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

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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 deffuzyfication process. This method can develop the right defuzzyfication procedure that resulted in more precise output crisp values [5]. Meanwhile Niu, et. al (2011) studied the application of volatility forecast to efficient resource allocation that provides probabilistic service level guarantees to user groups and volatility reduction from diversification, and its implications to new strategies for cost-effective server management [3]. The main difference between the previously reseraches 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 in 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.

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Table 1. *Bandwidth* Data

bandwidth Data	Max value *bandwidth*	Min value *bandwidth*	Number of data	*Fuzzy* set
Course	26164000	66800	432	401

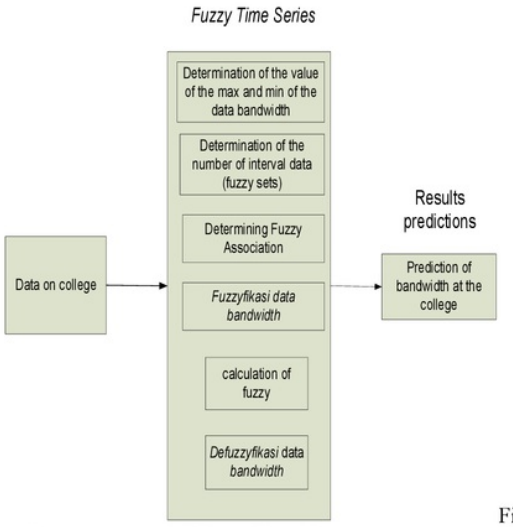

Fig 1. The procedures of Fuzzy Time Series Singh

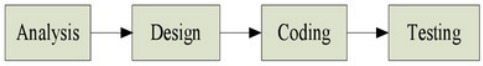

Fig 2. Linear sequential model

Table 2. Forecasting result of *Bandwidth*at learning hour condition

	Hour	Forecasting Result	Target	MAPE
		Singh		Singh
Monday	7	66800,00	68804,00	2,913
	8	12332484,00	13130000,00	6,074
	9	11745297,00	11260600,00	4,304
	10	19101445,25	16940000,00	12,759
	11	17290952,00	17010000,00	1,652
	12	24012854,83	23843000,00	0,75
	13	20292130,00	21600000,00	6,055
	14	16817940,25	16530000,00	1,742
	15	12870738,75	12876000,00	0,041
	16	19291737,33	19250000,00	0,217
	17	22306003,20	21774000,00	2,903
	18	11190731,50	12906400,00	13,293
Min		66800,00	68804,00	0.041
Max		24012854,83	23843000,00	13.293
Mean		15609926,18	15599067,00	4,392

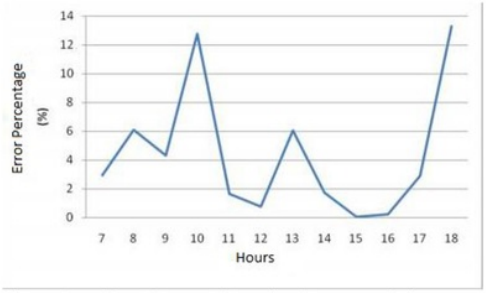

Fig 3. Graphics *Error* at learning hour condition (19/12/2011)

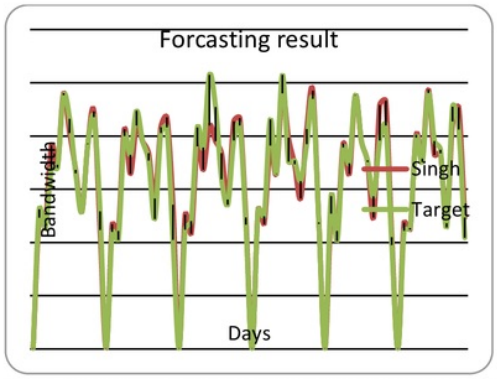

Fig 4. Graph of Forecasting Results in Course Condition

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