



Faculty of Engineering

FACE DETECTION APPROACH FOR VIDEO SURVEILLANCE

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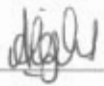
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FACE DETECTION APPROACH FOR VIDEO SURVEILLANCE

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ABSTRAK

Kini, komputer telah memainkan peranan yang penting dalam hidup kita. Komputer telah digunakan untuk menonton television, penyimpanan data-data sulit perniagaan, pemantauan keselamatan rumah, pengendalian peralatan rumah and sebagainya. Semua kegunaan tersebut kebanyakan bergantung kepada komputer. Jadi, system keselamatan komputer kita memainkan peranan yang penting untuk mengelakkan pengaksesan komputer. Oleh demikian, satu sistem pengesanan muka masa sebenar dicadangkan. Dalam laporan ini, satu sistem pengesanan dan pengecaman rupa bentuk muka telah dibentangkan. Asasnya, sistem ini menggunakan deteksi warna kulit untuk mendapatkan kawasan muka. Sistem ini mendapatkan kawasan muka menerusi warna kulit dan sejurusnya menumpukan pemprosesan gambar pada kawasan yang tertentu. System tersebut menukarkan maklumat muka kepada gambar hitam-putih dan menjalankan pengecaman rupa bentuk muka melalui rangkaian neural. Rangkaian neural digunakan untuk menyimpan maklumat muka dalam gambar. Rangkaian neural model Radial Basis Function digunakan untuk tujuan tersebut. Sistem ini dapat mengesan dan mengecam rupa bentuk muka yang disimpan. Sistem ini dapat mempamerkan peratusan kepadanan dengan gambar yang disimpan. Sistem ini dapat berfungsi dengan baik dalam pengecaman rupa bentuk sasaran dengan gaya yang berbeza dan mimik muka dengan sekurang-kurangnya 60% padan dengan sasaran. Sistem tersebut mencadangkan satu kamera web sebagai input video dalam sistem pengesanan dan pengecaman rupa bentuk muka masa sebenar.

ABSTRACT

Nowadays, computer has been acts an important role in our human life. Computer has been used for purposes such as television streaming, business confidential information storage, home security monitoring, home appliances controlling and etc. All of these usages are mainly based on the computer. Hence, our computer security system has makes an important roles in preventing unauthorized access to the computer. Thus, a real time face recognition system is proposed. In this report, a real time face detection and recognition system is presented. Basically, this system applied skin colour detection to allocate the face. The system allocates the face through skin colour sensing and further focused image processing on the specific area in the image. The system converted the facial information to grayscale image and performing face recognition using neural network. Neural network is used for storing the facial information of the training images. The Radial Basis Function Network is used for the particular purposes. The system is able to detect and recognize the face trained. The system would show the matching percentage of target with the training images. The system can perform well in recognizing the target faces with variation of poses and facial expression with at least 60% matched the target. The system proposed a direct webcam video input in real time based for the real time face recognition system.

Table of Content

Content	Page	
ACKNOWLEDGEMENT	II	
ABSTRAK	III	
ABSTRACT	IV	
TABLE OF CONTENTS	V	
LIST OF TABLE	IX	
LIST OF FIGURE	X	
LIST OF ABBREVIATION	XI	
CHAPTER 1	INTRODUCTION	
1.1	Introduction to Artificial Neural Network	1
1.2	History of Artificial Neural Network	2
1.3	Applications of Artificial Neural Network	3
1.4	Future of Artificial Neural Network	3
1.5	Face Detection	4
1.6	Face Recognition	4
1.7	Real Time Video Surveillance	5
1.8	Objective	5
1.9	Scope of Work	5
1.10	Chapter Outline	6

CHAPTER 2**LITERATURE REVIEW**

2.1	Artificial Neural Network Fundamental	7
2.2	Biological Neural Networks	8
2.3	Types of Artificial Neural Network	9
2.3.1	Hopfield Network	9
2.3.2	Multilayer Perceptron (MLP) network	10
2.3.3	Self Organizing Feature Map (SOFM/ Kohonen) network	11
2.3.4	Radial Basis Function (RBF/ Gaussian) network	11
2.4	Learning of Artificial Neural Network	12
2.4.1	Supervised Learning	12
2.4.2	Unsupervised Learning	12
2.4.3	Reinforcement Learning	13
2.5	Activation Function	14
2.5.1	Sigmoid Function	15
2.5.2	Gaussian Function	15
2.6	Advantages and Disadvantages of Artificial Neural Networks	16
2.7	Comparison of types of Artificial Neural Networks	17
2.8	Digital Image Processing	19
2.9	Face Detection	20
2.9.1	Feature-based Approach	20
2.9.2	Template Matching Approach	21
2.9.3	Image-based Approach	22
2.10	Face Recognition	23

CHAPTER 3 METHODOLOGY

3.1	Overview	25
3.2	Real-Time Webcam Input	26
3.3	Frame Grabber	26
3.4	Face Detection	27
3.5	Face Recognition	28
3.6	Radial Basis Function Network	28
3.6.1	Radial Basis Function Network in MATLAB	28
3.6.2	Algorithm of <i>newrb</i>	30
3.7	Real-Time Face Recognition System Process Flow	31

CHAPTER 4 RESULTS, ANALYSIS & DISCUSSIONS

4.1	Frame Grabber	32
4.2	Contrast Adjustment	33
4.3	Face Detection	34
4.4	Image Standardizing	36
4.5	Face Recognition	37
4.5.1	Face Recognition Varied in Upright Poses	39
4.5.2	Face Recognition in Various Facial Expression	41
4.5.3	Face Recognition With and Without Glasses	43
4.5.4	Face Recognition in Various Light Condition	44

4.5.5	Comparison of Different Training Set of RBFN	46
4.6	Real Time Video Surveillance	47
CHAPTER 5 CONCLUSIONS & RECOMMENDATIONS		
5.1	Conclusions	50
5.2	Recommendations	51
5.2.1	Face Detection in Extreme Light Condition	51
5.2.2	Moving Object Detection	52
5.2.3	Face Recognition with Higher Accuracy	52
5.2.4	Face Detection and Recognition via Variation of video Format	53
	REFERENCES	54

LIST OF TABLE

Table		Page
2.1	Activation Functions of Artificial Neural Networks	14
2.2	Artificial Neural Network Advantage and Disadvantage	16
2.3	Comparison table between MLP and RBF network	17
4.1	The Matching Percentage for 30 Images Varied in Poses	39
4.2	The Matching Percentage for 30 Images Varied in Facial Expression	41
4.3	The Matching Percentage for 9 Images Without Glasses	43
4.4	The Matching Percentage for 20 Images in Various Light Conditions.	44
4.5	Comparison Between RBFN with 5 and 10 Training Images	46

LIST OF FIGURE

Figure		Page
1.1	Architecture of a Typical Artificial Neural Network	1
2.1	Biological Neuron	8
2.2	A typical Hopfield Architecture	9
2.3	A Typical Multilayer Perceptron Architecture	10
2.4	A typical Radial Basis Function Network	11
2.5	Property of Sigmoid Function	15
2.6	Property of Gaussian Function	15
3.1	Network Architecture of RBFN in MATLAB	29
3.2	Flow Diagram of Face Recognition Approach in Video Surveillance	31
4.1	Frame Grabbed from Frame Grabber	32
4.2	Image After Contrast Adjustment	33
4.3	Skin Colour Region Marked	34
4.4	Cropped Face Image	35
4.5	Error Cropping Image	35
4.6	Image After Resize and Grayscale	36
4.7	Images Used for Training on RBFN Trained with 5 Images	37
4.8	Images Used for Training on RBFN Trained with 10 Images	37
4.9	MSE vs. Training Epoch for 5 Sample Images	38
4.10	Matching Percentage of Various Face Poses for Both RBFN	40
4.11	Matching Percentage of Various Face Expressions for Both RBFN	42
4.12	Test Images for Various Light Conditions	45
4.13	Real-Time Video Surveillance System Output	47

LIST OF ABBREVIATION

CCTV	-	Closed-Circuit Television
DFT	-	Discrete Fourier Transform
FFT	-	Fast Fourier Transform
HSI	-	Hue Saturation Intensity
LDA	-	Linear Discriminant Analysis
MLP	-	Multilayer Perceptron
MSE	-	Mean Square Error
PCA	-	Principal Component Analysis
RBF	-	Radial Basis Function
RBFN	-	Radial Basis Function Network
RGB	-	Red-Green-Blue
SOFM	-	Self Organizing Feature Map
YIQ	-	Y,I,Q NTSC colour model
YUV	-	Luminance-Bandwidth-Chrominance

CHAPTER 1

INTRODUCTION

1.1 Introduction to Artificial Neural Network

The Artificial Neural Network (ANN) is an information processing paradigm that inspired by the human brain. ANN is formed by information processing units, called neurons which are interconnected by links. Each link has its own algorithm designed to alter the weight of connections. In generally, ANN has three layers: input layer, hidden layer and output layer. Figure 1.1 shows architecture of a typical ANN.

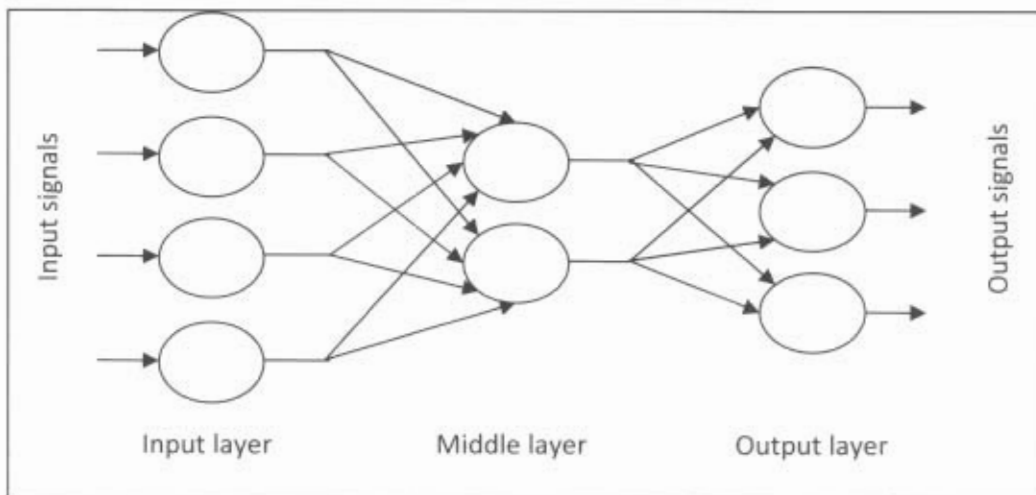


Figure 1.1 Architecture of a Typical ANN

1.2 History of ANN

The history of ANN is simplified as follows:

- 1943 - McCulloch and Pitts modeled a simple neural network using electrical circuits.
- 1949 - Hebb pointed out the fact that neural pathways are strengthened each time they are used.
- 1958 - Rosenblatt developed his perceptron brain models.
- 1969 - Minsky and Papert demonstrated a discouraging analysis on perceptrons.
- 1985 - Back-propagation learning was discovered independently by Parker and LeCun.
- 1988 - Broomhead and Lowe exploit the use of radial-basis functions in ANN.

1.3 Application of ANN

ANN is able to learn and store knowledge and it has broad applicability in practical. Currently, it has been used on the following field:

- i. Design and create a computer game.
- ii. Analysis and predicting the weather, earthquake, and etc.
- iii. Detecting and recognition of handwriting, vehicles plates, objects and etc.
- iv. Detecting and navigation-sensing for car system.

1.4 Future of Artificial Neural Network

ANN is simulating the fundamental of human brains. ANNs currently still have a great potential in various applications. In future, Artificial Neural Networks may develop in the following areas:

- i. I-Robot,
which can recognize human identity through face and thumbprint recognition and further communicate with human uniquely.
- ii. I-Truck which can recognize its owner and able to reaching target destination by self-navigating.-

1.5 Face Detection

Face detection system is to allocate the facial features from an image and has been widely used in information technology such as cameras to focus the face expression. There are three main approaches for face detection: feature based, template matching and image based. Feature-based is detecting using face feature such as eyes, nose and mouth. Template matching is matching the image with the face model. Image-based is detecting by using 2 class patterns as face classifier and non-face classifier.

1.6 Face Recognition

Face Recognition is to extract facial features in order to identify the owner of the face. Face recognition are drawn much attention to researcher especially in security purpose and face identification for criminals. Face recognition method can be categorized to 2D-based approach and 3D-based approach.

1.7 Real Time Video Surveillance

Video surveillance is defined as a video which is monitoring on a particular area. Generally, video surveillance is done by using a closed-circuit television or through webcam. The resolution of Closed-Circuit Television (CCTV) and the image quality commonly low. Besides, the noise level in CCTV is quite high and not suitable to use in automation system.

1.8 Objective

The objectives of this project are:

- i. To study the performance of several types of neural network algorithms for real time face recognition application.
- ii. To train the human faces using Radial Basis Function Network (RBFN).
- iii. To develop the face detection and recognition system using RBFN.
- iv. To simulate the real time face recognition system.

1.9 Scope of Work

The video surveillance systems are widely used over the world but the systems are able to monitor particular area only. The systems relied on human being to monitor screens physically. Hence, this project tends to implement face recognition algorithm with RBFN into video surveillance systems.

1.10 Chapter Outline

Chapter 1 introduces an overview of face detection, face recognition, video surveillance, history of ANN, application and future work of ANN, and objective of the project. It also includes the project scope and chapter outline of this report.

Chapter 2 contents the summary of the research study done for this project. It is about the works that have been done before in relevant topic.

Chapter 3 is providing the overall methodology of this project. It also included the approach and tools used in this project.

Chapter 4 discusses on the implementation of the real time face recognition system and the simulation results.

Chapter 5 is doing the conclusion for the whole project and future recommendation to be implemented to the system.

CHAPTER 2

LITERATURE REVIEW

2.1 ANN Fundamental

ANN is developed based on the concept of biological neurons. Biologically, the neurons connected to each other by synapses and the interconnections are constantly changing. In Artificial Neural Network, the neurons are connected by weighted links. Figure 1.1 in Chapter 1 shows the basic model of the architecture of an Artificial Neural Network, each neuron contains specific function. An ANN model is a structure that can be map to a set of data to demonstrate the relations between data. The model can be adjusted or trained using a set or few sets of data from a given source as input which called as training sets. The trained ANN model may used for classification, estimation, prediction or simulation on new data from same source or similar sources.

2.2 Biological Neural Networks

The brain is principally composed of a very large number of *neurons*, massively interconnected. Each neuron is a specialized cell which can propagate an electrochemical signal. Each neuron has a branching input structure called dendrites, a cell body called soma, and a branching output structure called axon. Figure 2.1 shows biological neuron.

The axons are connected to the dendrites of other neurons through a synapse. Each synapse actually contains a gap, with neurotransmitter chemicals poised to transmit a signal across the gap. Donald Hebb postulated that learning consisted principally in altering the strength of synaptic connections. [1]

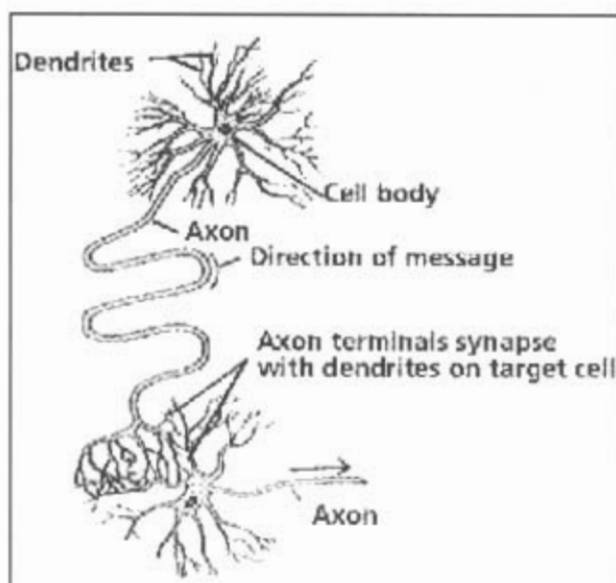


Figure 2.1 Biological Neuron

2.3 Types of Artificial Neural Network

There are many types of Artificial Neural Networks have been developed. The types of the Artificial Neural Networks consist of different types of neural architecture, learning and also activation functions.

2.3.1 Hopfield Network

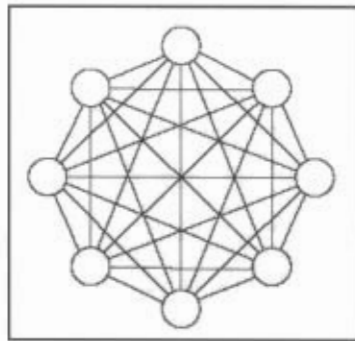


Figure 2.2 A typical Hopfield Architecture

Hopfield network is a type of Artificial Neural Networks in which nodes values are iteratively updated based on a local computation principle: the new state of each node depends only on its net weighted input at a given time. The network is fully connected and its weights are determined by the Hebbian principle. [2] Hebbian principle is described as a method of determining how to alter the weights between model neurons. The weight between two neurons will increase if the two neurons activate simultaneously, but it is reduced if they activate separately. [3]

2.3.2 Multilayer Perceptron (MLP) Network

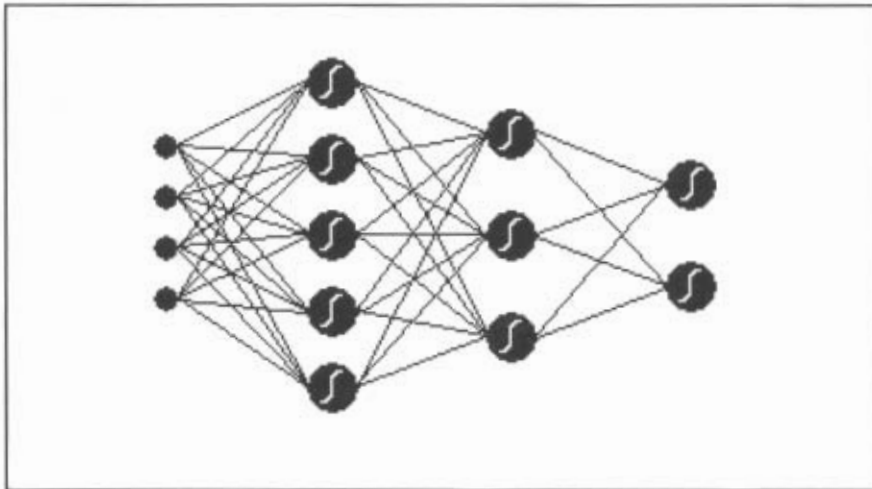


Figure 2.3 A Typical Multilayer Perceptron Architecture

MLP is a feed-forward network that trained with back-propagation algorithm. It is a supervised network that trained the desired responses with back-propagation technique. MLP consists of only one input layer and one output layer, but it can have one or more hidden layers. [1]