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Preface

2017 International Conference on Computer Science and Artificial Intelligence (CSAI 2017) was held in Jakarta, Indonesia during December 5-7, 2017. The purpose of CSAI is to bring together researchers and people from industry working in the fields of computer science and artificial intelligence. It seeks to offer a broad spectrum of current research in this area of theoretical and applied knowledge.

The volume consists of 53 selected papers (from originally 94 papers) which are presented orally at the conference or via poster session. The topics of papers include machine learning and artificial intelligence, software design and program development, image analysis and processing, design and application of information system, communication system and network security as well as computer theory and engineering technology.

The papers are accepted after being peer-reviewed by the conference Technical Program Committee and international reviewers based on the topic of each paper. All the authors of accepted papers have done excellent presentations on this conference via oral presentation or poster presentation. On the basis of the conference achievement, we collect and compile these research papers into the conference proceedings, in which the content represents the latest international academic progress of computer science and artificial intelligence fields. We hope that the presented papers will be interesting for readers and be a good base for inspiration for future developments.

The chairpersons, keynote speakers, plenary speaker played important role in conducting the proceedings of the session in a timely and efficient manner and on behalf of the conference committee, we express sincere appreciation for their involvement. The reviewers of the manuscripts, those by tradition would remain anonymous, have also been very helpful in efficiently reviewing the manuscripts, providing valuable comments well within the time allotted to them. We express our sincere and grateful thanks to all reviewers.

We truly believe the participants will find the discussion fruitful, and will enjoy the opportunity for setting up future collaborations. It is our sincere hope that CSAI will one day become the leading conference in this specific academic area.

CSAI 2017 Organizing Committee
December 22, 2017

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Determining Pigs Breeding Time by Sow's Vagina Image Analysis Using Wavelet Transforms and Artificial Neural Network

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ABSTRACT

A rapid development of image processing technique has been currently taking place. Image analysis is becoming an application which attracts a lot of attention among the other applications. It extracts image features to identify an object.Image analysis has been widely used in several fields such as animal husbandry.The object used in this study is the image of sow vagina. Determining the pig breeding time is something necessary for the breeders since it will greatly affect the number of piglets. The complexity in determining the pig breeding period becomes a main problem in this research. This system has been successfully established. The system can recognize patterns well with a maximum recognition rate of 98.7013%. In general Haar wavelets, db2 and coif1 produce better recognition performance. Haar wavelets are wavelets that have fewer computational loads than others.

CCS Concepts

• **Computing methodologies → Artificial intelligence → Computer vision → Computer vision problems → Object recognition.**

Keywords

Image Analysis; Wavelet Transforms; Haar; daubechies; coiflets; artificial neural network.

1. INTRODUCTION

The development of image processing has currently been quite rapid. This is supported by the development of computers with large memory capacity therefore it is possible to perform computing in a relatively short time. There are many applications contained in image processing techniques, such as image enhancement, image restoration, image analysis, image compression, and image data security systems [1]. The application which mostly attracts the attention among all of other applications is image analysis. It seeks to extract image features for identifying an object. Image analysis has been widely used in several fields.

This study discusses the application of image analysis in the field of animal husbandry. The object used in this research is the image of sow's vagina. Pig is a mammal which population is large and quite significant in Indonesia although it is less than cows and goats. It is due to not all regions in Indonesia can accept the existence of pig farms. Deciding the pig breeding time is necessary for breeders since it will greatly affect the number of piglets. Each boar can produce 200-250 cc of semen which contains 50-60 million sperm during mating. The fertilization occurred in sow needs only 100 cc sperms. However the sows are not all the time willing to mate with the boars. Only at certain moments alone can the sows are willing to mate with the boars.

The characteristics of a sow that is going to mate with a boar can be observed primarily on its vagina marked with red, swollen and mucus coming out. The observation done by human's sight is sometimes considered difficult to determine the exact mating times for the pigs since the pigs sometimes do not show the obvious signs. Pig breeding at inappropriate times will result either in failure on fertilization process or the number of piglets which do not match with what is expected.

The complexity in determining the pig breeding time period becomes a major problem in this study. Wavelet is then utilized as a preprocessing in the recognition of vagina image patterns. Wavelet is not only used as a new analytical device in mathematics but also a very reliable practical device for various applications ranging from differential equations to image processing. Wavelet and wavelet transformation are salient fields of computer graphics. Some applications that have been successfully created by utilizing wavelet are image compression, sound synthesis for music, image improvement, image edge detection, and so forth.

2. LITERATUR REVIEW

Image analysis is a part of image processing which extracts meaningful information from images. The analysis or the interpretation can be automatically generated by devices such as computer. Image analysis has been developed in various fields of science. At the classification of character recognition, image analysis can be used as sorting of mails, optical character recognition [2], and bank checks processing. In the medical field,

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image analysis is applied to the tumor detection process [3], measurement of the size and shape of internal organs [4], chromosome analysis [5], and red blood cells calculation. In the automotive industry, image analysis is used in the parts identification. In robotics, image analysis is used in the process of objects recognition and interpretation [6], and the robots movement control. In cartography, image analysis is used to synthesize weather maps. In forensics, image analysis can be used to match fingerprint [7] and to analyze automated securities systems. At the radar system, image analysis is used for target identification and detection, helicopter or aircraft landing assistance. Image analysis is also widely applied in remote sensing system for multispectral image analysis [8], weather forecasts [9], and agriculture industry from satellite image.

Based on its domain classification, there are two methods of performing image analysis. First is image analysis on spatial domain and the second is on frequency domain. The image analysis process is firstly developed solely in spatial domain. At the spatial image analysis process, an object features are only characterized by its gray level, joint-probability distribution, and spatial distribution. Some of the most commonly used methods are the decomposition of amplitude characteristics and the decrement of histogram characteristics. The superiority of image analysis in spatial areas is mainly due to relatively small computational load, but this method is very conventional and lacks the desired results [10].

Pattern recognition is a study to find out how machines observe the surrounding environment and learn the differences in object patterns and their background [11]. Pattern recognition becomes an interesting research topic of image processing as it brings potential benefits to various aspects of life. The pattern recognition is getting popular and widely used as a research topic

The pattern recognition in medical and the biometric identification are the evidence of how pattern recognition has greatly contributed on giving benefits for human life. The pattern recognition is utilized in medical to diagnose a disease and it is also used to observe the fetus growth in the womb. Dealing with internal organs is a complex job which has a high level of difficulty therefore the system is made use in order to establish a doctor’s accurate diagnosis that may later decide the next medical treatment. The system is developed for giving the further information to the doctors in deciding the advanced medical treatment steps [12], [13], [14], [15].

This research is conducted to analyze the sow’s genital image by using wavelet and artificial nerve tissue. The wavelet is functioned to reduce the image size and to segment the features of the object’s image [16]. Artificial nerve tissue is used for the given object’s image identification or recognition process. There are 2 phases in the identification process using artificial neural networks namely training phase and application phase. Color coordinate system to be used is the RGB color coordinate system and YUV. Both of their performances will be compared in order to obtain the best results according to the features and the characteristic of the object’s image.

3. METHODOLOGY

The methodology adopted in this study is divided into five stages. The first stage is material collection. The materials are collected to obtain a complete literature of the current research topic. The collecting of materials is done by searching for books, journals, and theses which are related to the topic from library and the internet. The gathered relevant materials are used to develop the algorithm for the study. The second stage is data collection. The data are obtained directly from a pig farm at Sanggrahan village, Banyuraden, Gamping, Sleman, Yogyakarta. The data which are going to be acquired are the genital image of the sows which are not ready to breed and ready to breed. The data are taken from 30 sows. The obtained data are then cropped and resized in order to get the data in the forms of image color in .bmp format (Windows Bitmap) with 256 x 256 pixels. The third stage is software design. The algorithm based flowcharts is developed at this stage. This is intended to ease the software development. The fourth stage is software development. The flowchart design is then implemented using the Matlab2013 programming language. The final stage is software testing. The finished software is then tested using the real image data to find out whether the software has run as it is desired.

4. DISCUSSION

The first recognition algorithm test was performed on an 8-bit grayscale color coordinate space. The selection of grayscale color coordinates is based on the simplicity of the computational load. The system was piloted with 77 pieces of images with 2 main patterns, namely "pigs not ready to be mated" and "pigs ready to be mated". Examples of test images can be seen in Figures 1 and 2. Table 1 is the percentage of recognition with variations in the value of alpha, decalpha and wavelet training. In this test used wavelet type with a short filter and has orthonormal properties, so it is expected to suppress the computational load.

Figure 1. Example of pattern test image "Pig not ready to be mated"

Figure 2. Example of pattern test image "Pig ready to be mated"

Figure 1 is an example of some test images of the sow’s vagina image that are not ready for mated. Based on the physical characteristics it appears that vagina is not slimy and has a relatively bright color. Figure 2 is an example of some imagery image of sow’s vagina image that is ready to be mated. Based on the observation of the physical characteristics seen that the genital red, swollen and out mucus. The computer software developed in this study should be able to distinguish the two patterns above.

Table 1. The percentage of Recognition with variations in the value of alpha, decalfa and wavelet training.

Alpha	decAlpha	Iteration	Percentage of Recognition			
			Haar	Db2	db4	Coif1
0.01	0.1	66	98.7013	96.1039	81.8182	96.1039
	0.2	31	97.4026	98.7013	81.8182	98.7013
	0.3	20	97.4026	98.7013	81.8182	97.4026
	0.5	10	97.4026	97.4026	81.8182	96.1039
	0.8	5	94.8052	97.4026	81.8182	94.8052
	1	1	92.2078	97.4026	81.8182	94.8052
0.005	0.1	59	97.4026	98.7013	81.8182	98.7013
	0.2	28	97.4026	97.4026	81.8182	96.1039
	0.3	18	97.4026	97.4026	81.8182	94.8052
	0.5	9	92.2078	97.4026	81.8182	94.8052
	0.8	4	92.2078	97.4026	81.8182	94.8052
	1	1	92.2078	97.4026	80.5195	94.8052
0.003	0.1	55	97.4026	98.7013	81.8182	96.1039
	0.2	26	97.4026	97.4026	81.8182	94.8052
	0.3	16	92.2078	97.4026	81.8182	94.8052
	0.5	9	92.2078	97.4026	81.8182	94.8052
	0.8	4	88.3117	96.1039	80.5195	94.8052
	1	1	85.7143	96.1039	80.5195	96.1039
0.001	0.1	44	92.2078	97.4026	81.8182	94.8052
	0.2	21	92.2078	97.4026	80.5195	94.8052
	0.3	13	87.0130	96.1039	80.5195	94.8052
	0.5	7	87.0130	96.1039	80.5195	94.8052
	0.8	3	87.0130	93.5065	80.5195	90.9091
	1	1	87.0130	93.5065	80.5195	92.2078
0.0001	0.1	22	87.0130	92.2078	80.5195	92.2078
	0.2	11	87.0130	89.6104	80.5195	92.2078
	0.3	7	87.0130	88.3117	80.5195	92.2078
	0.5	4	87.0130	87.0130	80.5195	92.2078
	0.8	2	87.0130	87.0130	80.5195	92.2078
	1	1	87.0130	87.0130	80.5195	92.2078

4.1 Noise Effect on Introduction Algorithm

Noise is the unwanted signals on the image. Usually these signals appear at the time of image digitization process. In digital imagery, noise is part of the digital image that affects the quality of the image. There are two types of noise, namely Gaussian noise and salt and pepper noise. In Gaussian the existing color noise at each noise point is different, the color value for this noise is the result of the reduction or addition of the pixel color values in the original image. While the noise salt and pepper is often known as impulse or shot noise. Noise on this type of shaped white spots and black scattered. Usually occurs due to data transmission errors and is not correlated at all with the neighboring pixels.

In this section, the algorithm will be tested with the effect of salt and pepper noise on the image to be recognized. Noise is given starting intensity 10% - 100%. Figure 3 below is an example of sow's vagina image that is given salt and pepper noise. It can be seen from the picture that giving noise with intensity more than 60% visually image pattern can no longer be recognized.

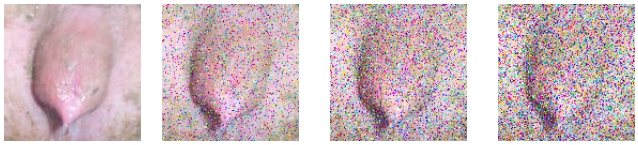

Figure 3. The "Pigs Ready Mated" Pattern Pattern Have Been Given Salt and Pepper Noise.

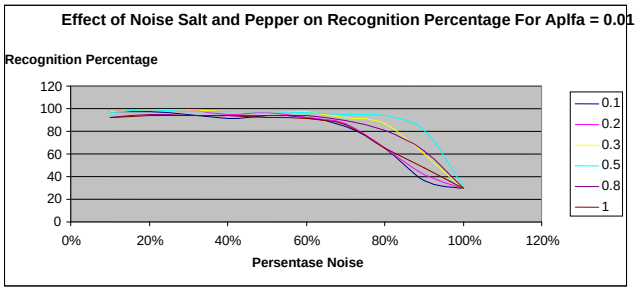

Figure 4. Graph of Effect of Noise Salt and Pepper on Recognition Percentage For Alfa = 0.01 and DecAlfa Value Variation.

Based on the graph in Figure 4. it is seen that the presence of noise is very influential on the performance of the recognition algorithm. The greater the intensity of noise given, the smaller the percentage of recognition value generated by the system. The pattern recognition system developed can recognize the pattern well until the noise intensity level is 60%. Visually observation with the eyes is very difficult to distinguish between two kinds of patterns when given noise more than 50%. Noise in the day-to-day may occur when there is an interruption when recording an object, or there are obstacles that interfere with the recording process.

4.2 Computational Load Comparison

The computational load will be calculated using the flops generated from the training process and the application process with input 77 test images. Table 2 is the flops comparison between recognition made in grayscale color coordinates, YUV and RGB color coordinates. Each color coordinate will be tested using Haar wavelet, db2, db4 and coif1.

Table 2. Flops Comparison

	Haar	**db2**	**db4**	**coif1**
Grayscale	145685766	233386880	4158013338	322069815
YUV	153335108	241037647	4234517119	329720163
RGB	390916349	654004989	1.2012e+009	920025625

Based on Table 2 it is seen that the largest computational load is found on pattern recognition in RGB color coordinate system. This is because pattern recognition in RGB color coordinate system will process the input image on three different color components. The computational load borne by processing in RGB color coordinates is approximately 3x the computational load in the grayscale color coordinate system. The type of wavelet also affects the resulting computational load. Haar wavelets are wavelets that have the least computation load, whereas wavelet db4 has the greatest computation load compared to other wavelets. The amount of computational load is strongly influenced by the length of the wavelet filter used.

5. CONCLUSION

The system for pig breeding has been successfully established. The system can recognize patterns well with a maximum recognition rate of 98.7013%. The system can be used to help pig farmers in determining the mating period for their livestock.

Haar wavelets are wavelets that have fewer computational loads than others. While wavelet db4 has the largest computational load. Haar wavelets have relatively fewer computational loads because they have short filter lengths. Wavelet db4 has a large computational load because wavelet db4 has a relatively long filter length. In general Haar wavelets, db2 and coif1 produce better recognition performance. While wavelet db4 less suitable for this research.

6. ACKNOWLEDGMENTS

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