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DEVELOPMENT OF FORECASTING MODEL OF FASHION SALES BASED ON BACK PROPAGATION NEURAL NETWORK AND CORRELATION ANALYSIS

[1]СЮЭВЭЙ ЦЗЯН (Xuewei Jiang), [2]КУЗЬМИЧЕВ В.Е. (Kuzmichev Victor), профессор,
ТЯНЬТЯНЬ [1]ЧЭН (Tiantian Cheng), мастер

[1]School of Fashion, Wuhan Textile University, Hubei, China

[2]Ivanovo State Polytechnic University, Russia

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Abstract. The result of operational decisions of fashion should be evaluated accuracy. In order to forecast accuracy, an improved forecasting algorithm, which combines correlation analysis, artificial neural network and the other computation skills, is proposed in this paper. The analysis of practical situations indicates that this improved algorithm can generate reasonably good forecasting quickly under the condition of limited data. We have compared our method with back propagation neural network combined with genetic algorithm. The result shown that our developed method can forecast the fashion sales with better results.

Fashion retailing is an industrial practice widely applied in modern garment marketing [1]. The new designs have to capture the latest fashion trend that the market most prefers. Since the period of fashion retailing is very short, the prophase useful information is limited, the accuracy and speed of fashion forecasting are critical.

The grey method is considered as a good instrument for forecasting without sufficient historical data and has been used to establish forecasting scheme [2]. But sometimes it was also relatively unreliable [3]. The grey method will be poorly performed when the prophase information has no obvious trend. Method based on artificial neural network is one of the very effective methods for forecasting of sales [4]. The different models based on an artificial neural network and its improvement variants have been constructed to predict the saleroom in the last few years [5-7]. Choi and Luo have proposed more suitable forecasting model respectively combined the extreme learning machine and the grey model and the genetic algorithm with artificial neural network in 2014 [8-9]. However, our work shown that the latest model has not outstanding performance when the number of arguments is too small, for example from 3 to 5 weeks. The aim of this paper is to improve the accuracy and computation speed of fashion forecasting by using the artificial neural network algorithm belonging to artificial intelligence field based on correlation analysis.

The sales dataset of 12 weeks have been collected. The arguments including the clothing retail price, seasonal index and cyclical index, the saleroom were set as output vectors and all data have been normalized by equation (1).

$$x_i = 2 \times (x_i - x_{min})/(x_{max} - x_{min}) - 1 \quad (1)$$

where x_i is every week data similar to input vector or output one, x_{min} and x_{max} are the minimum or maximum values of vector x respectively.

Due to the steepest descent searching is used in the training of neural network, the tradition back propagation neural network may fall into local minimum, over-fitting, and weak normalization capability. The model based on genetic algorithm uses the genetic algorithm to select optimization variables to avoid these disadvantages. This method is very useful to dataset with a large number of input variables, such as more than 40 weeks.

In order to obtain the optimization variables, the bivariate correlations between the input variables and the output vectors are calculated by equation (2). The arguments of clothing retail price, seasonal index and cyclical index should be selected by the step of optimization variables in fig. 1, eligible argument can be set as input variables. In this work, the saleroom belongs to output vectors. Then the Back Propagation neural network, which including input layer, two hide layers with 7 neurons and output layer, is used to predict the value.

$$r_{xy} = \frac{\sum(x_i-\bar{x})(y_i-\bar{y})}{\sqrt{\sum(x_i-\bar{x})^2}\sqrt{\sum(y_i-y)^2}}, \quad (2)$$

where x_i and y_i are every week data, x is the arguments such as clothing retail price, seasonal index and cyclical index, y is output vector.

If the correlation coefficient corresponding to one variable is larger than the threshold value 0.4 and has significant correlation that the significant level is less than 0.05, this variable can be set as an optimization variable. This process can also avoid the disadvantages as the same as the genetic algorithm. Because the computation of correlation coefficient is accurate and fast than genetic algorithm, figure 1 shown the model of improved neural network.

For the sequence of $\{X_i\}$, the historical data is X_1 to X_n, and the X_{n+1} can be predicted by the formula (3). The function f derive from the training of neural network with the historical data.

$$X_{n+1} = f(X_1, X_2, \cdots, X_n), \quad (3)$$

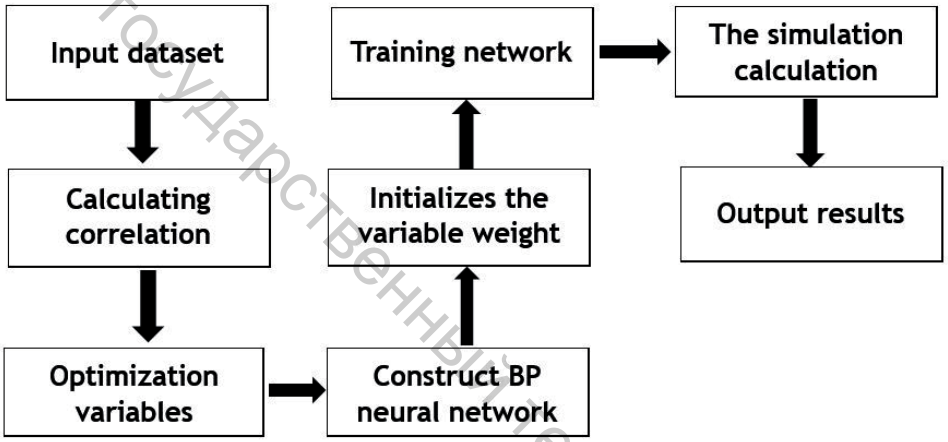

Figure 1 – The model of improved artificial neural network

The dataset of previous 11 weeks were set as training data and the latest one was used to test accuracy of the model. The back propagation neural network is used to forecast the saleroom. Figure 2(A) shown the relative error of predicted value in black line. The red line describes the model based on genetic algorithm. The relative error of testing are 11.7 % for the former and 10.8 % for the latter respectively. We have output the optimized arguments after genetic algorithm. The optimized arguments are clothing retail price, seasonal index and cyclical index still. This is the reason of the relative error has no great decreased. That is to say, this model is not suit to the sale forecasting with a small number of historical data.

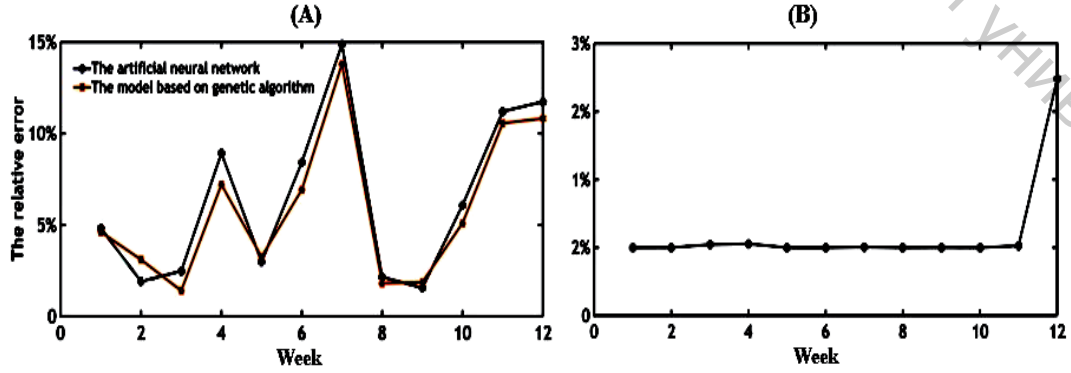

Figure 2 – The relative error between predicted and real value of different model

In the first stage of our development algorithm, the correlation coefficients has been computed. The correlation coefficient between the seasonal index and saleroom was 0.956 and has significant correlation on 0.01 level. This variable is set as optimization input variable according to the improved

model. The correlation coefficient between the clothing retail price and the cyclical index were less than 0.4, so these variables cannot be considered as input arguments. Only seasonal index is set as input variable in the following training and simulation. The relative error of testing data is 2.4 % that is much smaller than two previous models and the effect of the training is also very good. This result indicates that improved back propagation neural network is a better choice for sales forecasting.

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МЕТОДИЧЕСКИЙ ИНСТРУМЕНТАРИЙ ИНТЕГРАЛЬНОЙ ОЦЕНКИ РЫНКА ТРУДА СЕЛЬСКИХ ТЕРРИТОРИЙ УКРАИНЫ НА ОСНОВЕ МЕТОДА АНАЛИЗА ИЕРАРХИЙ

ТЕРОН И.В., ведущий научный сотрудник

Институт демографии и социальных исследований им. М.В. Птухи Национальной академии наук Украины, г. Киев, Украина

Ключевые слова: рынок труда, сельские поселения, метод анализа иерархий.

Реферат: представлена методическая схема интегральной оценки состояния рынка труда сельских территорий регионов Украины, с использованием метода анализа иерархий Саати. Адаптация данной методики определила ранг и «стартовый» уровень регионов в условиях евроинтеграции в 2014 г.

Определение методических основ интегральной оценки рынка труда сельских территорий позволяет адекватно оценить и выявить региональную специфику и возможности эффективной модернизации в условиях интеграционных процессов страны. Их учет «работает» как на повышение уровня обоснованности программ реформ и сокращения диспропорций и асимметрий социально-трудовой сферы регионов, т.е. на рост конкурентоспособности экономики, так и на и снижение социальной напряженности в регионах и формирование продуктивного социального капитала, а значит, обеспечивает общественную поддержку государственной экономической политики.

Методическая схема расчета рынке труда сельских территорий определяет: экономические возможности развития СТС в регионах страны; основные критерии и индикаторы их оценки; систему обоснованных методов оценки, которая включает следующие этапы.

1. Формирование системы оценочных индикаторов;