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FORECASTING OF PDRB IN JEMBER, EAST JAVA USING LEVENBERG MARQUARDT METHOD

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ABSTRACT

Forecasting of Product Domestic Regional Bruto (PDRB) in Jember has been developed to successful in consistently predicting the performance of the Domestic Government. The complex set of problem processes within PDRB have made the development of analytical models to be a significant challenge. Advanced simulation tools are needed to become more accurately model of PDRB systems. As an alternative approach, we have begun development of PDRB modeling based on Levenberg Marquardt which uses Matlab 7.6.0(R2008b). A neural network based learning system method has been proposed forecasting of PDRB. Levenberg Marquardt based technique is used for learning PDRB. Thus a precision model of Levenberg Marquardt has been evaluated. The correlation coefficient of this model is 0.99 shows good results for the target and network output.

Keywords: forecasting, levenberg marquardt, learning, neural network

INTRODUCTION

The economic developments in Jember seen by rising incomes in the agricultural sector in line with the arrival of the harvest season in March-April. Weather conditions characterized by low rainfall supports the achievement of yields in the agricultural sector. Activity increased consumption coincides with school holidays, the new school year and preparation for the fasting (Central Bank of Indonesian Republic, 2011). Economically, a high resource potential is not yet provide support for PDRB. In order to determine the policy is necessary to do some activities that support, among others: a survey mapping the PDRB, problems and obstacles encountered in the development and estimation of PDRB.

The estimation of modeling is a key point of development successfully (Kaloko, 2011). Modeling estimation using RBF method provides accuracy 0.99977. The estimation modeling using BPN method has errors of 0.00045 percent (Kaloko, 2011).

The modeling forecasting of PDRB should be developed to get the policy model right. In this paper we propose a new estimation model with a neural network using Levenberg Marquardt method.

METHOD

Mathematical Laboratory (Matlab) version R2008b (developed by Math Works, Natick, Massachusetts) was employed to perform the simulation procedures and development of mathematical computing. All computational simulations were performed on a Window machine with Intel Dual Core 2GHz as the processors and 1 GB of RAM.

OVERVIEW OF LEVENBERG MARQUARDT

Levenberg Marquardt algorithm was designed by using the second derivative approach without having to calculate the Hessian matrix. If the feedforward neural networks using sum of squares performance function, then the Hessian matrix can be approximated as (Kusumadewi, 2004):

$$H = J'*J \tag{1}$$

and the gradient can be calculated as:

$$gW = J'*e \tag{2}$$

with J is Jabobian matrix that contains first derivatives of network errors on the weights, and e is a vector that contains the network error. Jacobian matrix can be calculated with the standard backpropagation technique which is of course much simpler. Levenberg Marquardt algorithm using the approach to compute the Hessian matrix by improving Newton's method:

$$W_{k+1} = W_k - [J'*J + \mu * 1]^{-1} * J'*e \tag{3}$$

If μ is 0, then this approach will be the same as Newton's method. However, if μ is too large, then this approach would be similar to gradient descent with learning rate is very small. Newton's method is very fast and accurate to obtain the minimum error, therefore the algorithm is expected to soon be able to change the value of μ becomes equal to 0. For that after several iterations, the algorithm will reduce the value of μ, the increase of μ in value if it takes a step to reduce the function of performance. The ANN architecture used as a model of PDRB is shown in Figure 1.

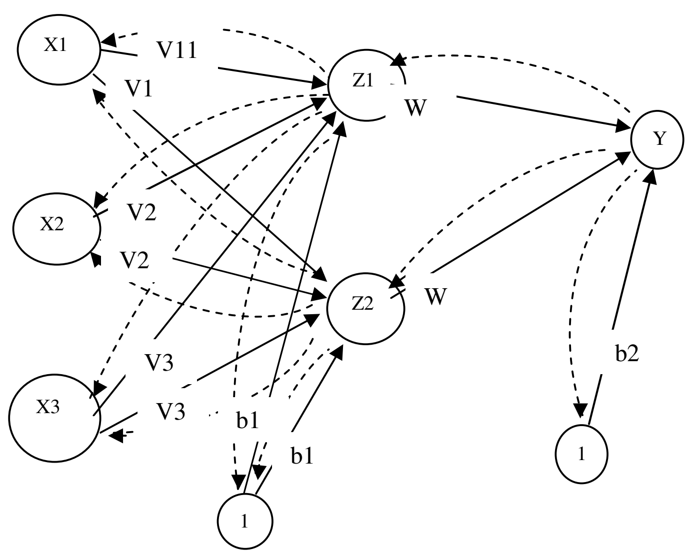

Figure. 1. ANN architecture used to model of PDRB.

RESULT AND DISCUSSION

Training neural network is essentially a non linear least squares problem, and thus can be solved by a class of non linear least squares algorithms. Among them, the Levenberg Marquardt is a trust region based method with hyper spherical trust region. This method work extremely well in practice, and is considered the most efficient algorithm for training median sized artificial neural networks. Like Quasi Newton methods, the Levenberg Marquardt algorithm was designed to approach second order training speed with out having to compute Hessian matrix (Burney et al, 2005).

The Levenberg Marquardt coefficient initialize of PDRB is required with error term ΔE. Product Domestic Regional Bruto is very high noise, and significant non stationarity. Here, we consider the prediction of the direction of change in the PDRB for the next. A number of researchers have applied neural network technology to exchange rates prediction. This is for the very first time that ANN

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technique of forecasting is applied at PDRB. The data set used has been taken from PDRB of Jember. We have taken four data points for training of neural networks.

There are a number of available training algorithms that can be used with back propagation method, but Levenberg Marquardt has proven results specifically to a sum of squares error function for financial forecasts of share rate forecasting. The comparison ability of the different approaches is usually problem dependent. Basic principles of simple back propagation algorithm is to improve the weights of the network with the direction that makes the performance function to be falling rapidly. In incremental mode, the gradient calculation and repairs performed at each operating weight of the input data. This function will use the network object, a collection of input data as input and target training, and will produce well trained network objects, network output, errors that occur weights final as the output value. The PDRB of Jember can see at table 1.

Table 1. The PDRB of Jember.

Year	*GDRB(Billion Rp)*	*Output model [kg]*	*Error(%)*
2006	8706	8774	-0.78
2007	9226	9204	0.23
2008	9783	9835	-0.53
2009	10323	10393	-0.19

Initial plot is shown in Figure 2, a number of data are carried out for validation of proposed method. In each initial data learning is given the perturbation to test the effectiveness of algorithm. The network output and target for the data were analyzed with linear regression. The linear regression for the target and network output in this model is shown in Figure 3. The equation for best fit in this model is:

$$Y = 0.99T + 1.5e^2$$

where *Y*: output network, *T*:target.

The correlation coefficient of this model is 0.99, shows good results for the target and network output.

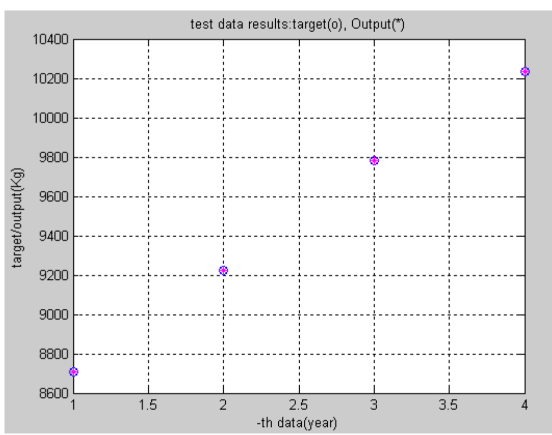

Figure 2. ANN comparison to actual data

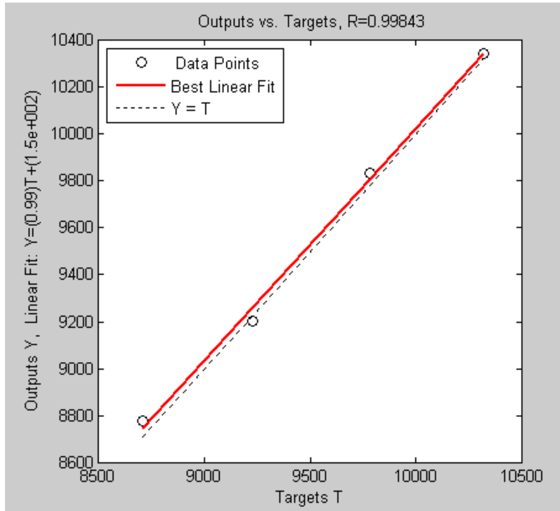

Figure 3. The linear regression for the target and network output

The network performance value along with each epoch is presented in the figure 4. We set the network performance measurement goal at 1E-03. Generalization performance is reasonable, indicating confidence in the training results and produced fairly accurate forecasts.

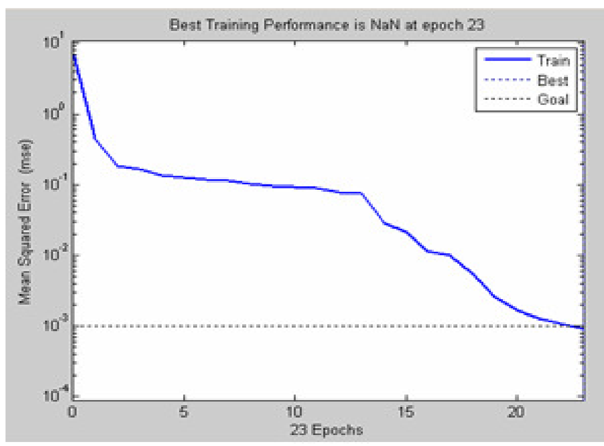

Figure 4. The network performance of this model.

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