FORECASTING OF NATURALGAS CONSUMPTION USING GREY-ANN HYBRID METHOD

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Overview

As world's energy issue was raised, demand management has emerged as an important consideration (Gillingham et al., 2009). In addition, global gas demand has increased on average by 2.7% per year since 2000 and this is faster than oil (IEA, 2014). Therefore, forecasting gas consumption would lead to an efficient use of gas in demand management. Moreover, this helps minimizing air pollution and environmental problem (Hamzacebi and Es, 2014). In this study, we use a Grey-ANN hybrid method for gas consumption forecast. Many previous studies using ANN or Gery method make an effort to improve the predicted accuracy, but we have a simple method here. we gained an idea from Grey method, that is AGO(Accumulated Generating Operation). AGO can offset impact of shock in time series data like weather, oil price shock etc. We estimated the predicted AGO using ANN and convert into the predicted value of gas consumption. This model is expected to improve the predicted accuracy than ANN and normal Grey model.

Methods

In this study, we introduced Grey-ANN hybrid method to predict gas consumption. First, monthly gas consumption data of Korea from January 1997 to June 2014 is converted AGO. Second, using this AGO data, forecaste a gas consumption AGO data by backpropergation ANN and finally convert forecasted AGO into gas consumption again. This is simplely and powerful method to get on the predicted accuracy.

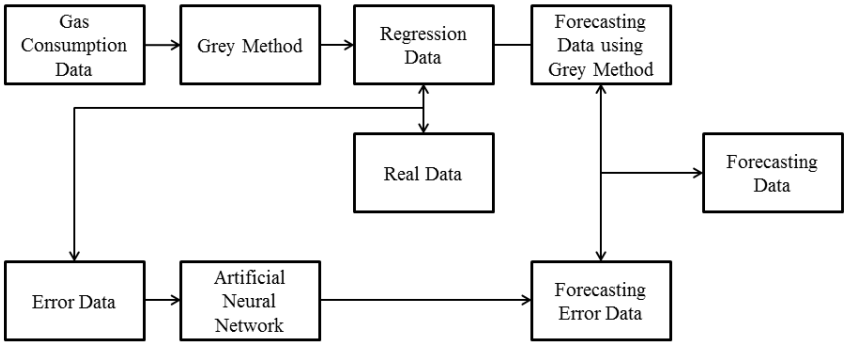

Figure 1. Process of Grey-ANN hybrid method

Results

We compared the model prediction accuracy between residual Grey method and Grey-ANN hybrid method. As a result, the MAPE and RMSE were calculated lower in Grey-ANN hybrid method and was improved prediction accuracy. Fig.2 shows the regression result of Grey method, Fig.3 shows the predictive value of error term calculated by ANN, and Fig.4 shows the predicted value of gas consumption for 10 months of the two methods.

Table 1. RMSE and MAPE of predicted result

	Residual Grey method	Grey-ANN hybrid method
RMSE	331.2597	252.0437
MAPE	15.0813	11.1308

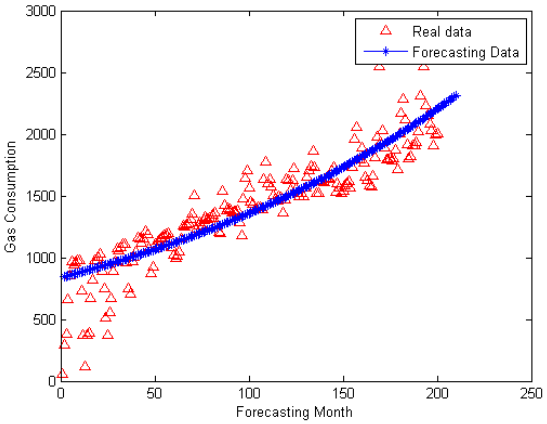

Figure 2. Result of Grey method

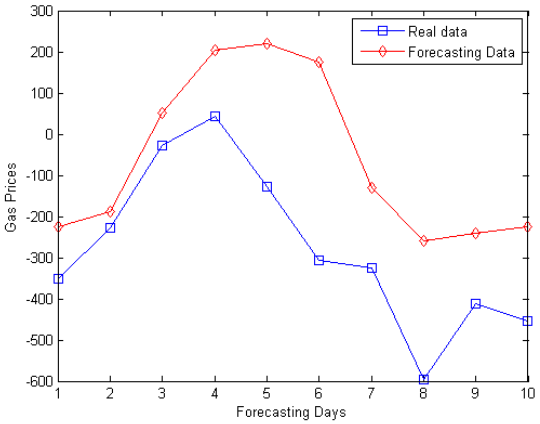

Figure 3. Predictive value of error term by ANN

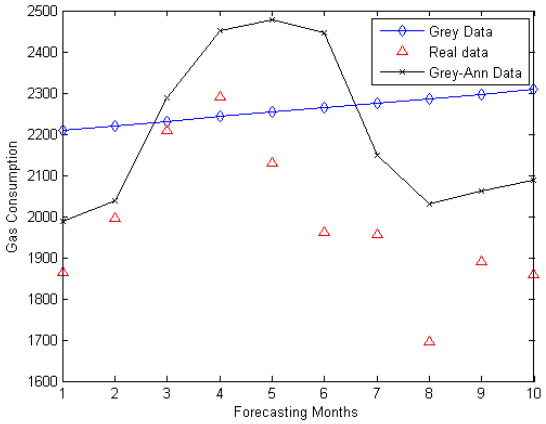

Figure 4. Predicted value of gas consumption

Conclusions

Compared to the predicted value of the residual Grey and ANN method, we can see that the prediction accuracy is improved. This shows the limitations of the residual Grey method that added an almost linear error correction to the predicted value. By estimating error values occurring in process of time series using ANN, a nonlinear error prediction value caused prediction accuracy to increase. In previous studies, prediction by ANN cannot describe in the blackbox, have had difficulty in interpretation. On the other hand, as ANN method was applied to the only error term in this hybrid method, we can reduce the unexplained part because of blackbox and increase the prediction accuracy.

References

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Hamzacebi, C., Es, H.A., 2014, "Forecasting the annual electricity consumption of Turkey using an optimized grey model," *Energy* Vol. 70, pp. 165-171.

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Acknowledgement

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