

**DEVELOPMENT OF HIERARCHICAL
SKIN-ADABOOST-NEURAL NETWORK
(H-SKANN) FOR MULTIFACE DETECTION IN
VIDEO SURVEILLANCE SYSTEM**

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**DEVELOPMENT OF HIERARCHICAL SKIN-ADABOOST-NEURAL
NETWORK (H-SKANN) FOR MULTIFACE DETECTION IN
VIDEO SURVEILLANCE SYSTEM**

by

ZULHADI ZAKARIA

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LIST OF ABBREVIATIONS

ANN	Artificial Neural Network
CCTV	Close-circuit Television
CGF	Conjugate gradient with Fletcher-Reeves updates
CGP	Conjugate gradient with Polak-Riebre updates
CNN	Convolution Neural Network
DNA	Deoxyribonucleic Acid
FCI	Face Candidate Identification
FSL	Face Skin Location
FSM	Face Skin Merging
FV	Face Verification
H-SKANN	Hierarchical of Skin, Adaboost and Neural Network
H-SKSVM	Hierarchical of Skin, Adaboost and Support Vector Machine
H1L	Single Level of Adaboost
H3L	Three Hierarchical Level of Adaboost
HCI	Human Computer Interaction
HMSLBP	Integral Histogram of Multi-Scale Local Binary Pattern
HSA	Hierarchical Skin Area
HSV	Hue-Saturation-Value
Hu-SA	Human Skin Adaptation
IOU	Intersection Over Union
MD	Mahalanobis Distance
MLP	Multi-layer Perceptron
MYA	Million Youth Assembly
NN	Neural Network
OSS	One secant backpropagation
RP	Resilient backpropagation
SCG	Scaled conjugate gradient
SFR	Suitable Face Resolution

YCbCr	Luminance-Chrominance Blue-Chrominance Red
YCgCr	Luminance-Chrominance Green-Chrominance Red
YCbCr-MD	Luminance-Chrominance Blue-Chrominance Red with Mahalanobis Distance
YCbCr-MD+FSM	Luminance-Chrominance Blue-Chrominance Red with Mahalanobis Distance in Face Skin Merging

**PEMBANGUNAN KULIT-ADABOOST-RANGKAIAN NEURAL SECARA
HIERARKI (H-SKANN) UNTUK PENGESANAN PELBAGAI MUKA DI
DALAM SISTEM PENGAWASAN VIDEO**

ABSTRAK

Pengesanan muka secara automatik merupakan langkah pertama bagi kebanyakan sistem biometrik masa kini yang berasaskan muka seperti pengesanan muka, pengesanan ekspresi wajah, pengesanan jantina dan pengesanan kedudukan kepala manusia. Walau bagaimanapun, teknologi pengesanan muka berpandukan kepada sistem komputer masih mempunyai pelbagai kelemahan serta cabaran sama ada di persekitaran yang tertutup dan terbuka seperti pencahayaan lampu yang tidak terkawal, oklusi pada muka, arah muka dan perubahan pada ekspresi muka. Tesis ini mencadangkan teknik untuk mengesan pelbagai muka manusia bagi tujuan aplikasi pengawasan video dengan seni bina algoritma yang strategik dan berdasarkan struktur reka bentuk secara hierarki. Teknik ini terdiri daripada dua blok utama yang dikenali sebagai Penyetempatan Kulit Muka (FSL) dan Kawasan Kulit Muka Berhierarki (HSA). FSL dirumus untuk mengekstrak data kulit bagi tujuan proses pada peringkat pertama bagi sistem pengesanan ini di mana ia juga terdiri daripada Penggabung Kulit Muka (FSM) bagi menggabungkan kawasan kulit yang terpisah dengan tepat. HSA dicadangkan untuk memperluaskan pencarian muka manusia pada kawasan segmentasi kulit yang dikenal pasti dengan menggunakan strategi seni bina secara berhierarki, di mana setiap peringkat hierarki terdiri daripada integrasi di antara algoritma Adaboost

dan Neural Network. Uji kaji dijalankan ke atas sebelas jenis pangkalan data yang terdiri daripada pelbagai cabaran terhadap sistem pengesanan muka manusia. Keputusan masing-masing menunjukkan bahawa kaedah H-SKANN memperoleh keputusan ketepatan secara purata sebanyak 98.03% dan 97.02% bagi pangkalan data penanda aras dan kawasan pengawasan.

DEVELOPMENT OF HIERARCHICAL SKIN-ADABOOST-NEURAL NETWORK (H-SKANN) FOR MULTIFACE DETECTION IN VIDEO SURVEILLANCE SYSTEM

ABSTRACT

Automatic face detection is mainly the first step for most of the face-based biometric systems today such as face recognition, facial expression recognition, and tracking head pose. However, face detection technology has various drawbacks caused by challenges in indoor and outdoor environment such as uncontrolled lighting and illumination, features occlusions and pose variation. This thesis proposed a technique to detect multiface in video surveillance application with strategic architecture algorithm based on the hierarchical and structural design. This technique consists of two major blocks which are known as Face Skin Localization (FSL) and Hierarchical Skin Area (HSA). FSL is formulated to extract valuable skin data to be processed at the first stage of system detection, which also includes Face Skin Merging (FSM) in order to correctly merge separated skin areas. HSA is proposed to extend the searching of face candidates in selected segmentation area based on the hierarchical architecture strategy, in which each level of the hierarchy employs an integration of Adaboost and Neural Network Algorithm. Experiments were conducted on eleven types database which consists of various challenges to human face detection system. Results reveal that the proposed H-SKANN achieves 98.03% and 97.02% of averaged accuracy for benchmark database and surveillance area databases, respectively.