Southeast Europe Journal of Soft Computing
Available online: http://scjournal.ius.edu.ba

ISSN 2233 – 1859

Vol 9, No. 2, September 2020, pp. 11-14

Statistical Texture Mean-Windowing Feature of Snake Identification

[1*] Rosniza Roslan, [2] Nurul Hafeeza Aziz, [3]Nursuriati Jamil and [4] Raseeda Hamzah

[1, 2] Faculty of Computer and Mathematical Sciences, Universiti Teknologi MARA Melaka (Jasin Campus), Melaka, Malaysia.
[3, 4] Faculty of Computer and Mathematical Sciences, Universiti Teknologi MARA Shah Alam, Selangor, Malaysia.
**Corresponding Author*: rosniza@tmsk.uitm.edu.my

Article Info

Article history:

Article received on 11 August 2020

Received in revised form 15 August 2020

Keywords:

snake identification; image processing; K-Nearest Neighbor; Support Vector Machine; Naïve Bayes

ABSTRACT: Snake identification has been explored in various domains such as the image processing domain. In Malaysia, many of the snake species are non-venomous but still dangerous to the human. Conventionally, snake identification is evaluated by collecting the information from the patient. However, it is very hard and difficult to recognize the venomous and non-venomous snake types. Also, doctors need to inject the anti-venom into the patient which produced the side effect. Therefore, this paper classified the venomous snake of Naja Kaouthia and other venomous snake species. All the image datasets have been captured at Malacca Butterfly & Reptile Sanctuary, Melaka. The statistical vectors are extracted by using the normalized mean-moving windows. The taxonomical statistical texture vectors of snake region features are classified using Tree, K-Nearest Neighbor, Support Vector Machine, and Naïve Bayes classifiers. Results showed that most of the classifiers produced an accuracy rate of 100%.

1. INTRODUCTION

The field of snake identification research has been incorporated in many areas such as computer vision, science, and medication [1]. The study on snake identification using image processing has been started in the early 1990s [2]. Researchers have done many applications on the animal such as snake identification [3] - [6], bird species classification [7] and other application. Generally, there is much research on snake species identification are performed outside Malaysia [6]. Most of the snake species in Malaysia are non-venomous and safe to humans [8]. However, the venomous snake species still exist in Malaysia where the cases have been reported to clinical [9]. Some of the venomous snakes that exist in Malaysia are Dendroaspis Polylepis, Calloselasma Rhodostoma and Naja Kaouthia. The current evaluation is doctors will record the victim's evaluation in a book [5]. Most of the victims and zoologists cannot recognize the snake bite, snake type and skin pattern since some of the snakeskin look-alike skin with other snakes [6][10]. The other information that will be collected from the victim such the skin color, texture, and size [10]. Therefore, the doctors will inject the general anti-venom because of the unknown snakebite [6]. Some of the venoms that react with this anti-venom give side effects such as the victim's skin become itchy.

There are numerous researchers who investigated snake identification including the Back Propagation Neural Network (BPNN), Genetic Algorithm (GA) [8], similarity nearest neighbor classifier using taxonomy features. However, it is a complicated work to identify the correct species type as some of the images are poor illumination, shadows, indistinct and complex background [2][7]. Hence, this paper studied compared the statistical texture classifiers on snake identification.

This paper is comprised as follows. Section 1 clarifies the motivation and existing snake identification research. Section 2 discusses the methodology conducted during this research. Section 3 explains the image data collection. Section 4 and 5 describe the experimented texture extraction and snake identification. Whereas, Section 6 shows the analysis of the experimental results. Finally, the paper is concluded and future works are explained in the last section.

2. METHODOLOGY

The main goal of this paper is to extract the statistical texture vectors of mean, standard deviation, and magnitude of snake region feature images using normalized mean-variance moving window and to identify the specific type of snake. Also, to identify the snake type and compare the classifiers of Tree, K-Nearest Neighbour, Support Vector Machine and Naive Bayes. Three phases involved in this study are snake image data collection, selecting the taxonomical snake region features, statistical texture extraction, snake identification and accuracy evaluation.

3. IMAGE DATASET

All the snake image datasets are collected from Malacca Butterfly & Reptile Sanctuary, Melaka, Malaysia. The total images that have been gathered are 20 snake images which include 15 images are from Naja Kaouthia species images and five other venomous snake species of Gunprecht's Green Pit Viper and Green Tree Python. The image datasets are pre-processed for the statistical texture extraction phase. Each of the snake images has been pre-processed by selecting the snake region features by 10 times; 150 images are from Naja Kaouthia species image and 50 images are from the other five venomous snakes. There are 31 identified taxonomical snake features that have been used during the experiment [4]. The sample of extracted snake region feature is shown in Figure 1. Therefore, a total of 200 snake region features has been investigated during the experiment. Figure 2 and Figure 3 illustrate the sample of Naja Kouthia species and other venomous snake species, respectively.

Figure 1. Sample of the extracted snake region features

Figure 2. Sample of Naja Kouthia species

Figure 3. Sample of other venomous snake species

4. TEXTURE FEATURE EXTRACTION

Texture feature extraction refers to the extraction of texture snake region features. The statistical texture of mean, standard deviation, and magnitude are extracted from the snake region features. Then, the mean-variance moving window is used to normalized the extracted features of the snake region image to get the results of feature vectors [4]. The normalized mean-moving windows are described as Equation (1).

$$I_n(k_x,k_y)=\frac{\sum_{i=-m1}^{m1}\sum_{j=-n1}^{n1}\left(I\left(k_x-i,k_y-j\right)-I_u\right)}{I_\sigma} \qquad (1)$$

where

I_u : intensity value of mean in the image

I_σ : intensity value of standard deviation in the image

I_n : image normalized

(k_x,k_y) : coordinate value in the image

5. SNAKE IDENTIFICATION

The classifiers that have been experimented within this paper are Tree (complex, medium, simple), K-Nearest Neighbor (fine, medium, coarse, cosine, cubic, weighted), Support Vector Machine (linear, quadratic, cubic, fine Gaussian, medium Gaussian, coarse Gaussian) and Naïve Bayes methods. This paper then comparing between all of these classifiers. To identify the species type, there are three inputs been obtained from the normalized statistical feature vectors of mean, standard deviation and magnitude. The classifiers of Tree, K-Nearest Neighbor, Support Vector Machine and Naïve Bayes are the simple, well-known and most fundamental for class identification. The previous researchers demonstrated that all the experimented classifiers are robust, simple and powerful techniques [6].

6. RESULTS AND DISCUSSIONS

This paper experimented with and evaluated the 200 snake region features of snake images of Naja Kaouthia species image and five other venomous snake species of Gunprecht's Green Pit Viper and Green Tree Python. There are three statistical texture vectors of normalized mean, standard deviation and magnitude that have experimented. The sample of experimental statistical texture vectors is tabulated in Table 1.

Table 1. Sample Statistical Texture Vectors

Original Image	**Texture Vectors**		
	Mean	**Standard Deviation**	**Magnitude**
	0.037	1.720	261212.3
	0.048	2.057	238869
	0.051	2.129	234789
	0.035	1.737	259971.5
	0.055	2.290	226392.3
	0.049	2.024	240815.3
	0.051	2.082	237449.1
	0.040	1.880	249835
	0.040	1.807	254867
	0.047	2.121	235229.9

The purpose of the quantitative evaluation is to evaluate the accuracy result of the snake image datasets, to measure the performance of the classifier when extracting texture vectors. The experimental results of snake identification shown in

Table 2. This identification is evaluated using the confusion matrix of True Positive (TP) defined as the number of percentage Naja Kaouthia species images that are correctly predicted, False Negative (FN) defined as the number of percentage of the other five venomous snake species that incorrectly predicted. The accuracy rate produced refers to the total number of percentage predicted snake types that are corrected identified.

Table 2. Results of Accuracy Rate for Snake Identification

Classifier	**True Positive (%)**	**False Negative (%)**	**Accuracy Rate (%)**
Tree – complex	100	0	100
Tree – medium	100	0	100
Tree – simple	100	0	100
K-Nearest Neighbor – fine	100	0	100
K-Nearest Neighbor – medium	100	0	100
K-Nearest Neighbor – coarse	75	25	75
K-Nearest Neighbor – cosine	100	0	100
K-Nearest Neighbor – cubic	100	0	100
K-Nearest Neighbor – weighted	100	0	100
Support Vector Machine – linear	100	0	100
Support Vector Machine – quadratic	100	0	100
Support Vector Machine – cubic	100	0	100
Support Vector Machine – fine Gaussian	100	0	100
Support Vector Machine – medium Gaussian	100	0	100
Support Vector Machine – coarse Gaussian	100	0	100
Naïve Bayes	100	0	100

All the classifiers produced an accuracy rate of 100%, except for the Coarse K-Nearest Neighbor model. Overall, this paper showed that the majority of all the classifiers are correctly predicted the snake type by applying the normalized snake region features. Therefore, the snake identification results presented the promising usage of all these classifiers. However, this research needs to improve some of the classifiers which to produce a higher accuracy rate.

7. CONCLUSION

This research has been investigated on statistical texture vectors by using the snake region features. It showed that majority of the classifiers produced a 100% accuracy rate. Furthermore, these normalized snake region features proved that all the taxonomical statistical texture vectors have been produced a higher accuracy identification rate.

For further research development, this research may experiment on the other statistical texture and color features. Future research may improve on the Coarse K-Nearest Neighbor classifier. This research may also focus on the real-time image data and apply the deep learning technique to extract the features and identify the snake species.

ACKNOWLEDGMENTS

This research was supported by the Ministry of Higher Education (MOHE) with grant reference of 600/RMI/DANA 5/BESTARI/0002/2016 and Universiti Teknologi MARA.

REFERENCES

[1] Delgado-Gonzalo, R., Schmitter, D., Uhlmann, V., & Unser, M. (2015). Efficient Shape Priors for Spline-Based Snakes. IEEE Trans. Image Processing, 24(11), 3915-3926.

[2] Marchant, J. A., & Schofield, C. P. (1993). Extending the snake image processing algorithm for outlining pigs in scenes. Computers and Electronics in Agriculture, 8(4), 261-275.

[3] Marvi, H., Bridges, J., & Hu, D. L. (2013). Snakes mimic earthworms: propulsion using rectilinear travelling waves. Journal of the Royal Society Interface, 10(84), 20130188.

[4] Penning, D. A., Dartez, S. F. & Moon, B. R. (2015). The big squeeze: scaling of constriction pressure in two of the world’s largest snakes, Python reticulatus and Python molurus bivittatus. Journal of Experimental Biology, 218(21), 3364–3367.

[5] Noh, S. M., Yan, V. X., Vendetti, M. S., Castel, A. D., & Bjork, R. A. (2014). Multilevel induction of categories: Venomous snakes hijack the learning of lower category levels. Psychological science, 25(8), 1592-1599.

[6] James, A. P., Mathews, B., Sugathan, S. & Raveendran, D. K. (2014). Discriminative histogram taxonomy features for snake species identification. Computing and Information Sciences, 4(3), 1–11.

[7] Roslan, R., Nazery, N. A., Jamil, N., & Hamzah, R. (2017, October). Color-based bird image classification using Support Vector Machine. In Consumer Electronics (GCCE), 2017 IEEE 6th Global Conference on (pp. 1-5). IEEE.

[8] Halim, S. A., Ahmad, A., Noh, N. M., Ali, A. M., Hamid, N. H. A., Yusof, S. F. D., Osman, R. & Ahmad, R. (2012, August). A development of snake bite identification system (N'viteR) using Neuro-GA. In Information Technology in Medicine and Education (ITME), 2012 International Symposium on (Vol. 1, pp. 490-494). IEEE.

[9] Halim, S. A., Ahmad, A., Noh, N. M., Safudin, M. S. B. M. A., & Ahmad, R. (2011, December). A comparative study between standard back propagation and resilient propagation on snake identification accuracy. In IT in Medicine and Education (ITME), 2011 International Symposium on (Vol. 2, pp. 242-246). IEEE.

[10] Singh, S., & Singh, G. (2013). Snake bite: Indian Guidelines and Protocol. Medicine update of API, 94, 424-426.

[11] Kuriyama, T., Misawa, H., Miyaji, K., Sugimoto, M., & Hasegawa, M. (2013). Pigment cell mechanisms underlying dorsal color-pattern polymorphism in the japanese four-lined snake. Journal of morphology, 274(12), 1353-1364.