UNIVERSITI PUTRA MALAYSIA

CONTENT-BASED IMAGE RETRIEVAL SYSTEM FOR PLANT LEAF DATABASE USING TEXTURE

AHMED NASER HUSSEIN

CONTENT-BASED IMAGE RETRIEVAL SYSTEM FOR PLANT LEAF DATABASE USING TEXTURE

AHMED NASER HUSSEIN

Master of Science

University Putra Malaysia

April 2011

CONTENT-BASED IMAGE RETRIEVAL SYSTEM FOR PLANT LEAF DATABASE USING TEXTURE

By

AHMED NASER HUSSEIN

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

April 2011

DEDICATION

To my family, they always encouraged me to continue my studies

To my great Father, for his prayers and endless support

To my beloved wife, none of this would be possible without your love and moral support

To my home IRAQ

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

CONTENT-BASED IMAGE RETRIEVAL SYSTEM FOR PLANT LEAF DATABASE USING TEXTURE

By

AHMED NASER HUSSEIN

April 2011

Chair: Syamsiah Mashohor, PhD

Faculty: Engineering

Automatic plant leaf images retrieval system help the students and the researchers in botany field. It does so by overcoming limitations associated by the system such as the domain knowledge requirement and the time consumption. It also helps in learning process where the retrieval will speed up the search of any plant species and gives better experience to the students to familiarize themselves with the plant species. The motivation of this work was driven by inherent difficulties of the manual classification of plant leaf images. To achieve that, an automatic, fast, and robust content based image retrieval (CBIR) system is designed. The richness and uniqueness of plant leaf texture is used in this work as a principal feature in classifying the plant leaf species. A study on the texture extraction approach for plant leaf image is crucial in designing an effective image retrieval system.

To classify plant leaf image, CBIR system is employed which extract the leaf texture and then use the extracted feature to compare against the gallery for similarity measurement. The texture extraction is accomplished using Discrete Wavelet Transformation (DWT) incorporating with entropy measurement which enhances the classification of images.

The dataset for this experimental work has been obtained from the American National Herbarium Collections. The dataset offers wide diversity of rotation, noise, luminance and scale on plant leaf image. The experiments have been performed on seven plant species that consist of 280 images. To evaluate the robustness of the system, the experiments are repeated on 92 species that consist of 3597 images. The proposed framework yields a correct classification rate of 92.5% , 85.92% of average precision rate for top 5 images, 71.9% of average recall rate for top 100 images, length of feature vector is 36, and the average retrieval time is 1.0656 seconds only on overall system framework. The results were compared with another CBIR system which is based on Gray Level Co-occurrence Matrix (GLCM) and then showed better performance in terms of evaluation of images classification and retrieval.

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

SISTEM DAPATAN BERASASKAN KANDUNGAN UNTUK PANGKALAN DATA DAUN TUMBUH-TUMBUHAN MENGGUNAKAN CIRI TEKSTUR

Oleh

AHMED NASER HUSSEIN

April 2010

Pengerusi : Syamsiah Mashohor, PhD

Fakulti : Kejuruteraan

Sistem dapatan imej daun tumbuh-tumbuhan automatik membantu pelajar dan penyelidik dalam bidang botani. Ianya dibina bagi mengatasi had yang dikaitkan dengan sistem itu seperti keperluan domain pengetahuan dan penggunaan masa. Ia juga membantu proses pembelajaran di mana dapatan akan menyegerakan pencarian mana-mana spesies tumbuhan dan memberi pengalaman lebih baik bagi pelajar membiasakan diri mereka dengan spesis tumbuhan. Motivasi kerja ini telah didorong oleh kesukaran sedia ada yang wujud pada pengelasan manual imej daun tumbuh-tumbuhan. Untuk mencapai satu sistem yang automatik, cepat dan tepat, sistem dapatan imej berasaskan kandungan (CBIR) telah direkabentuk. Kekayaan dan keunikan tekstur daun tumbuh-tumbuhan digunakan dalam tugas ini sebagai ciri

utama dalam mengklasifikasikan spesis daun tumbuh-tumbuhan. Satu kajian mengenai pendekatan pengekstrakan tekstur untuk imej daun tumbuh-tumbuhan amat penting dalam mereka sistem dapatan imej yang berkesan. Untuk mengelaskan imej daun tumbuh-tumbuhan, sistem CBIR yang mana tekstur daun digunakan dan kemudian ciri yang diekstrak dibandingkan dengan galeri untuk ukuran persamaan. Pengekstrakan tekstur dicapai menggunakan *Discrete Wavelet Transformation* (DWT) dengan menggabungkan dengan ukuran entropi yang mana memperbaiki pengelasan imej.

Dataset kajian eksperimentasi ini diperolehi dari Koleksi Herba Kebangsaan Amerika. Pada awalnya, eksperimen dijalankan pada tujuh jenis famili tumbuhan yang berbeza dan ianya merangkumi sejumlah 280 imej keseluruhannya. Kemudian, eksperimen dijalankan berulang kali terhadap 92 jenis spesies yang terdiri daripada 3597 imej untuk penilaian prestasi sistem. Rangka kerja yang dicadangkan berjaya mencatat sehingga 92.5% untuk kadar klasifikasi betul. 85.92% daripada kadar ketepatan purata untuk 5 imej utama, 71.9% daripada kadar purata perolehan semula untuk 100 imej utama, 36 ciri panjang vector dan purata masa dapatan hanyalah 1.0656 saat untuk keseluruhan sistem rangka kerja. Perbandingan bagi hasil kajian ini dengan sistem CBIR yang berasaskan GLCM dijalankan dan sistem yang dicadangkan menunjukkan prestasi yang lebih baik dari segi pengelasan imej dan imej dapatan.

ACKNOWLEDEMENTS

All praise to supreme almighty Allah s.w.t. The only creator, cherisher, sustainer and efficient assembler of the world and galaxies whose blessings and kindness have enabled the author to accomplish this project successfully.

The author gratefully acknowledges the guidance, advice, support and encouragement he received from his supervisor, Dr. Syamsiah Binti Mashohor, Lecturer of the Department of Computer and Communication Systems Engineering, Faculty of Engineering, University Putra Malaysia. She keeps advising and commenting throughout this project until it turns to real success. With his unfailing patience this thesis has been completed successfully.

Great appreciation is expressed to Dr. M. Iqbal Bin Saripan, Lecturer of the Department of Computer and Communication Systems Engineering, Faculty of Engineering, University Putra Malaysia, for his valuable remarks, help advice and encouragement. The door of his office was always open for me. His help and guidance has been a great motivation for me to complete this work.

Thanks are due to Mr. Ahmed M. Mharib for his encouragement and support. He was always available to help when it was needed the most. His patience is greatly acknowledged.

Appreciation also to the Faculty of Engineering for providing the facilities and the components required for undertaking this project. The author is thankful to all UPM students' friends for their help to let this work exist to the world.

APPROVAL

I certify that an Examination Committee has met on 14 April 2011 to conduct the final examination of Ahmed Naser Hussein on his Master thesis entitled "Content-Based Image Retrieval System for Plant Leaf Database Using Texture" in accordance with Universiti Pertanian Malaysia (Higher Degree) Act 1980 and Universiti Pertanian Malaysia (Higher Degree) Regulations 1981. The Committee recommends that the candidate be awarded the relevant degree. Members of the Examination Committee are as follows:

Salasiah binti Hitam, PhD
Lecturer
Faculty of Engineering
Universiti Putra Malaysia
(Chairman)

Abdul Rahman bin Ramli, PhD
Associate Professor
Faculty of Engineering
Universiti Putra Malaysia
(Internal Examiner)

Siti Khairunniza binti Bejo, PhD
Lecturer
Faculty of Engineering
Universiti Putra Malaysia
(Internal Examiner)

Putra Sumari,, PhD
Associate Professor
Faculty of Computer Sciences
Universiti Sains Malaysia
Malaysia
(External Examiner)

_____
SHAMSUDDIN SULAIMAN, PhD
Professor/Deputy Dean
School of Graduate Studies
University Putra Malaysia

Date:

This thesis was submitted to the Senate of University Putra Malaysia and has been accepted as fulfilment of the requirement for the degree of Master of Science. The members of the Supervisory Committee were as follows:

Syamsiah binti Mashohor, PhD
Senior Lecturer
Faculty of Engineering
Universiti Putra Malaysia
(Chairman)

M. Iqbal bin Saripan, PhD
Associate Professor
Faculty of Engineering
Universiti Putra Malaysia
(Member)

_____

HASANAH MOHD GHAZALI, PhD
Professor and Dean
School of Graduate Studies
Universiti Putra Malaysia

Date:

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 University Putra Malaysia or other institutions.

AHMED NASER HUSSEIN

Date: 14 April 2011

TABLE OF CONTENTS