AN APPLICATION OF RADIAL BASIS FUNCTION IN IDENTIFYING BANANA MATURITY LEVEL

NOOR ZARITH AQMAR BINTI MOHAMAD

This Report Is Submitted In Partial Fulfillment Of Requirements For The Degree of Bachelor In Electrical Engineering (Power Electronic and Drives).

Fakulti Kejuruteraan Elektrik
Universiti Teknikal Malaysia Melaka

MAY 2008

"I hereby declare that I have read this project and in my opinion this project is sufficient in terms of scope and quality for the Bachelor of Electrical Engineering (Power Electronic and Drives)"

Signature	:	……
Name of Supervisor	:	**ELIA ERWANI BINTI HASSAN**
Date	:	**7 MAY 2008**

"I hereby declare that this report is a result of my own except for the excerpts that have been cited clearly in the references".

Signature : ……

Name : **NOOR ZARITH AQMAR BINTI MOHAMAD**

Date : **7 MAY 2008**

ACKNOWLEDGEMENT

In the name of Allah S.W.T The Most Beneficient. The Most Merciful. It is with deepest sense of gratitude of the Almighty Allah who gave me strength and ability to complete this project.

I would like to express my deepest gratitude to my project supervisor, Mrs. Elia Erwani Hassan, for her dedication in guidance, advice and willingly gives her ideas and suggestion for completing my project.

Finally, this project is specially dedicated to my loving parents, lecturers and also to all my friends and many other who somehow or rather had helped me directly or indirectly in successful completion of my project and those who loves me.

ABSTRACT

This project approach the alternative way in identifying the banana maturity's level by using Radial Basis Function (RBF) network. Radial Basis Function is one of Artificial Neural Network (ANN) algorithm that used the application of function approximation. This approximation depends on several parameters such as input, target, spread and goal. As an input, an array of seven neurons will corresponds to the average, variance and standard deviation of banana maturity's level and four indicator related to each banana maturity's level. After went through the learning process the network able to give an accurate result during training phase. At the end, after doing testing phase the Radial Basis Function networks give better performance and best approximation in identifying banana maturity's level in order to overcome the conventional method.

ABSTRAK

Projek ini adalah cara altenatif bagi mengenal pasti tahap kematangan buah pisang dengan menggunakan rangkaian fungsi asas jejari. Fungsi asas jejari merupakan salah satu neural buatan yang menggunakan fungsi penghampiran. Penghampiran ini bergantung kepada parameter seperti masukan, sasaran, serakan dan matlamat. Array dari tujuh neuron yang merupakan purata, varian dan sisihan piawai bagi setiap biji pisang dan empat indikator yang releven bagi setiap tahap kematangan pisang dijadikan sebagai masukan. Setelah menempuhi proses pembelajaran (training), rangkaian tersebut berkebolehan memberi keputusan yang tepat semasa fasa latihan. Akhir sekali, setelah melakukan percubaan (testing), rangkaian fungsi asas jejari memberi prestasi lebih baik dan penghampiran terbaik dalam mengenal pasti tahap kematangan buah pisang dengan bertujuan mengatasi kaedah lazim.

TABLE OF CONTENTS

LIST OF TABLE

LIST OF FIGURE

LIST OF ABREVIATIONS

ANN	-	Artificial Neural Network
RBF	-	Radial Basis Function
HMLP	-	Hybrid Multi Layer Perceptron

LIST OF APPENDIXES

LIST OF EQUATIONS

CHAPTER I

INTRODUCTION

1.1 Objectives

The aim of this project was to identify banana maturity's level by using Radial Basis Function. The main objectives are :

- Identifying banana maturity's level By using Radial Basis Function
- Predict the banana maturity's level accurately
- Approach an alternative way in identify banana maturity's level

1.2 Scopes of Work

This project is software based, which is identifying banana maturity's level by using Radial Basis Function. The software that used to train and test data is MATLAB 7.0. The scope of this project also include training process and testing process of the data. The data is divided by two in each category which is 50 data for training process and other 50 data for testing process. In this project there are three inputs in this project which are mean, variance and standard deviation. Meanwhile, the outputs of this project are premature, unripe, ripe and overripe. All this matter will contain on the build up the software and at the end the user will able to predict the banana maturity's level accurately.

1.3 Background

1.3.1 Artificial Neural Network

An artificial neural network (ANN), often just called a "neural network" (NN), is a mathematical model or computational model based on biological neural networks. It consists of an interconnected group of artificial neurons and processes information using a connectionist approach to computation. In most cases an ANN is an adaptive system that changes its structure based on external or internal information that flows through the network during the learning phase.

In more practical terms neural networks are non-linear statistical data modeling tools. They can be used to model complex relationships between inputs and outputs or to find patterns in data.

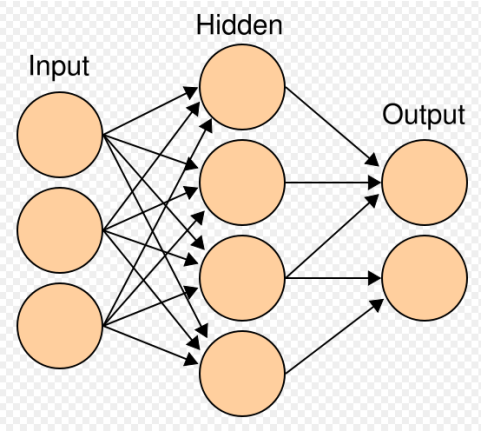


Figure 1.1 : An example artificial neural network with a hidden layer

1.3.2 The Radial Basis Function Algorithm

Radial Basis Functions are powerful techniques for interpolation in multidimensional space. A RBF is a function which has built into a distance criterion with respect to a centre. Radial basis functions have been applied in the area of neural networks where they may be used as a replacement for the sigmoidal hidden layer transfer characteristic in Multi-Layer Perceptrons. RBF networks have two layers of processing: In the first, input is mapped onto each RBF in the 'hidden' layer. The RBF chosen is usually a Gaussian.

In regression problems the output layer is then a linear combination of hidden layer values representing mean predicted output. The interpretation of this output layer value is the same as a regression model in statistics. In classification problems the output layer is typically a sigmoid function of a linear combination of hidden layer values, representing a posterior probability. Performance in both cases is often improved by shrinkage techniques, known as ridge regression in classical statistics and known to correspond to a prior belief in small parameter values (and therefore smooth output functions) in a Bayesian framework.

1.4 Case Study

Banana is the common name for a fruit and also the herbaceous plants of the genus *Musa* which produce the commonly eaten fruit. They are native to the tropical region of Southeast Asia and Australia. Bananas come in a variety of sizes and colors when ripe, including yellow, purple and red. Bananas can be eaten raw though some varieties are generally cooked first. Depending upon cultivar and ripeness, the flesh can vary in taste from starchy to sweet, and texture from firm to mushy. Unripe or green bananas and plantains are used for cooking various dishes such as banana pudding and are the staple starch of many tropical populations.

1.5 Motivation of Research

Usually people predict the banana maturity's level by press it or looking at the color of the skin. However those method cannot guarantee an accurate result. This project approach the alternative way in identifying the banana maturity's level by using Radial Basis Function (RBF) algorithm. The sensitivity of each structure of neural network in differentiate maturity level will analyze and compare the result. The data should be train convergence to the output that had been set before in order to get the best result while doing testing process. The implementation of the project will provide fast and risk-free way in identifying banana's maturity level. At the end of the project, neural network will give better performance in giving the optimum result.

CHAPTER II

LITERATURE REVIEW

2.1 Introduction

This project will focus on application of Artificial Neural Network to solve pattern recognition (classification) problem. A set of banana's maturity level is chosen in a case of classification problem. The following studies were reviewed to gain an idea in doing this thesis.

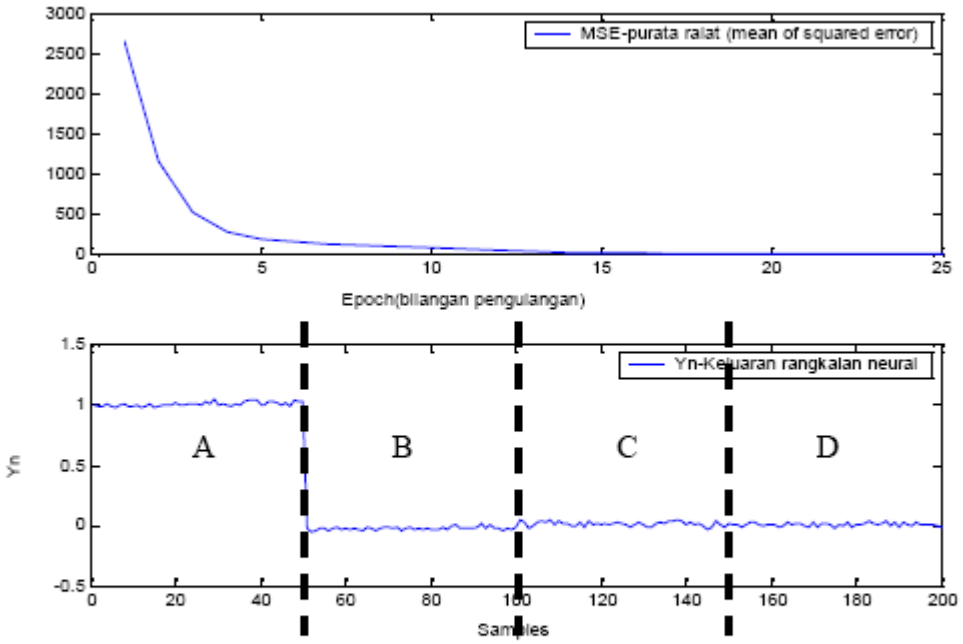
2.2 Study of Similar System

2.2.1 A Prediction and Differentiating on Banana's Maturity Level Using Helical Antenna Neural Network by Sahazati Md Rozali, USM (2003)

In this project, an alternative approach of using helical antenna and neural networks is proposed. This project is a continuation of previous project involving the determination of the most suitable network for this application. It involved two parts, the hardware and software development. Two helical antennas were used, one as a transmitter and the other one as a receiver. Four maturity level of bananas and three neural networks models were tested for this application. The early part of the project involved the process of collecting electromagnetic wave strength data which was transmitted through bananas using HP VEE software. Three neural networks architecture were tested; Multilayer Perceptron (MLP), Hybrid Multilayer Perceptron (HMLP) and Local Output Locally Recurrent Global Feed Forward (LOLRGF) with Recursive Prediction Error Algorithm (RPE) which were developed using

MATLAB. The result obtained indicated that the Hybrid Multilayer Perceptron (HMLP) is the best and suitable network that can detect banana's maturity levels.

An error between target and desired value for HMLP give a minimum value compared with MLP and LOLRGF by referring figure 2.1.



y1