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LAMBDA-MAX NEURO-FUZZY SYSTEM

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AUTHOR'S DECLARATION

I declare that the work in this thesis was carried out in accordance with the regulations of Universiti Teknologi MARA. It is original and is the result of my own work, unless otherwise indicated or acknowledged as referred work. This thesis has not been submitted to any other academic institution or non-academic institution for any degree or qualification.

I, hereby, acknowledge that I have been supplied with the Academic Rules and Regulations for Post Graduate, Universiti Teknologi MARA, regulating the conduct of my study and research.

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ABSTRACT

Accurate predictive modelling is highly essential and ANFIS has successfully been used as forecasting tool in various fields. ANFIS is made up of a multilayer feed-forward network that comprises of two important elements in soft computing namely the neural network learning algorithm and fuzzy reasoning which provides smoothness in data processing. However, the weight determined by the first three layers of ANFIS causes inconsistencies in coefficient signs with underlying monotonic relations thus making it impossible to represent known monotonic relations. Hence the objective of this research is to find an alternative method among the AHP techniques of determining the weights to be supplied to the back-propagation layers of ANFIS. Lambda-Max technique has been identified to be the most suitable weight determination technique due to its simple calculation and precision of weights obtained. The newly developed Lambda-Max ANFIS is then used to predict the physical properties of degradable plastics using real life data obtained from the laboratory of the Malaysian Palm Oil Board (MPOB). Bootstrapping resampling technique was applied to the data and consistency index measurement was carried out to ensure the suitability of the data prior to the model development. The system is capable to identify the most suitable input predictor sets based on the values of Root Mean Square Error (RMSE), R and R^2. The prediction ability of the Lambda-Max ANFIS is compared to the prediction accuracy of the conventional ANFIS. Both the Lambda-Max and conventional ANFIS were found to exhibit significantly similar high prediction accuracies. Predicted output of Lambda-Max ANFIS was also compared to the output of MPOB laboratories. The results show that Lambda-Max gives highly similar prediction output with the actual laboratory output. On top of that, Lambda-Max outputs are highly consistent for any given input combination. Hence, the developed Lambda-Max ANFIS can be used for forecasting purposes with high prediction accuracy and the system can be used as an alternative to laboratory prediction on the physical properties of degradable plastics. Hence it will save time and cost.

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CHAPTER ONE
INTRODUCTION

1.1 INTRODUCTION

Predictive analysis is the process of selecting, exploring, analyzing, and modeling data to create better business outcomes. Successful predictive analysis considers where data is located, the condition of the data, and how accessible it is. It is very beneficial to industries to forecast the future outcomes for certain problems. It has helped organizations to create new strategies to enhance the upcoming outputs. Apart from that, it also helped organizations in decision making problems based on the weights obtained by the systems (Adam, 2008).

Advance in financial markets and other fields have needed the improvements in the methods so that the non-linear problems can be formulated too. Thus, the developments in soft computing studies have discriminated the existing quantitative methods that were only used for linear regression (Lahsasna et. al, 2008). These soft computing systems include neural network computing, fuzzy logic computing, and evolutionary computing (Zadeh, 1994).

Soft computing systems had been used for estimating the outcome in the linear as well as non-linear problems. It can be used as a single method or as combination of two or more soft computing methods. Combinations of the elements are named hybrid soft computing.

One example of hybrid soft computing is Adaptive Neuro-Fuzzy Inference System (ANFIS). It was introduced by Jang in 1993. ANFIS learns from the given input data to get the membership function parameters. ANFIS studies from the data obtained from past experiments and foresee the future (Bonissone, 1997). It is usually used for getting a model that can predict the upcoming outputs for forecasting problems. ANFIS is made of a multilayer feed-forward network that comprises two important elements in soft computing namely the neural network learning algorithm and fuzzy reasoning. The combination of these two elements provides smoothness in data processing, due to the fuzzy control interpolation and also adaptability in determining the final rules of the system, due to the neural networks back-propagation.