UNIVERSITI PUTRA MALAYSIA

IMRPOVEMENT OF EAR RECOGNITION RATE USING COLOR SCALE INVARIANT FEATURE TRANSFORM

KOMEIL HADIDI

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IMRPOVEMENT OF EAR RECOGNITION RATE USING COLOR SCALE INVARIANT FEATURE TRANSFORM

By

KOMEIL HADIDI

Thesis Submitted to the School of Graduate Studies, Universiti Putra Malaysia, in Fulfilment of the Requirements for the degree of the Master of Science

January 2013

DEDICATION

This thesis is dedicated to my parents for their endless love and encouragement. Also I lovingly dedicate this thesis to my wife, who supported me each step of my way, and my lovely daughters, Houra & Minoo.

Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfilment of the requirement for the degree of Master of Science

IMRPOVEMENT OF EAR RECOGNITION RATE USING COLOR SCALE INVARIANT FEATURE TRANSFORM

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January 2013

Chair: Professor Mohammad Hamiruce Bin Marhaban, PhD

Faculty: Engineering

Local features are effective for ear biometrics. Scale Invariant Feature Transform (SIFT) technique has been used in many biometrics types as well as ear, but it is suitable for gray-scale images. In addition, the number of keypoints which can be retrieved by SIFT has an upper limit.

This research is aimed to develop a method for using color information (in addition to gray images) to generate additional feature points for higher recognition rate. SIFT has four stages. The first stage of SIFT, which is applying difference of Gaussian function on the image, has been changed such that the resulting key-points will be generated from a pair of RGB color planes. This structure is inspired by color double opponent neuronal circuits in the primate brains.

In the last stage of SIFT, the gray and color features will be compared against gray and color database, respectively. The scores of all active color channels will then be added together to produce final score of database images to win as a matching image.

The proposed approach is compared with standard model of SIFT by applying both of them on USTB database of ears with 780 side view ear images from several viewpoints up to 20 degrees difference. Comparison among standard and different color opponent channels demonstrates that 4.3% higher recognition rate has been achieved by utilizing Red/Green opponent channel, in addition to the gray channel, for 20 degrees rotation in viewpoint. For Yellow/Blue channel, the improvement is 6% in maximum rotation of the head. Comparative analysis demonstrates that the proposed method can achieve higher recognition rate by utilizing color image information.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia
sebagai memenuhi keperluan untuk ijazah Master Sains

PENAMBAHBAIKAN FUNGSI PENGECAMAN TELINGA MELALUI TRANSFORMASI CIRI-CIRI BERWARNA SKALA TAK BERUBAH

Oleh

KOMEIL HADIDI

Januari 2013

Pengerusi: Professor Madya Mohammad Hamiruce Bin Marhaban, PhD

Fakulti: Kejuruteraan

Ciri-ciri setempat adalah berkesan untuk biometrik telinga. Teknik transformasi ciri-ciri berskala tak berubah atau *Scale Invariant Feature Transform* (SIFT) telah digunakan dalam pelbagai jenis biometrik termasuk telinga, tetapi ia hanya sesuai digunakan untuk imej-imej berskala kelabu. Di samping itu, bilangan keypoints yang boleh diambil oleh SIFT mempunyai had limit.

Jesteru itu, penyelidikan ini adalah bertujuan untuk membangunkan satu kaedah dengan menggunakan maklumat warna (sebagai tambahan kepada imej kelabu) untuk menjana ciri-ciri tambahan, yang membolehkan kadar penentuan yang lebih tinggi. SIFT mempunyai empat peringkat. Peringkat pertama SIFT, iaitu penerapan perbezaan fungsi Gaussian ke atas imej, telah diubah supaya hasilan titik-titik penting atau *key-points* dapat dijana daripada sepasang satah warna RGB. Struktur ini adalah berinspirasikan kepada lawan warna berganda litar-litar *neuronal* yang terdapat di dalam otak-otak primat. Di peringkat terakhir SIFT, ciri- ciri kelabu akan dibandingkan dengan pangkalan data kelabu manakala ciri-ciri warna pula akan dibandingkan dengan pangkalan data warna. Skor-skor kesemua saluran-saluran

warna aktif akan dijumlahkan bagi menghasilkan skor akhir imej-imej pangkalan data yang akan digunakan dalam penentuan imej sepadan.

Pendekatan yang dicadangkan ini telah dibandingkan dengan model piawai SIFT dengan mengaplikasikan kedua-duanya pada pangkalan data USTB telinga dengan 780 imej-imej telinga pandangan sisi dari beberapa titik-titik pandangan atau *viewpoints* dengan perbezaan sehingga 20 darjah. Hasil perbandingan di antara standard dan saluran-saluran lawan warna yang berbeza menunjukkan bahawa prestasi pengecaman sebanyak 4.3% lebih tinggi telah dicapai dengan menggunakan saluran lawan merah/hijau di samping saluran kelabu, untuk putaran 20 darjah pada titik pandangan. Saluran warna kuning/biru pula mencatatkan peningkatan sebanyak 6% pada putaran maksimum kepala. Perbandingan analisis dengan menggunakan warna maklumat imej,dapat menunjuk bahawa kaedah yang dicadangkan boleh mencapai kadar penentuan yang lebih tinggi.

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APPROVAL SHEET

I certify that an Examination Committee has met on date of 21 January 2013 to conduct the final examination of Komeil Hadidi on his Masters degree thesis entitled "Improvement of Ear Recognition Rate Using Color Scale Invariant Feature Transform" in accordance with Universiti Pertanian Malaysia (Higher Degree) Act 1980 and Universiti Pertanian Malaysia (Higher Degree) Regulations 1981. The Committee recommends that the student be awarded the Masters of Science (Control and Automation Engineering).

Members of the Examination Committee were as follows:

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This thesis was submitted to the Senate of Universiti Putra Malaysia and has been accepted as fulfilment of the requirement for the degree of Master of Science.
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DECLARATION

I declare that the thesis is my original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously, and is not concurrently, submitted for any other degree at Universiti Putra Malaysia or at any other institution.

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KOMEIL HADIDI

Date: 21 January 2013

TABLE OF CONTENTS **Page**