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Program and Abstract Book

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PROGRAM AND ABSTRACT BOOK

predictor. The entropy-based method with iterative process are attempted on each member attribute and the concept of rough sets theory is presented in the approximation space boundaries of a set of knowledge to such subsets for finding best performance of classifier. Finally, a resolving method is used to combine partial selective attributes to obtain useful rules to improve the accuracy of misclassification and extract missing information about particular instance attribute values. We utilize only known values to construct more effective decision tree.

OD10 Euclidean TSP is P

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Abstract

The TSP (Traveling Salesman Problem) naturally arises as a subproblem in many transportation and logistical applications. The traveling salesman problem (TSP) has caught much attention of mathematicians and computer scientists specifically because it is easy to describe but difficult to solve. This paper will describe a novel technique in approaching Euclidean TSP. The aim of this technique is to reduce the total exponential number of routes in Euclidean TSP into a polynomial number of routes by a series of filters. The filters shall divide the graph into subgraphs and form clusters. The difficulty of the Euclidean TSP lies mostly in combining the clusters to form global solution to the TSP. The challenge is to come out with a standard algorithm that will always produce the optimal tour or near optimal tour. The remaining question is whether there is still hard Euclidean TSP that can escape the heuristic power of such algorithm.

Keywords: *Traveling Salesman Problem*

OD11 A Hybrid Forecasting Model For Malaysian Exports Natural Rubber-based Products

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Abstract

Natural rubber is one of the most important crops in Malaysia. Malaysia is the third largest producer of rubber in the world after Thailand and Indonesia. As Malaysia's economic shifted from primary industries to manufacturing, Malaysia becomes one of the world biggest exporters of natural rubber-based products (NRP) such as gloves, catheters and latex threads. One of the major goals of agricultural policy in Malaysia is to increase foreign exchange earning through increasing exports of natural rubber-based products. However, fluctuation in the export earning will lead to the unclina@fsksm.utm.my.

ertainty in the level of foreign exchange earning. For example, in 2003, 2004 and 2005 the rubber product industry contributed RM 6.07, RM 7.88 and RM8.03 billion respectively to the country export earnings. Therefore, the aim of this study is to propose a hybrid forecasting model to predict the export earning for natural rubber based product. This hybrid model will consist of linear (linear regression) and nonlinear model (artificial Neural Network) and consider several factors that affect the export earnings such as the production of natural rubber-based product, the price of natural rubber and the price of synthetic rubber. To benchmark the result produced by the propose model, comparison with traditional techniques (Multiple Regression) will be conducted.

Keywords: *Natural rubber-based products, forecasting, Linear Regression, Multiple Regression, Artificial Neural Network*

A Hybrid Forecasting Model For Malaysian Exports Earning of Natural Rubber-based Products

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Keywords: Natural rubber-based products, forecasting, Linear Regression, Multiple Regression, Artificial Neural Network

1.0 Introduction

Even though Malaysia's has planned to be industrial country in year 2020, the agricultural sector still remains one of the most important contributors to Malaysian economy. Natural rubber is an important agricultural commodity in Malaysia. It was planted in Malaysia for more than three decades. Besides natural rubber, Malaysia also depends on other agricultural commodities such as palm oil, paddy, coconut, cocoa, pepper, tobacco and pineapple.

Today, Malaysia is the third largest rubber producer in the world and the fifth largest consumer of rubber, and among one of the world's largest exporter of rubber products. There are more than 344 companies that are actively involved in rubber product industry. Latex products such as household goods, gloves, tyres, footwear and foam products are some of the rubber products produced in Malaysia. The sector employs more than 54,000 workers and contributes RM6.7 million to the Malaysian export earnings. In 2004, NR production had increased by 19.2% in 2004. [Annual Reports, MRB, 2003]

Malaysian government set up Malaysia Rubber Board (MRB) to oversee the development of rubber industry in Malaysia. It was founded on 1st January 1988. It has three agencies under its supervision; Rubber Research Institute of Malaysia, Malaysia Rubber Research and Development Board, and Malaysia Rubber Exchange Board. The main task of MRB is to assist in the development and modernization of the Malaysian rubber industry. It covers all aspects of works related to rubber such as cultivation of the rubber tree, the extraction and processing of latex, the manufacturing of rubber products and the marketing of rubber and rubber products.

2.0 Why need to forecast export earning of natural Rubber based products?

Besides being a major natural rubber producer, Malaysia is also a major exporter of rubber products. Malaysia is also the world's leading producer and exporter of rubber-based downstream products like gloves, threads and catheters. More than 190 countries imported rubber-based products from Malaysia (RM4.51bil worth) in 2001. United States

followed by Britain and Japan is the major buyers for Malaysia NR products. Malaysia is currently ranked as the world's primary producer of rubber-based products, with control of 60% of the global rubber-glove market. Rubber-based downstream products are divided into two major categories: latex goods and industrial rubber goods. Latex goods include footwear, rubber gloves, latex thread, lifejackets, sealants, and catheters. Industrial rubber goods include tires, rubber gaskets, hoses, mats, tubes, mountings, rubber bearings, wipers and mud flaps.

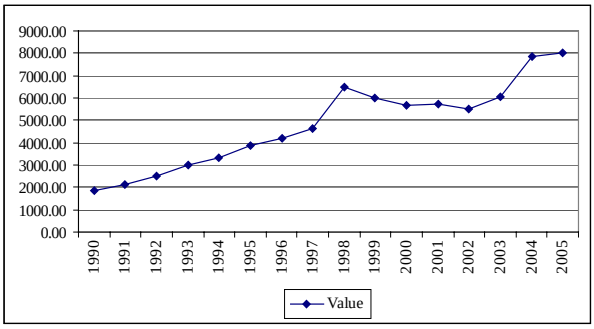

Figure 1: Total amount of Export Earning for NR based products (in million)

One of the major goals of agricultural policy in Malaysia is to increase foreign exchange earning through increasing exports of natural rubber-based products. However, as we can perceive in **Figure 1**, there is variation in income earning of NR product export. Consequently it will lead to the uncertainty in the level of foreign exchange earning and will affect the Malaysia income based on NR products. Therefore an accurate forecast model is needed in order to assist MRB to make appropriate plan as to avoid losing income in exports earning of natural rubber-based products.

Due to that, several techniques such as nonlinear model [Hamid and Iqbal, 2004] and combine techniques [Wang, 2003, Hong and Lee, 2005] have been proposed in order to get the most realistic and accurate prediction from the forecasting model. In this study, we attempt to use combine techniques such as hybrid model to forecast export earning of NR products. Therefore, two different individual model were used namely as multiple regression (MR) and artificial neural network (ANN). Combine techniques have been applied in many fields but so far not have been used in forecasting natural rubber product.

3.0 Data Used in Study

To facilitate our study, annual export earning data for natural rubber product from 1990 to 2005 were used and analyzed. Data from 1990 to 2003 were used in developing model, while data from 2003 to 2005 were used to validate the model. In this study, we also considered several factors, which might influence the total amount of the export earning for NR products. They are natural rubber products such as tyre, inner tube, footwear, latex product, and rubber good. Others factors are natural rubber price (SMR), synthetic rubber price (SBR), the number of employment, natural rubber product and natural rubber consumption

4.0 Methodology

This paper proposes a hybrid model to forecast NR export products earning. It consists of two individual models. They are multiple regression (MR) and Artificial Neural Network (ANN). The multiple regression equation is employed to model the relationship between independent variable (affecting factors which were denoted by $x_1, x_2, \ldots$) and dependent variable (export earning which was denoted by Y) to forecast the export earning of NR products. Meanwhile, ANN is employed to forecast the residual produced by MR model. Then we integrated both forecasting values to get the final forecast for the export earning of NR products.

4.1 Multiple Regression Model

From ten independent variables used in this study, only four independent variables were selected for modeling natural rubber export products. They are tyre, footwear, latex product and rubber good. Each of them is denoted by x_1, x_2, x_3 and x_4. These four variables were selected based on the p-value and t-value. If the p values is less then 0.05 and t-value is greater than 1, the variable was considered as significant and must be include in the equation. Hence, the propose multiple regression model to forecast the export earning of natural rubber products (denoted by Y) is

$$
\begin{aligned}
Y &= a + b_1 x_1 + b_2 x_2 + b_3 x_3 + b_4 x_4 + e \\
&= 11.3 + 1.06 x_1 + 1.01 x_2 + x_3 \\
&\quad + 0.92 x_4 + e
\end{aligned}
$$

Where, e is the error.

Based on the adjusted coefficient of determination, r^2 =0.9998, we can conclude that our model is significant enough and acceptable because it can explain 99% variation in Y.

4.2 Artificial Neural Networks (ANN)

Despite the many desirable features of ANN, constructing a good network for a particular application is a non-trivial task. It involves choosing an appropriate architecture (the number of layers, the number of units in each layer, and the connections among units), selecting transfer function of the middle and output units, designing a training algorithm, choosing initial weights and specifying the stopping criteria. It is widely accepted that a three layer feedforward network with an identity transfer function in output unit and logistic functions in the middle layer units (White, 1989). Hence, in this study, we used a single hidden layer feedforward network, which is the most widely used neural network for forecasting (Zhang, Patuwo, & Hu,1998).

Others parameters such as the number of input and hidden nodes, learning parameters (learning rate and momentum) were determined by trial and error. The final structures of ANN model used in this study were shown as in **Table 1.**

Table 1. ANN structures

Number of input nodes =2 Number of output nodes =1 Number of hidden nodes =2
Learning algorithm = back propagation
Learning rate =0.5, Momentum =0.9
Transfer function Identity Function: output layer Logistic function: hidden layer
Stopping criteria = 0.005

Two input nodes are use to represent the two lags of residual and one output node is use to represent the one-step ahead forecast residual. The size of hidden unit is initially set as equal to the sum of input nodes and output nodes divided by two. If the network fails to converge to a solution, it may be that more hidden nodes are required. If it converges, the number of hidden nodes can be reduced to achieve an optimal system performance.

The overall computing process involves several steps. First, scale the given data, evaluates the outputs, sum up the RMSE, and then transform the output value back to the original scale. During the training state, the ANN model was provided with a training data set, containing all input values as well as the desired output values. The best model was chosen based on the minimum value of RMSE. Then this model is used to forecast the next residual value.

4.3 Hybrid model

In order to obtain final forecasting value for export earning of NR products, output from MR model and ANN are integrated. Next this value will be compared with the forecasting value given by individual model (Multiple regression) in order to validate the accuracy performance of our proposed model. The accuracy measurement used in this study is Root Mean Square error (RMSE), Mean absolute error (MAE) and relative mean absolute error (RMAE). The formulas for RMSE, MAE and RMAE are shown below.

$$RMSE = \sqrt{\frac{1}{n}\sum_{i=1}^{n}(P_i - T_i)}$$

$$MAE = \frac{1}{n}\sum_{i=1}^{n}\left|P_i - T_i\right|$$

and

$$RMAE = \frac{1}{n}\sum_{i=1}^{n}\left|\frac{P_i - T_i}{T_i}\right|$$

where

n = sample size

P_i = predicted value and T_i = target value.

5.0 Results

Table 2 shows the result from the experiment. Column 2, column 3 and column 4 are used to represent the export earning of NR

products for actual value, forecasted value produced by MR and forecasted value from hybrid model. From the Table 2, we observed that the RMSE, MAE and RMAE produced by hybrid model were lower than individual model.

Table 2: Comparative result

Year	Actual total amount export Earning (in million)	Hybrid Model (MR + ANN) (in million)	Individual Model (MR) (in million)
2004	7876.61	7890.44	7890.56
2005	8031	8044.21	8024.55
	RMSE	10.04	10.86
	MAE	8.52	10.20
	RMAE	0.0011	0.0013

Therefore we can conclude that the forecasting performance of individual model can be improved by hybridizing two different individual methods.

6.0 Conclusion

In this study, we propose a hybrid model for forecasting export earning for NR products. Then the comparative performance between proposed model and naïve individual model (multiple regression) is conducted. Based on the lower comparatively prediction errors achieve, both individual and hybrid model can be used as forecasting model to predict export earning of NR products. But the forecasting performance given by hybrid model is better than MR model. Therefore, to obtain more accurate and reliable forecasting value, instead of using individual model, hybrid model is recommended as a tool in forecasting export earning for Malaysia's Natural Rubber- based products.

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