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Nomor   : 044/UN9.1.9/UPPM/2015   04 November 2015
Lampiran : 2 (dua) lembar
Perihal   : Pelaksanaan Seminar Hasil Penelitian dan Pengabdian kepada Masyarakat
          Hibah Fakultas Ilmu Komputer Universitas Sriwijaya

Yth. Bapak / Ibu
       Dosen Penerima Hibah Fakultas Ilmu Komputer
       Universitas Sriwijaya
       di
       Palembang

Dengan hormat, diberitahukan kepada dosen penerima hibah Penelitian dan Pengabdian kepada Masyarakat Fakultas Ilmu Komputer Universitas Sriwijaya bahwa seminar hasil Penelitian dan Pengabdian kepada Masyarakat akan dilaksanakan tanggal 02 Desember 2015 pada *Annual Research Seminar* (ARS). *Extended Abstract* dikumpulkan paling lambat pada tanggal 20 November 2015 kepada ibu Feni Selfania. Pencairan dana Penelitian dan Pengabdian kepada Masyarakat tahap II (40%) di bagian keuangan melalui saudari Naretha dapat dilakukan dengan menunjukkan bukti pengumpulan:

1. Extended Abstract ke UPPM Fakultas Ilmu Komputer Universitas Sriwijaya;

2. bukti pengumpulan Laporan Akhir Penelitian dan Pengabdian kepada Masyarakat yang telah sesuai dengan kontrak dan keluaran, hasil atau tujuan yang dijanjikan pada proposal.

Demikian, kami sampaikan pemberitahuan ini. Atas perkenan dan kerjasamanya, kami ucapkan terima kasih.

Ketua,

Samsuryadi
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Tembusan: Yth.

1. Dekan sebagai laporan

2. Wakil Dekan bidang Akademik

3. Wakil Dekan bidang Umum dan Keuangan

4. Kasubag. Kepegawaian dan Keuangan

Yth. Bapak / Ibu
      Dosen Penerima Hibah Fakultas Ilmu Komputer
      Universitas Sriwijaya
      di
      Palembang

Extended Abstract dibuat menggunakan kertas A4 dengan batas bagian atas 0.75 inci, bagian kiri dan kanan 0.63 inci, serta1 inci untuk bagian bawah dengan font *time new roman*s. ABSTRAK ditulis menggunakan Bahasa Inggris maksimum 300 kata, judul berukuran 20, nama penulis, institusi dan email penulis, latar belakang (pendahuluan), hasil dan pembahasan, daftar pustaka atau rujukan berukuran 10, sedangkan abstrak berukuran 9.

Extended Abstract diperkenankan seluruhnya dalam bahasa Inggris seperti contoh pada kertas terpisah.

Ketua UPPM Fasilkom,

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Ear Image Recognition using Hyper Sausage Neuron

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Abstract-. It is important to distinguish an individual from a group of other individuals to ensure information security and integrity. One of human body parts that has distinguishable characterics is the ear. Prior attempts on identification of human ear image has been implementing statistical pattern recognition which focusing more on classification between sample sets. This research attempts to build a robust ear image recognition system using Hyper Sausage Neuron (HSN) that concetrates on cognition process rather than classification. A recognition software has been built and tested to recognize ear images. Ear images presented into the software has its geometrical moment invariants extracted. These moments is then used to build a seven dimensional feature vector which will construct a network of HSN of each individual it represents. Different ear images from the same individual is presented into the software to test its accuracy. The experiment result shows that ear recognition using HSN has better accuracy and faster training time than previous recognition attempts using statistical pattern recognition.

BACKGROUND

Individual recognition have been proven to be useful in securing information. It is important to distinguish an individual from a group of other individuals to ensure information security and integrity. Biometric is a method to recognize a person based on their certain physiology characteristics. It has been previously explored and suggested as an authentication method [1] [2]. One of human body parts that has distinguishable characterics is the ear. Compared to other body part, such as face, ear has several advantages, namely that its shape does not change significantly throughout human life and that it is not easily affected by emotional change [3].

Prior attempts on identification of human ear using statistical pattern recognition results in more than 90% accuracy [4] [5] [6]. However, in accordance to the nature of neural network, these attempts are focusing on classifying and differentiating the training samples. This nature made the recognition system may be weak to new, untrained sample. Thus, if there is a new training sample to be added to the network, the whole network has to be re-trained to maintain its accuracy. Repeating these process can be time consuming with increasing network and sample sets.

Hyper Sausage Network (HSN) is a part of biomimetic pattern recognition. It concentrated on the cognition process rather than classification of sample sets. Each sample is separated and has no connection to other [7]. Therefore, if there is an added sample, only a certain part needs to be trained. It also implemented the principal of homology-continuity (PHC) [8]. HSN can be described as the basic covering unit of the training set. Its coverage in high dimensional space constructs a sausage like shape in feature space for covering the distribution area of the sampling points in the same class [9]. The HSN covering can be seen as a topological product of a one-dimensional line segment and a two-dimensional super sphere [10].

As previous studies suggested, ear is a potential biometric focus, but, previous attempts using statistical pattern recognition might be vulnerable to untrained data. HSN, on the other hand has a different cognitive process that is more robust to untrained data. This research attempts to build a robust human ear image recognition system using HSN and compare its result and training time to previous studies.

RESULTS AND DISCUSSIONS

An ear image recognition software prototype has been built using Java programming language. The recognition uses Geometrical Moment Invariant (GMI) as its feature extraction method. GMI is based on nonlinear combination of normalized central moments. It has seven features that does not changed althought the image is translated, scaled, mirrored, and rotated [11]. It has been proven as an effective feature extraction method to

The recognition software has two main processes, namely, the training process and the recognition process. The software flow chart can be seen on Fig. 1. Both of the processes takes binary human ear image as input. The training process results is then saved into external file containing HSN networks of each individual and their respective id, whereas the recognition process will show each input image owner id.

To test the accuracy of HSN in recognizing human ear image, sample images from 25 individuals has been tested into the software. Sample images were taken from the AMI ear database. The images were collected and pre-processed by scaled, gray scaled, and thresholded into binary image as seen on Fig. 2. The pre-processing is done externally using image editing software. Each individual is represented by 6 images, 3 were used for training, and the other 3 were used to test the recognition accuracy.

Experiment were conducted under 4 different configurations based on different threshold's β value. Threshold value in HSN represents a sausage super sphere's radius. The value can be a static value, or derived from the sausage's characteristic, which is the line segment width (D_{lj}) and a user-determined β value. Results of these experiments can be seen on Table 1. In this experiment, different threshold value does not affect the

recognition result, but it significantly increase the accuracy compared to static threshold value.

TABLE I
SUCCESS RATES OF DIFFERENT EXPERIMENT CONFIGURATIONS

Threshold	Static (th = 1.000.000)	th = $\beta * D_{ij}$		
		$\beta = 0.4$	$\beta = 0.75$	$\beta = 0.9$
Success rate (%)	90.67%	97.33%	97.33%	97.33%

The process of training and recognizing image were also timed. Training process of 25 individuals with each 3 sample sets was done in 0.125 sec, while the recognition process of 75 images takes 1.718 sec, averaging in 0.023 sec of each image.

TABLE II
COMPARISON OF THE SYSTEM TO OTHER STATISTICAL PATTERN RECOGNITION

Recognition Method	Success Rate Percentage	No. Of training sample	Training time (s)
Hyper Sausage Neuron with GMI	97.33%	75	0.125
Backpropagation with ZMI [4]	96.67%	75	n/a
SOM with GMI [5]	96%	75	n/a
SOM with Geometrical Feature [6]	98%	46	2.3

Compared to previous attempts on human ear identification in Table 2., the result is better than [4] and [5], while it is lower than [6]. But, the training time is significantly faster than it is of SOM.

Based on the current experiment result of the ear image recognition, HSN has shown a promising result and better processing time to prior attempt to ear image recognition. Future development of the system consist of dynamic addition of training sample, and different application of HSN threshold value.

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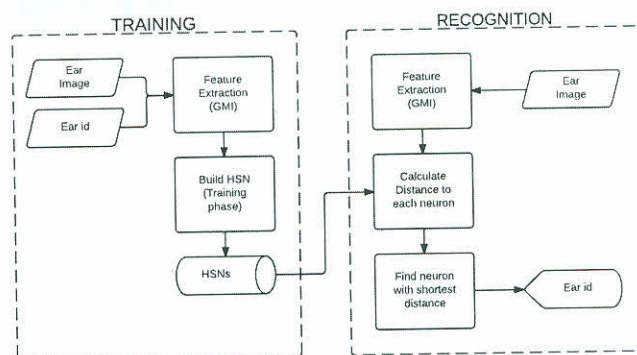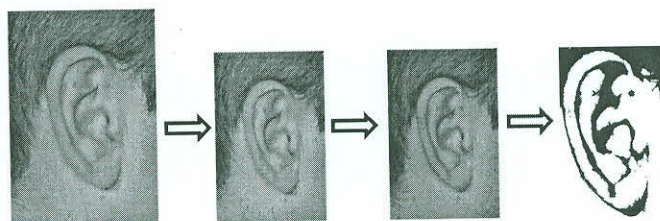
Fig 1. Ear Image Recognition with HSN software flow chart

Fig 2. Ear Image Pre-processing