Calculating vehicle intensiveness increase on eid al-fitr day with anfis method

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ABSTRACT

The number of motorized vehicles increases every year, especially private vehicles and is not offset by inadequate access until the road becomes more crowded, even traffic jams occur, especially during public holidays and national holidays. for example, during eid holidays there is a density of traffic flow when going back and forth every year, with the development of current technology the density of traffic flows that occur can be calculated so that it will be easier to anticipate in the future. but in this study only will examine the parameter values that cause the vehicle to occur density and accumulation, because it can be developed with parameter values so that the results can be obtained efficiently in solving traffic density.

from the results of the anfis method, efficiency is obtained, namely on h-1 and h days of 2014, and 2017 can use the first parameter while 2015, and 2016 can use the second parameter. and for the h + 1 day of 2014, 2016, and 2017, it is more efficient to use the first and only parameters in 2015 which have the efficiency value using the second parameter. anfis application in this calculation can be developed in a prediction system.

1. Introduction

Increased use of motorized vehicles every year, especially 4-wheeled private vehicles, and 2-wheel vehicles are not matched by inadequate access to increasingly crowded highways and even traffic jams occur especially during public holidays and national holidays. For example, during Lebaran holidays there is a density of traffic flow when going home every year. In this study researchers will build a system with ANFIS method where the data used in the last 5 years does not rule out the possibility of very drastic changes in data. The data changes will become a reference for making parameters and each year will be distinguished by the value of each parameter which is certainly changing, from the value that is always changing the researcher will calculate the error margin of the calculation if the calculation is used by the ANFIS method [1]. In this study it was not carried out by other methods because researchers would only compare which parameter values were more optimal if applied in real traffic. For the parameter value that is always changing it occurs because of the effect of development, if we see before the parameter value is built in the medium level, then when the building is done the parameter value will drop to a low level where density will occur, but if the construction is complete the parameter value rises again Even passing the initial value where from the low value to high value, this will make the traffic become congested or traffic

can be said smoothly without any congestion. With the development of technology today the traffic flow density that occurs can be predicted so that it will be easier to anticipate in the future.

Traffic flow is close to capacity so congestion begins to occur. Congestion will increase if the traffic flow is so large that the vehicle will be very close to one vehicle with other vehicles. Total congestion occurs when the vehicle must stop or move very slowly and be added with other vehicles that keep coming from behind [2].

Traffic depends on road capacity, the amount of traffic that wants to move, but if the road capacity cannot accommodate, then the existing traffic will be hampered and will flow according to the maximum road network capacity [3]. Traffic congestion on the highway segment occurs when the flow of traffic vehicles increases with increasing travel demand in a certain period and the number of road users exceeds the existing capacity [4].

One method of artificial intelligence that is often applied in prediction systems is Fuzzy logic. Fuzzy logic is a problem-solving methodology that is suitable for data acquisition-based systems and control systems [5]. Because it does not only rely on true and false values, this method can provide good results in predictions, especially in predictions that produce continuous values. Previous research is the application of fuzzy mamdani where this model is used to build a system that resembles intuition or human feelings that examines the problem of predicting the price of palm oil.

With the existence of an information system that is capable of predicting it will certainly make the relations service more easily anticipate congestion so that it can make a solution to overcome the prediction of density that will occur [6]. This prediction system is made using calculations from ANFIS algorithm (Adaptive Neuro-Fuzzy Inference System), is a combination of the mechanism of Fuzzy Inference System which is described in the neural network architecture. Fuzzy Inference System used is the first order Tagaki-Sugeno-Kang (TSK) fuzzy inference system with consideration of simplicity and ease of computation [7]. To forecast well, it takes a variety of information (data) that is quite a lot and observed in a relatively long period of time, so that the results of the analysis can be known to what extent the fluctuations occur and what factors influence the changes . Theoretically, the most decisive time series analysis is the quality or accuracy of the information or data obtained and the time or period of the data collected [8].

Because the data that changes every year will be an obstacle in research, so in this study researchers chose the ANFIS method because the nature of ANFIS itself is adaptive where if there is a change in parameter values, the adaptive nature of ANFIS will be connected to the neurons in the ANFIS method in determine prediction results. In addition to ANFIS there is another method, namely the Backpropagation method, but in the Backpropagation method it is static, it cannot be adaptive to changes that occur in the parameter value [9].

2. Method

This type of research is quantitative research, quantitative research is an important factor in the research process itself. That part of the research activity is a process of theory or theorizing process. In this research process performs a deductive analysis process to try to answer the problems being faced. In quantitative research, theory or theory paradigm is used to determine which researchers find research problems, find hypotheses, find concepts, find methodologies and find data analysis tools[10]. This research was carried out independently using descriptive and experimental methods. From the data obtained then compared with the data tested. The results of the analysis were then compared with data in the previous year to compare the margin error rate.

Anfis is a combination of Fuzzy Logic and Artificial Neural Network (ANN). Fuzzy logic has advantages in modeling qualitative aspects of human knowledge and decision-making processes by applying rules. ANN has advantages in recognizing patterns, learning and practicing in solving a problem without requiring mathematical modeling. And can work based on historical data entered into it and can predict future events based on these data. So that ANFIS has both abilities[11]. The framework of the ANFIS method has five layers, namely the Fuzzification layer, rule layer, Normalization layer, Defuzzification layer, and Neurotunggal results[12]. In Figure 1 are the steps that will be carried out by researchers in conducting research, in which the study will begin with data sDayng, consisting of the number of vehicles each year and divided again for 4 days. After

division of vehicle data, parameter mapping is also done where the values of these parameters will be used in calculating the suitability of traffic density values from year to year. After that the researcher will proceed to the initial matrix formation phase using the FCM method, where the central cluster calculation will be used by using the equation. After obtaining the value, it is continued with an improvement in the degree of membership. The data that will be used in this study is data for 4 days starting from D-1 before Eid, during Lebaran, H + 1 after Eid, and H + 2 after Eid, where on that day the density of vehicles occurring in the city of Kediri is obtained very big compared to other days. This is because many vehicles coming from outside the city of Kediri come to the city of Kediri or just just cross the city of Kediri to go to other cities around the city of Kediri such as Nagnjuk, Jombang, Surabaya, Malang, Blitar, Trenggalek, and Tulugagung.

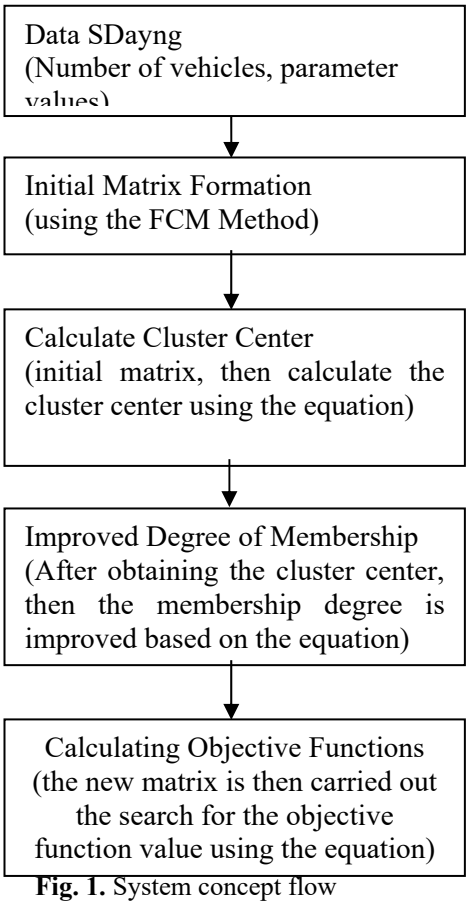

Fig. 1. System concept flow

The object under study is in the City of Kediri. In data collection, mapping will be carried out based on the road sections in Table 1 below:

Table 1. Road Mapping in Kediri City

No	Name jalan	Panjang Jalan (m)	Lebar Jalan (m)	Jumlah *traffic light (buah)*	Jalur / Lajur
1	Jl. Sersan Bachrun	3720	18	2	2 / 4
2	Jl. Gatot Subroto	4150	10	3	2 / 1
3	Jl. Semeru	2175	18	1	2 / 4
4	Jl. Urip Sumoharjo	4217	12	1	2 / 1
5	Jl. Perintis Kemerdekaan	6195	22	2	2 / 4
6	Jl. Raya Gampengrejo	17280	14	1	2 / 1
7	Jl. A. Yani	7458	20	3	2 / 4

3. Results and Discussion

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Data on the number of vehicles that causes the density of vehicles to be tested in the ANFIS method are presented in Table 2 as follows:

Table 2. Number of vehicles per day

Year	Day		
	D-1	D	D+1
2014	4.821.063	1.953.152	2.691.953
2015	5.127.427	2.038.639	2.731.034
2016	4.899.172	2.010.852	2.493.117
2017	4.217.749	1.972.003	2.591.031
2018	5.052.713	2.342.719	2.833.018

Data is presented in the form of an image so that it can be known which days have the highest traffic in traffic in the city of Kediri, as in Figure 1 and Figure 2 below:

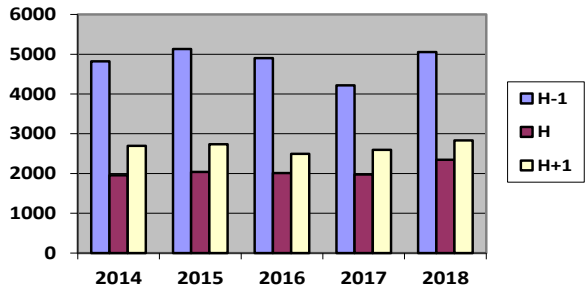

Fig. 2. Annual comparison density

The data in Figure 1 in the form of graphs each year look relatively the same where at H-1, Eid and H + 1 are almost the same range. The data is taken from the Provincial data, in vehicles entering the City of Kediri.

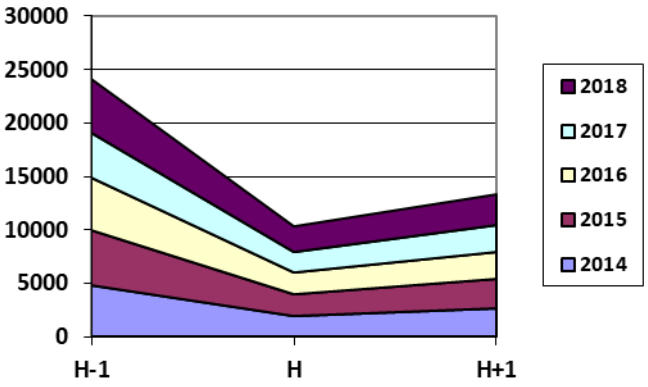

Fig. 3. Comparison density per day

In Figure 2 presented a table of differences from each year with the same presented day there is a decrease in data every year except in 2017 there was a very drastic increase. This happened because in 2017 the government gave a long holiday for 10 days, resulting in traffic congestion in the area of Kediri City. The parameter values that will be included in the calculation method to obtain the margins in the following Table 3:

Table 3. Parameter Value 1

Name	Jumlah	Nilai
Lebar Jalan	6 meter	40
Traffic Light	5 persimpangan	70

The first parameter value in Table 3 is the value before the development, while the value with the second parameter is presented in Table 4 below:

Table 4. Parameter Value 1

Name	Jumlah	Nilai
Lebar Jalan	8 meter	75
Traffic Light	9 persimpangan	50

By using the formula so that the values are addaptive and obtained in neurons in the ANFIS method, we get density data and parameter value data for calculating the margins of the density that occur every year, then proceed with the calculation using ANFIS. The results achieved obtained from the parameter values close to the optimal point of traffic flow density are presented in the form of the following table:

Table 5. Results with parameter value 1 on H-1

Tahun	Data awal	Prediksi	Data Asli	Margin
2014	4.821.063	4.823.377,11	5.127.427	6,3%
2015	5.127.427	5.129.888,16	4.899.172	-4,49%
2016	4.899.172	4.901.523,6	4.217.749	-13,95%
2017	4.217.749	4.219.773,52	5.052.713	19,73%

In Table 5 the calculation on H-1 using the first parameter value the closest margin is on the 2015 calculation of data for the 2016 prediction. It is said to be closest where the value is close to 0 (null).

Table 6. Results with parameter value 1 on day H

Tahun	Data awal	Prediksi	Data Asli	Margin
2014	1.953.152	1.954.089,51	2.038.639	4,32%
2015	2.038.639	2.039.617,55	2.010.852	-1,41%
2016	2.010.852	2.011.817,21	1.972.003	-1,97%
2017	1.972.003	1.972.949,56	2.342.719	18,74%

In Table 6 the calculation on Eid day by using the first parameter value the closest margin is on the 2015 data calculation for the 2016 prediction, when compared with the data in table 5 the similarity of the margin in 2015 approaches 0 (null) and 2017 which are both far away from 0 (null).

Table 7. Results with parameter value 1 on H + 1

Tahun	Data awal	Prediksi	Data Asli	Margin
2014	2.691.953	2.693.245,14	2.731.034	1,4%
2015	2.731.034	2.732.344,9	2.493.117	-8,75%
2016	2.493.117	2.494.313,7	2.591.031	3,87%
2017	2.591.031	2.592.274,69	2.833.018	9,28%

In Table 7 the calculation on Eid day by using the first parameter value the closest margin is on the 2016 data calculation for the 2017 prediction, when compared to the data in table 5 and table 6 the initial data difference is very different. In Table 5 the calculation results are obtained from the first parameter value on the day before Eid, continued in Table 6 with the first parameter value for Eid and the last Table 7 is the calculation result using the first parameter value on the day after Eid. Furthermore, the results of the calculation using the second parameter value are described in Table 8 for the days before Eid, Table 9 for the Idul Fitri, and Table 10 for the days after Lebaran, as follows:

Table 8. Results with parameter value 2 on H-1

Tahun	Data awal	Prediksi	Data Asli	Margin
2014	4.821.063	4.690.503,79	5.127.427	9,31%
2015	5.127.427	4.988.571,15	4.899.172	-1,79%
2016	4.899.172	4.766.497,52	4.217.749	-11,51%
2017	4.217.749	4.103.528,14	5.052.713	23,13%

In Table 8 calculation on H-1 using the second parameter value, the closest margin is in the 2015 calculation datja for the 2016 prediction, if observed there is a security between the data from the first and second parameters. It is said to be closest where the value is close to 0 (null).

Table 9. Results with parameter value 2 on day H

Tahun	Data awal	Prediksi	Data Asli	Margin
2014	1.953.152	1.900.258,691	2.038.639	7,28%
2015	2.038.639	1.983.430,617	2.010.852	1,38%
2016	2.010.852	1.956.396,117	1.972.003	0,79%
2017	1.972.003	1.918.599,187	2.342.719	22,10%

In Table 9 the calculation on Lebaran day by using the second parameter value, the closest margin is on the 2016 data calculation for the 2017 prediction, in this calculation the results are not matched by using the parameter value because the initial data used is the same but the width parameter is different.

Table 10. Results with parameter value 2 on H + 1

Tahun	Data awal	Prediksi	Data Asli	Margin
2014	2.691.953	2.619.052,221	2.731.034	4,27%
2015	2.731.034	2.657.074,868	2.493.117	-6,17%
2016	2.493.117	2.425.600,899	2.591.031	6,82%
2017	2.591.031	2.520.863,289	2.833.018	12,38%

After obtaining the results from the calculation of each parameter value and every different day in the city of Kediri, the margin will be obtained in the calculation. From the margin value, an image is made so that the values that are close to 0 in the calculation are easily known, where the value close to 0 is the efficient value of the parameter value applied. As in Figure 4, which displays the day before Lebaran with a value of 2 parameters, Figure 4 displays the day of Lebaran, and Figure 5 shows the calculation data after Lebaran day.

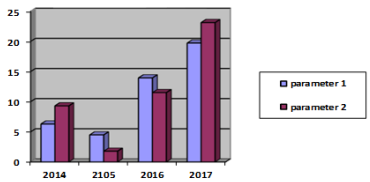

Fig. 4. Comparison of Margin on H-1

In Figure 4 it can be seen the difference when data is calculated using both parameters, in the graphical picture it can be seen with different annual data that affect different values as well.

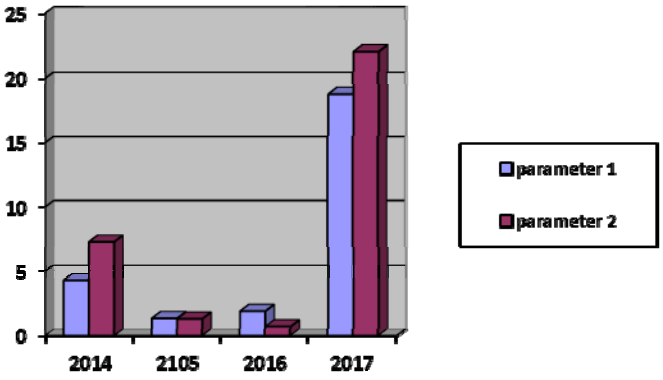

Fig. 5. Comparison of Margin on Day H

On Figure 5 can be seen in 2017 the margin of calculation seems very far from point 0, this is because in 2017 a long holiday held by the government affected the density of vehicles that occurred in the City of Kediri.

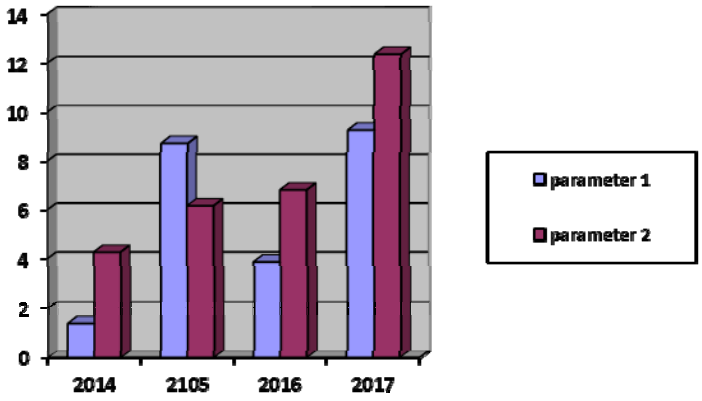

Fig. 6. Comparison of Margin on H + 1

Figure 3 shows that the first parameter values in 2014 and 2017 are closer to the original data, and 2015 and 2016 are closer to using the second parameter value. In Figure 4 it can be seen that the first parameter values in 2014 and 2017 are closer to the original data, and 2015 and 2016 are closer to using the second parameter value. Finally in Figure 5, it can be seen that the first parameter values in 2014, 2016 and 2017 are closer to the original data, and 2015 is closer to using the second parameter value.

4. Conclusion

In this study, the margin results are different in each year using different values. As can be seen on H + 1 which is different than H-1. In this study only prioritize calculations and do not provide a way out. Based on the results of the research that has been made there is one that margins with an acquisition close to 0, namely in 2016 on the day of H using the calculation with the second parameter value of 0.79%. This is certainly very good to be developed so that not only in 2016 is the H day the margin is close to 0, but can be applied in all years on different days.

Based on the results of the method achieved efficiency that is on D-1 of 2014, and 2017 is more suitable to use the first parameter while 2015, and 2016 are more suitable to use the second parameter on the day of 2014, and 2017 is more suitable to use the first parameter while 2015, and 2016 more suitable to use the second parameter. And for H + 1 days in 2014, 2016, and 2017, it is more efficient to use the first and only parameters in 2015 which have the efficiency value using the second parameter. Suggestions to improve performance and improve the research that has been made, the researcher gives the following suggestions: In further research, research can be made that compares ANFIS with other methods such as Backpropogation, development can also be in the application of methods to proceed to the system to predict the density of the following year, provided solutions in dealing with densities such as alternative pathways using mapping methods commonly used in networks applied in prediction of congestion.

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