

REAL TIME TARGET IDENTIFICATION FOR SECURITY APPLICATIONS

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ABBREVIATION

NN	-	Neural Network
ANN	-	Artificial Neural Network
CCTV	-	Closed-circuit television
MLP	-	Multilayer Perceptron
W	-	Weight
x	-	Input data
y	-	Output data
FF	-	Feed Forward
RGB	-	Red, Green, Blue
GUI	-	Graphic User Interface
ROI	-	Region of Interest

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ABSTRACT

Nowadays, there are a lot of security alarm systems in the markets and those security alarm systems are similar, which is either CCTV video record with alarm siren or security password system with siren, or the combination of both. Thus, the real time target identification project for the security applications is proposed. In this project, a real time face detection and face recognition system for color image sequences is presented. Basically, the system applies edge detection technique for the face localization. The system localizes the human head through outline analysis of boundaries image, then focusing the attention on a specific area in the image. The system applies the same technique to the face recognition, with combination of neural networks. The system extracts the human facial from the color sequences images and simulates the human facial by using the neural networks. The simulation is based on the RGB color layer of images. Neural networks are used to build the database of the system for storing the facial images and the training data of target facial. The Rprop technique is used for the training process for the system. The system is able to detect the human face and able to recognize the face. The system would show the results of target been identified with percentages of matching and together with the image of the target. The system can perform well in recognizing the target and the percentage of matching is above 90%. Besides, the system also able to recognize the target when the target having some changes, example like target wearing hat, veil and etc. The proposed approach is using a direct input webcam video in real time based for the face detection and face recognition.

ABSTRAK

Pada pasaran hari ini, terdapat pelbagai jenis alarm sekuriti dan alarm- alarm tersebut hampir sama, di mana alarm sekuriti bersiren dengan CCTV record atau alarm sekuriti bersiren dengan katalaluan, ataupun kombinasi kedua-dua alarm tersebut. Dalam projek ini, sistem pengenalan rupa bentuk muka dan pegesahan wajah berdasarkan imej berwarna yang berturutan dibentangkan. Pada asasnya, sistem ini memperkenalkan teknik pengenalan bentuk untuk penempatan muka. Sistem ini mencari dan membuat pengenalan terhadap kepala manusia melalui penganalisis terhadap batas sempadan, kemudian pemfokusan terhadap satu kawasan khusus dalam imej. Sistem ini juga memperkenalkan teknik yang sama untuk pengesahan wajar, dengan gabungan bagi rangkaian neural. Sistem mengekstrak rupa muka daripada imej-imej berwarna yang berturutan dan mensimulasi rupa bentuk muka dengan rangkaian neural. Proses simulasi adalah berdasarkan tiga asas komponen, iaitu lapisan warna “RGB”. Kegunaan rangkaian neural adalah untuk membina pangkalan data untuk sistem ini supaya imej-imej muka dan data-data imej dapat disimpan. Teknik yang digunakan untuk melatih rangkaian neural adalah teknik Rprop. Sistem akan menunjukkan keputusan bagi kepadanan terhadap pengenalan dan pengesahan bentuk muka dalam peratusan dan juga akan mempamerkan gambar sasaran. Sistem ini menunjukkan prestasi yang bagus dalam pengenalan dan pengesahan rupa bentuk muka dengan peratusan padanan yang tinggi iaitu 90 peratus ke atas. Selian daripada itu, sistem ini berupaya mengenal dan mengesah sasaran walaupun sasaran berubah, seperti sasaran memakai topi, tudung dan sebagainya. Sistem ini dicadangkan untuk menggunakan kamera web sebagai input video untuk pengenalan dan pengesahan rupa bentuk muka secara langsung.

CHAPTER 1

INTRODUCTION

1.1 Introduction of Real Time Target Identification

Real time target identification is an active research topic lately, especially real time face detection and face recognition. This research has wide range of application which includes security authentication and monitoring. The proposed real time target identification for the security purpose system is a system which is able to detect the human face and capable for face recognition in real time using a webcam.

1.2 Real Time System

According to the Oxford dictionary, real time in computing system refer to the system which can receive continually changing data from outside sources, process this rapidly, and supply result that influence the sources [1]. Thus, the actual time that it takes for a process to occur and the information is updated in real time for a system. Real time system includes:

- i. Real time computing.
- ii. Real time in media.
- iii. Real time Java.
- iv. Real time business intelligence.

1.3 Face Detection

Face detection system locates the upper human body then the detection of facial feature from an image or frame. Face detection has drawn much attention because of its wide range of application in the computing system. The popular methods for face detection, which is using skin region face detection method [2]. This is the simple method and widely use by the researchers. The other method is using neural networks to locate the face [3]. The system will be trained by using the neural networks and the judgment will be supplied to the output depending on the trained result.

1.4 Face Recognition

Face recognition is to extract the human facial feature and able to do analyses for the purpose of recognition. Face recognition has drawn much attention to some researchers, because of its wide range of applications, especially for security purpose and medical field. Face recognition analysis can associate to the analysis of eyes, lips, eye brown, nose and ears. There are a lot of methods for face recognition, and the popular method is using neural network based. The system will be trained by neural network and the result of output will be processed according to the trained networks.

1.5 Neural Network

The term neural network had been used to refer the network of biological neurons. Neural network is involves with a simple processing elements (neuron),

which are connected together to form a network nodes. Neural Network's (NNs) practical use comes with algorithm designed to alter the strength (weights) of the connection in the network to produce a signal flow. In computer science, the term Neural Network (NNs), is refer to a group of neurons element that connected with each other to form a three layer of input layer, hidden layer and output layer which shown as figure 1.1. The input layer receives the information or data and then sends to the hidden layer. The hidden layer is the layer that calculates and makes a decision layer with a lot of mathematical equation. The output layer is connected to the output of the hidden layer, and will show the decision that make by the hidden layer [4].

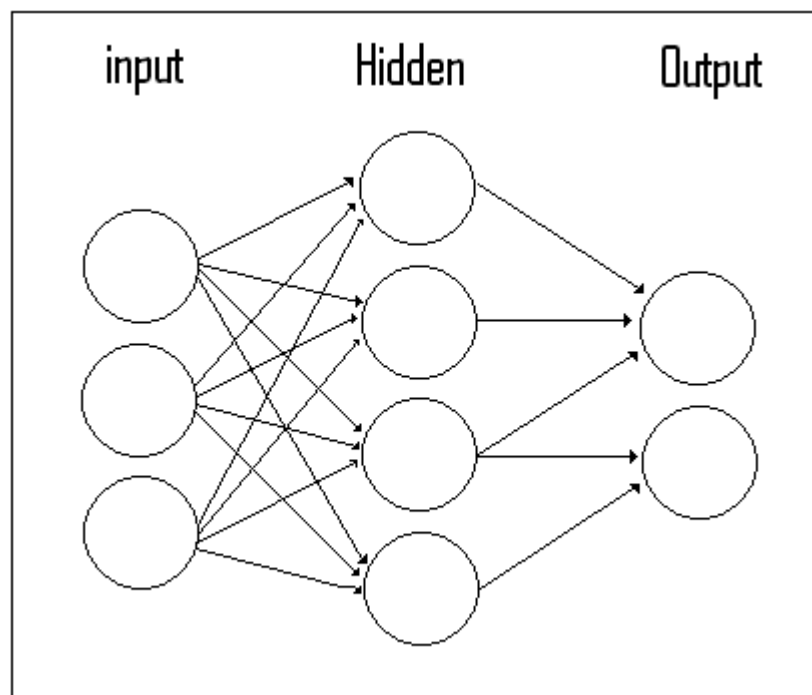


Figure 1.1: Neural Network Layout [modified from wikipedia].

1.6 History of Neural Network

Neural network simulation is a recent development. However this field was establish before the advent of computer. The history of NN shows below [5]:

- 1940s - McCulloch and Pitts proposed neuron models in the form binary threshold devices and stochastic algorithms.
- 1949 - Hebb introduced the concept of learning by reinforcement or association.
- 1959-1962 - Rosenblatt designed and developed the perceptron.
- 1965 - Nilsson summarized the state of the field of learning machines.
- 1969 - Minsky and Papert presented a discouraging analysis of the limitation of perceptron.
- 1984 - Simon dismissed the perceptron by published under the heading “Birth and Death of a Myth”.
- 1986 - Rumelhart, Hinton and Williams dealing with the development of new training algorithms for multilayer

perceptrons. The new method is called the generalized delta rule for learning by backpropagation.

Present - Further research still going to improve or extract the maximum performance of neural network.

1.7 Application of Neural Networks (NNS)

There are a lot of ANNs applications. It can be use in the biological process, in the computer sciences application, home security, control system and etc. Here are the some examples of the application for NN:

- i. Analysis, calculation, storing and comparing in biological process
- ii. Design and create a computer game
- iii. Animation, multimedia and virtual reality.
- iv. Home security alarm system with passwords
- v. Iris identification security system
- vi. Hand print analysis security system
- vii. Face detection and identification security system
- viii. Control, set and train the robot according to user desire.

1.8 Future of Neural Networks

Current NNs technologies will be vastly improved upon in the future. Everything from the simple character recognitions and face detection, then, to

prediction of stock market movements will become more advance due to researchers continually developed a new method of neural network. In future, NNs might develop in certain area as below:

- i. Robots that can feel, make own-decision, and think like human.
- ii. Stock markets prediction
- iii. Self-driving car
- iv. Self-diagnosis of medical problems using neural network
- v. More stronger fire-wall for all security system

1.9 Problem Statement

One of the real-world problems solving system which implement the ANN technology is the security system. Nowadays, the world is not secure anymore and the statistic shows increasing crime rates every year. There are a lot of security alarm systems in the markets and those security alarm systems are similar, which is either CCTV video record with alarm siren or security password system with siren, or the combination of both. Although there are lots of security alarm systems, the crime rates still increases. This is due to the weakness of the system. For example, the CCTV video system functions as a video recording security system alarm siren as a trigger. In addition, the CCTV video record system might have some distortion on the video pixel which cause by the surrounding environment and other noise distortion. Thus, real-time target identification system that implemented the neural network for the security alarm system is proposed to solve the problems.

1.10 Project Objective

The objectives of the project are:

1. To implement the real time system for target identification.
2. To implement edge detection for the moving target and face detection.
3. To identify human face by using backpropagation neural networks.
4. To train neural network by using Rprop technique.

1.11 Chapter Outline

Chapter 1 introduces an overview of real time system, face detection, face recognition, neural network, application and future of the neural networks, and the objectives of the project. Besides, it also explains the problem statement of this research and chapter outline of throughout this project.

Chapter 2 provides a summary of the studies or researches done in regarding to the project.

Chapter 3 explains the methodology of this project and shows the techniques of process and developing the algorithms by using edge detection and neural network via the software MATLAB.

Chapter 4 provides the results of the project and analysis of the results. It also evaluates the performance of the system based on the results.

Chapter 5 discusses the problems faced in this project. It also discusses the conclusion of the project regarding to the result obtained in chapter 4. It also gives suggestion to improve the project results for the future works.

CHAPTER 2

LITERATURE REVIEW

2.1 Digital Image Processing

Digital image may be defined as a two-dimensional function, $f(x,y)$, where x and y are spatial (plane) coordinates, and the amplitude of f at any pair of coordinates (x, y) is called intensity or gray level of the image at that point [6]. When x, y and the amplitude values of f are all finite, discrete quantities, it is called a digital image. Digital image processing refers to the process of analyzing the image using computers. Digital image processing was introduced in the early 1920s and has now become a very widely used tool in the medical field as well as for industrial inspection. Digital image processing has the same advantages over analog image processing as digital signal processing has over analog signal processing, it allows a much wider range of algorithms to be applied to the input data, and can avoid problems such as the build up of noise and signal distortion during processing.

2.1.1 Grayscale

In computing, a grayscale digital image is an image in which the value of each pixel is a single sample. Displayed images of this format are typically composed of shades of gray, varying from black at the weakest intensity to white at the strongest. Grayscale images are distinct from black and white images only.