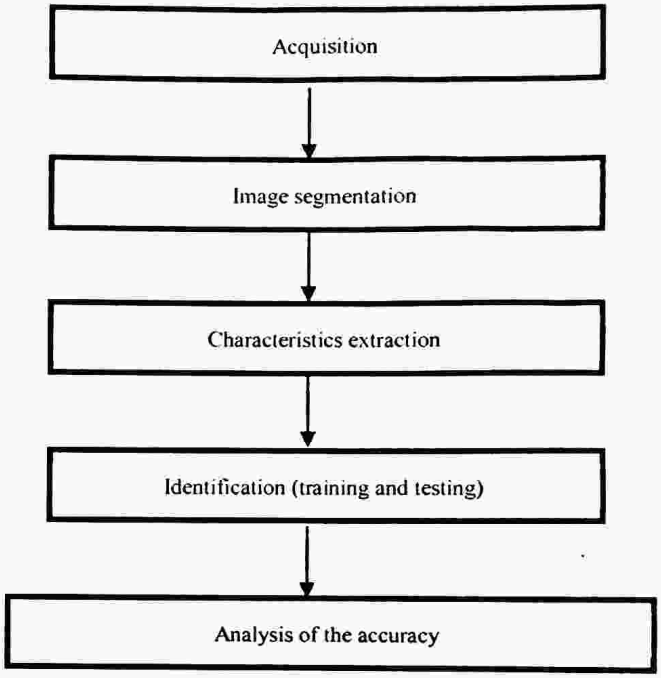

Fig. 3. Research Stage

Preprocessing on the image uses thresholding segmentation and followed by the extraction of shape and color characteristics to obtain the metric, eccentricity, hue, saturation, and value.

The value obtained from the preprocessing then implemented on these two algorithms. Further, analysis based on the accuracy produced by these two algorithms. The stage in this research can be described in Fig. 3.

III. Results And Discussion

A. Image Segmentation Result

The result of this image segmentation through thresholding method in MATLAB programming the result is presented in Fig. 4.

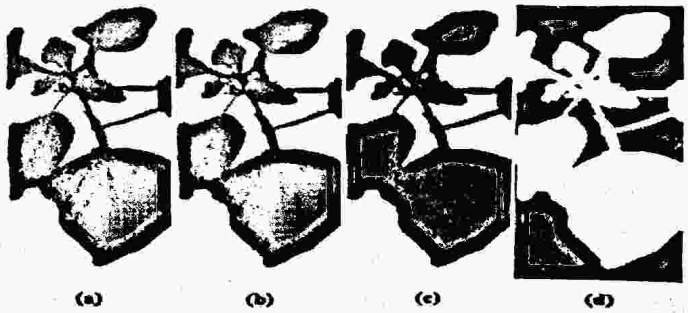

Fig. 4. Image Segmentation Process: (a) RGB Image; (b) grayscale Image;(c) thresholding result; (d) complement result

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B. The result of characteristics extraction

In order to obtain the metric and eccentricity value are extracted through shape characteristics extraction, whereas to obtain the hue, saturation, and value are carried through color characteristics extraction. The sample of several results of the extraction of characteristics of the herbal plant image is presented in Table I.

TABLE I. SAMPLE OF THE CHARACTERISTICS EXTRACTION

No	Type of Plant	Characteristics				
		Metric	Eccentricity	Hue	Saturation	Value
1	akar kucing	0.1734	0.9100	0.1502	0.2774	0.6826
2	awar awar	0.1673	0.9727	0.1435	0.1900	0.7900
3	bambu kuning	0.1508	0.6800	0.1516	0.2997	0.7029
4	bandotan	0.5088	0.8946	0.1176	0.2522	0.7725
5	begonia	0.3942	0.8043	0.0820	0.2299	0.7835

C. Clustering process based on K-means

All five of this extraction characteristics result is used as the input value in the k-means clustering algorithm. Out of 80 plant images available, the number of clusters used to identify the herbal plants is 61. The clustering types of herbal plants using the k-means clustering algorithm are shown in Fig. 5.

In Fig. 5, the sequence of different clusters in one type of herbal plant. Out of 80 images, only 39 images that were correctly identified, and the obtained accuracy (*akurasi*) value was 48.75%. This showed that the k-means clustering algorithm could not properly identify the plant image.

D. Testing process using the K-means

From the clustering, the testing process was carried out using 11 testing images. The result of this test is presented in Table II.

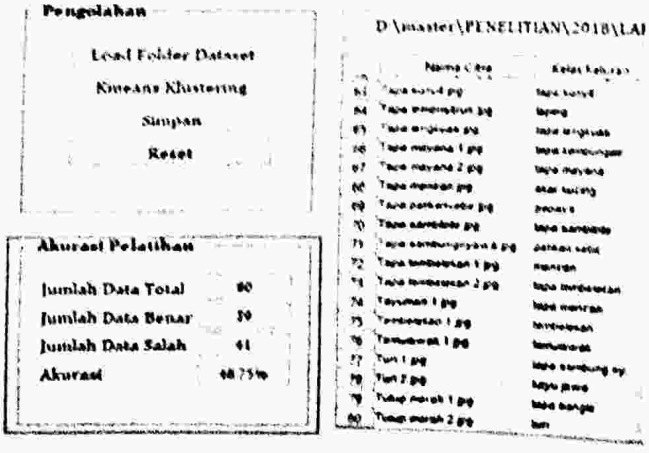

Fig. 5. The interface of the herbal plant clustering using the k-means

TABLE II. THE RESULT OF HERBAL PLANT IDENTIFICATION ON THE TESTING PROCESS USING THE K-MEANS CLUSTERING

No	Input cluster	Output cluster
1	Akar kucing	Tapa sambung nyawa
2	Awar-awar	Tapa lengkuas
3	Begonia	Begonia merah
4	Ceplukan	Temulawak
5	Jarak tintir	jarak tintir
6	Kananga	Tabu kuning
7	Klayu garuga	Tutup merah
8	Tabu kuning	Tapa meniran
9	Layuman	Begonia
10	Tembelekan	tembelekan
11	Temulawak	temulawak

In Table II, it is clear that out of 11 tested images, there are only three images that are correctly identified. Hence the accuracy produced in the system in this testing process is:

$$Accuracy = \frac{Number\ of\ correctly\ identified\ image}{Number\ of\ tested\ image} x\ 100\%$$

$$= 3/11\ x\ 100\% = 27.27\% = 27.27\%$$

E. Training process with the artificial neural network

Artificial neural network algorithm is implemented to identify types of herbal plant based on five inputted values from the characteristics extraction. The identification process is conducted using the back propagation of artificial neural network algorithm with the architecture as shown in Fig. 6.

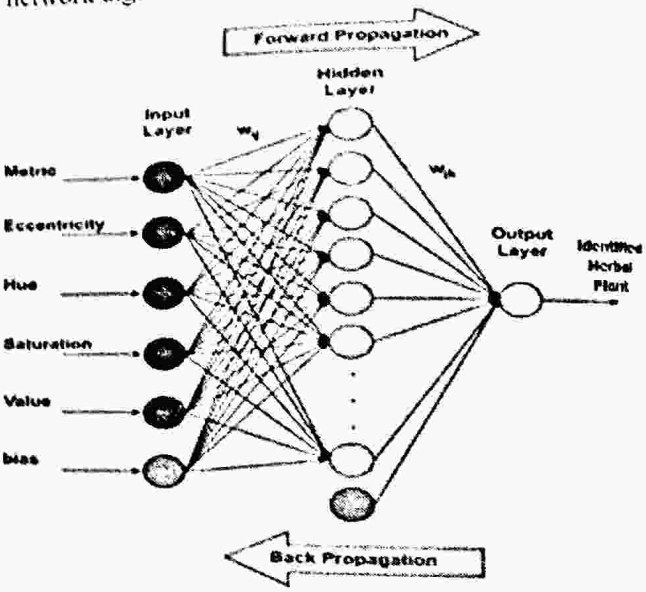

Fig. 6. The architecture of back propagation ANN for herbal plants

The artificial neural network used consists of three layers: an input layer, one hidden layer, and one output layer. The training process used Sigmoid Binary activation function on a hidden layer and Levenberg-Marquardt function process.

When the values from the result of the extracted image are obtained, the next process is the image training process. This training process serves to seek the best and most appropriate parameters and values for each layer that would be used in the testing process. The parameters trained are as follow

- Learning = 0.10
- Maximum iteration = 1000
- Error tolerance standard = 10-6
- Activation function = Sigmoid binary
- Number of trained data = 80

The artificial neural network training process is carried out by variating the number of the neuron on the hidden layer

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as shown in Fig. 7 and several trial result of the training process is shown in Table III.

TABLE III. THE RESULT OF THE NETWORK TRAINING USING PARAMETERS VARIATION

Number of neurons			Number of epoch	Accuracy (%)
Input layer	*Hidden Layer*	*Output Layer*		
5	10	1	1000	14.28
5	20	1	1000	42.85
5	30	1	1000	48.35
5	40	1	227	100
5	50	1	219	100
5	60	1	143	100
5	70	1	327	100
5	80	1	305	100
5	90	1	242	100
5	100	1	370	100

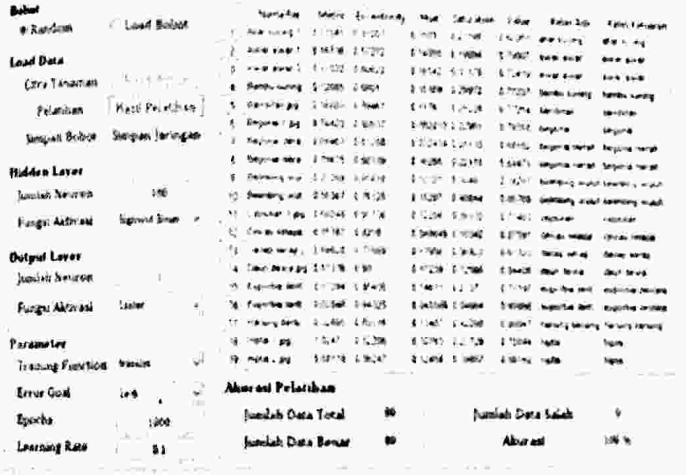

Fig. 7. Interface of the herbal plant training with the artificial neural network

In Table III, it is clear the architecture that provides the highest accuracy and the least accuracy is the architecture with 60 neurons on the hidden layer. This architecture was then used to transfer the input value into the output value on system testing process. The output of this artificial neural network algorithm showed better clustering result.

F. Testing process using the artificial neural network

The testing is carried out using 11 testing images, and the result is shown in Table IV.

TABLE IV. THE RESULT OF HERBAL PLANT IDENTIFICATION ON ARTIFICIAL NEURAL NETWORK TESTING SYSTEM

No	Input cluster	Output cluster
1	Akar kucing	Awar-awar
2	Awar-awar	Awar-awar
3	Begonia	Begonia
4	Ceplukan	Ceplukan
5	Jarak tintir	Jeruk nipis
6	Kananga	Kayu jawa
7	Klayu garuga	Klayu garuga
8	Labu kuning	Laping kubu
9	Tayuman	Tayuman
10	Tembelekan	Temulawak
11	Temulawak	Temulawak

In Table IV, it is clear that out of 11 images, there is six correctly identified image. Hence the accuracy of the system in this testing process is:

$$Accuracy = \frac{Number\ of\ correctly\ identified\ image}{Number\ of\ tested\ image} x\ 100\%$$

$$= 6/11\ x\ 100\% = 54.54\% = 27.2$$

Based on the implementation of these two algorithms, artificial neural network algorithm showed better accuracy than the k-means clustering algorithm. The artificial neural network algorithm accuracy level was 54.54%, while the k-means accuracy was only 27.27%.

This high result by artificial neural network algorithm is due to this algorithm that works under supervision or through the training process. Hence, there is a learning process that should be done to recognize each type/cluster of the herbal plant. Whereas the k-means algorithm did not undergo this process (unsupervised).

Another thing to be highlighted in this research is that the accuracy for both of this algorithm was still very low (54.54% and 27.27%). This was due to the number of images available for each plant is limited (mostly, one plant only has one image compared to a large number of plants type (61 types of plants). In the future, the amount of training data will be increased to get better accuracy.

IV. CONCLUSION

The stage of image processing carried out is image segmentation, characteristics extraction, and identification. The segmentation process is carried out using the thresholding method to create a binary image which represents the object in white color and represent the background in black color. The characteristic extraction is based on the shape and color analysis. The shape analysis is based on the metric value and eccentricity, whereas the color analysis is based on the saturation, hue, and value. These five extracted characteristics is used as an input value in the identification process. Identification process is carried out using two algorithms, k-means clustering algorithm and artificial neural network algorithm with back propagation. The clustering process uses 80 images whereas the testing process uses 11 images. The accuracy of training using the k-means clustering algorithm is 48.75% and during the testing process, the accuracy is only 27.27%. in artificial neural network algorithm, the accuracy during the training process is 100%, and the accuracy during testing process is 54.54%. This result showed that the clustering of the herbal plant using the artificial neural network system is better than the k-means clustering algorithm.

ACKNOWLEDGMENT

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REFERENCES

[1] M. S. Mirchandani, M. Pendse, P. Rane, and A. Vedula, "Plant disease detection and classification using image processing and artificial neural networks," Plant Dis., no. 5(06), 2018.

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[2] J. Singh and H. Kaur, "A review on: Various techniques of plant leaf disease detection," in 2nd International Conference on Inventive Systems and Control (ICISC), 2018, pp. 232–238.

[3] M. H. Hu, Q. L. Dong, B. L. Liu, and P. K. Malakar, "The potential of double K-Means clustering for banana image segmentation," J. Food Process Eng., vol. 37(1), pp. 10–18, 2014.

[4] S. Borah, E. L. Hines, M. S. Leeson, D. D. Iliescu, M. Bhuyan, and J. W. Gardner, "Neural network based electronic nose for classification of tea aroma," Sens. Instrum. Food Qual. Saf., vol. 2(1), pp. 7–14, 2008.

[5] F. Fida et al., "Leaf Image Recognition Based Identification of Plants Supportive Framework for Plant Systematics," PSM Biol. Res., vol. 3(3), pp. 125–131, 2018.

[6] C. Church, H. Young, G. Parraga, and G. N. Maksym, "Improvements in Functional Image Impedance Modelling of Asthmatic Lungs Using K-Means Clustering," in B20. Asthma: New Findings in Airway Smooth Muscle Pathophysiology and Potential Therapy, American Thoracic Society, 2018, pp. A2746–A2746.

[7] F. Masoumi, T. Eslamkish, M. Honarmand, and A. A. Abkar, "A Comparative Study of Landsat- 7 and Landsat- 8 Data Using Image Processing Methods for Hydrothermal Alteration Mapping," Resour. Geol., vol. 67(1), pp. 72–88, 2018.

[8] J. N. Callow, S. M. May, and M. Leopold, "Drone photogrammetry and KMeans point cloud filtering to create high resolution topographic and inundation models of coastal sediment archives," Earth Surf. Process. Landforms, vol. 43(12), pp. 2603–2615, 2018.

[9] J. Li, X. Li, B. Yang, and X. Sun, "Segmentation-based image copy-move forgery detection scheme," IEEE Trans. Inf. Forensics Secur., vol. 10(3), pp. 507–518, 2015.

[10] S. Tatiraju and A. Mehta, "Image Segmentation using k-means clustering, EM and Normalized Cuts," in University Of California Irvine, 2008, pp. 1–7.

[11] N. Dhanachandra, K. Manglem, and Y. J. Chanu, "Image segmentation using K-means clustering algorithm and subtractive clustering algorithm," Procedia Comput. Sci., vol. 54, pp. 764–771, 2015.

[12] H. Haviluddin, R. Alfred, J. H. Obit, M. H. A. Hijazi, and A. A. A. Ibrahim, "A Performance Comparison of Statistical and Machine Learning Techniques in Learning Time Series Data," Adv. Sci. Lett., vol. Vol. 21, no. Number 10, October 2015, pp. 3037–3041, 2015.

[13] Purnawansyah and H. Haviluddin, "Comparing performance of Backpropagation and RBF neural network models for predicting daily network traffic," in 2014 Makassar International Conference on Electrical Engineering and Infonnatics (MICEEI), 2014, pp. 166–169.

[14] Mislan, H. Haviluddin, S. Hardwinarto, and M. Aipassa, "Rainfall Monthly Prediction Based on Artificial Neural Network: A Case Study in Tenggarong Station, East Kalimantan - Indonesia," Procedia - Procedia Comput. Sci., vol. 59, pp. 142–151, 2015.

[15] Mislan, F. O. G. Achmad, Haviluddin, and P. Novianti, "Water Level Prediction of Lake Cascade Mahakam Using Adaptive Neural Network Backpropagation (ANNBP)," in 1st International Conference on Tropical Studies and Its Application (ICTROPS), 2018.

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