



UNIVERSITI PUTRA MALAYSIA

***AUTOMATED APPROACH FOR OIL PALM IN
VITRO SHOOT CLASSIFICATION***

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VITRO SHOOT CLASSIFICATION**

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**MASTER OF SCIENCE
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**AUTOMATED APPROACH FOR OIL PALM *IN VITRO* SHOOT
CLASSIFICATION**

By

ABDUL HALIM BIN ISMAIL

**Thesis Submitted to the School of Graduate Studies, Universiti Putra
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**AUTOMATED APPROACH FOR OIL PALM *IN VITRO* SHOOTS
CLASSIFICATION**

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ABDUL HALIM BIN ISMAIL

March 2010

Chairman: Mohammad Hamiruce Marhaban, PhD

Faculty: Faculty of Engineering

Oil palm tissue culture shows promising future in providing uniform and quality cloned ramets for planting. However, mass production of oil palm plantlet is currently prohibitive in spite of its high demand. This is due to the fact that most of the processes in tissue culture are done manually which is labour-intensive as well as prone to contamination. In order to mass-produce clonal planting materials, an automated system is desirable, which is expected to be more cost effective as well as enhancing efficiency. In this study, the automation system is targeted at the shoots development stage since it is tedious job and routine to be operated manually as no automation system is currently adaptable for the tasks. This research focuses on the classification of various categories of normal and abnormal oil palm *in vitro* shoots. The oil palm *in vitro* shoots samples were digitized and employed for automated approach. A customized method for automatic image thresholding has been proposed to deal with various samples geometrical orientations and a wide variety of lighting conditions, as the environment for the future automation system would likely to be this way. Features were later extracted based on thinning and convexity image morphologies. By manipulating the features data obtained, three classification

methods have been experimented, namely Linear Discriminant Analysis, K-mean clustering and back-propagation neural network. Results showed that all classification methods perform well, and able to differentiate between normal and abnormal oil palm *in vitro* shoots, with highest classification rate at ninety three percent. This is expected to greatly facilitate the development of the prospective automation system.



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

PENDEKATAN AUTOMATIK UNTUK PENGELASAN ANAK PUCUK *IN VITRO* KELAPA SAWIT

Oleh

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Kultur tisu kelapa sawit menunjukkan masa depan yang cerah di dalam menyediakan anak pucuk klon yang seragam dan berkualiti. Walaubagaimanapun, pengeluaran secara pukal anak pokok buat masa kini adalah terbatas meskipun mendapat permintaan yang tinggi. Ini adalah kerana kebanyakan proses kultur tisu dilakukan secara manual di mana ia memerlukan tenaga yang banyak dan juga cenderung kepada pencemaran. Untuk penghasilan pukal bahan penanaman klon, sistem automasi adalah sangat diperlukan, di mana ia dijangkakan lebih kos efektif serta meningkat kecekapan. Di dalam kajian ini, sistem automasi adalah ditumpukan di tahap pembangunan anak pucuk *in vitro* kerana ia merupakan kerja yang rumit dan rutin untuk dibuat secara manual disebabkan tiada sistem automasi yang boleh disuaikan untuk tugas ini. Kajian ini tertumpu kepada pengelasan pelbagai kategori normal dan abnormal anak pucuk *in vitro* kelapa sawit. Sampel-sampel anak pucuk *in vitro* kelapa sawit telah dimasukkan ke pola digital dan digunakan dalam pendekatan automatik. Kaedah pengambangan imej automatik yang diubahsuai telah dicadangkan untuk menangani kepelbagaian orientasi geometri dan keadaan pencahayaan, sepertimana persekitaran sistem automasi kelak. Ciri-ciri kemudiannya

disarikan berdasarkan morfologi penipisan dan kecembungan imej. Dengan memanipulasikan data ciri yang diperolehi, tiga kaedah pengelasan telah diuji, iaitu Analisis Pembezalayan Lelurus, pengelompokan purata-K, dan perambatan balik rangkaian neural. Keputusan semua kaedah pengelasan menunjukkan prestasi yang baik, dan berjaya untuk membezakan di antara anak pucuk *in vitro* kelapa sawit yang normal dan abnormal, dengan kadar pengelasan tertinggi sebanyak sembilan puluh tiga peratus. Ini dijangkakan dapat sebaiknya membantu pembangunan sistem automasi kelak.



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APPROVAL SHEETS

I certify that a Thesis Examination Committee has met on **5 March 2010** to conduct the final examination of **Abdul Halim Ismail** on his thesis entitled “**Automated Approach for Oil Palm *In Vitro* Shoots Classification**” in accordance with the Universities and University Colleges Act 1971 and the Constitution of the Universiti Putra Malaysia [P.U.(A) 106] 15 March 1998. The Committee recommends that the student be awarded the Master of Science degree.

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DECLARATION

I declare that the thesis is my original work except for quotations and citations which has 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 any other institution.

ABDUL HALIM ISMAIL

Date: 13 May 2010



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