THE APPLICATION OF FUZZY TIME SERIES SINGH FOR FORECASTING BANDWIDTH NETWORK DEMAND

Aryanti
Department of Telecommunication Engineering State Polytechnic of Sriwijaya Palembang, Indonesia 30139
Aryanti@polsri.ac.id

Ikthison Mekongga
Department of Computer engineering State Polytechnic of Sriwijaya Palembang, Indonesia 30139
Mekongga@polsi.ac.id

Abstract- The purpose of this research is to develop information system which forecast bandwidth network demand by using Fuzzy time series Singh. Data were taken in State Polytechnic of Sriwijaya during learning hour starting from 07.00 am - 06.00 pm from Monday to Saturday in odd semester of Academic Year 2011/2012. Next, the data were processed by fuzzy time series Singh in order to get forecasted data. Then, the forecasted data were compared to the actual data in order to get validity of the data. The forecasted data using fuzzy time series Singh was nearly precise to the actual data with mean absolute percentage error of 8.523%.

BACKGROUND

Fuzzy time series is a new concept established fuzzy relations on time series data having linguistic values for forecasting future values. Previous related research was done by Song and Chissom. It focused on the implementation of fuzzy relational equation and fuzzy logic for forecasting the total number of students who registered in Alabama University [4]. Singh in his research related to fuzzy implemented a simplified computational approach to develop relational equation using complicated max-min composition and shorten Song and Chissom defuzzication process. This method can develop the right defuzzication procedure that resulted in more precise output crisp values [5]. Meanwhile Niu, et. al (2011) studied the application of volatility forecast to efficient resource alllocation [3]. The main difference between the previously research and this research is the use of Fuzzy time series Singh to develop bandwidth network demand forecasting. The data were from daily traffic data which processed by software system-Borland C#.

CURRENT RESULTS

Data were taken from daily historical data: Monday, Tuesday, Wednesday, Thursday, Friday and Saturday starting from 07.00 a.m. to 06.00 pm. This data were the input data of Fuzzy Time Series Singh research. For data validity, the input data were separated into two groups, first group was used for forecasting using Fuzzy time series Singh and the second group was used for validating. Based on the academic calendar, the total number of the effective weeks for learning were 7 weeks starting from 7 November 2011 - 24 December 2011, data taken from the first to the sixth week were used for forecasting dan data of the seventh week were used for validating. The greater the number of data, the better the result will be. The process model used in the construction of this software was linear sequential model or also known as the waterfall model. The linear sequential model includes activities in Fig 2. Linear sequential model. Table 2. consists of forecasting result at learning hour condition of Singh method max error is 13,293%, min error is 0,041% and average error is 4,392%. Error percentage per hour of bandwidth forecasting demand in Fig 3. Graphics Error at learning hour condition. This graphic forecasts bandwidth at learning hour condition with mean error of 4,392%. Fig 4. Graph of Forecasting Results in Course Condition. Based on the result of bandwidth demand forecasting using Fuzzy time series Singh, the forecasted result is good and it is nearly precise the actual data in Fig 4. Mean absolute percentage error of 8,523% for forecasted bandwidth using Fuzzy time series Singh. It means bandwidth demand forecasting using Fuzzy time series Singh is good as the alternative method in forecasting bandwidth demand. For minimizing forecasting error, we can narrow the interval of fuzzy set and availability of lots of bandwidth data.

It is suggested for the future development of this system for forecasting at semester break or special date of academic calendar in which the result of the research can be used as information system reference in determining bandwidth demand so that it is beneficial for administrators or IT officials in determining the needed bandwidth.

REFERENCES

Table 1. Bandwidth Data

<table>
<thead>
<tr>
<th>bandwidth Data</th>
<th>Max value bandwidth</th>
<th>Min value bandwidth</th>
<th>Number of data</th>
<th>Fuzzy set</th>
</tr>
</thead>
<tbody>
<tr>
<td>Course</td>
<td>26164000</td>
<td>66800</td>
<td>432</td>
<td>401</td>
</tr>
</tbody>
</table>

1. The procedures of Fuzzy Time Series Singh

2. Linear sequential model

Table 2. Forecasting result of Bandwidth at learning hour condition

Fig 1. The procedures of Fuzzy Time Series Singh

Fig 2. Linear sequential model

Fig 3. Graphics Error at learning hour condition (19/12/2011)

Fig 4. Graph of Forecasting Results in Course Condition