Forecasting Crime: Application of Trend Projection Method in Sumenep District

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Forecasting Crime: Application of Trend Projection Method in Sumenep District

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Abstract.Criminal activity is possible to happen every day. The police carries out the recording process of criminal reports without any further data processing to obtain a useful solution for handling the crime. One forecasting method can be used to process criminal data in order to produce predictions of crime, so that it can be used by the police as the crime prevention tool. One forecasting method used is the Trend Projection Method. This method matches the trend line to series of historical data which will be projected into the future with a period of time. This method requires data from previous years so that this study took data 4 years earlier. With this forecasting method, the result of criminal forecasting value is almost close to the actual data. From the results of the testing system on 5 sub-districts for motor vehicle thievery, the accuracy system value was 32%, 5 subdistricts for theft of goods obtained an accuracy value of 16%, and 4 sub-districts for theft of animals obtained an accuracy of 6%.

Key word :forecasting, trend Projection, criminal activity, accuracy

1. Introduction

The term criminal or crime is a form of behavior that is contrary to human morality, conduct detrimental to society, and violates laws and criminal laws. Such behavior can be done by men and women. In general, according to Reksohadiprodjo and Karseno [1], there are four crime groups. First is a group of crimes against property rights such as robbery, theft, legality, deliberate arson, and embezzlement. The second is a group of crimes against personal rights such as murder, rape and abuse. The third is a group of negative behaviors according to community views such as gambling, prostitution, and narcotics. Then the fourth is a group of violations such as riots, and traffic violations. Actions that lead to criminal acts or crimes do not automatically arise. There are many factors that can influence a person to take this action.

Crimes in Sumenep Regency continue to increase from year to year and the types vary. In fact there are crimes that occur that are difficult to accept our common sense such as sexual violence, and depend on the culture that developed in the community. Increased crime is caused by several issues such as the economy, social, conflict, politics, the nature of the community itself. The crime of theft is very prevalent in Sumenep, not only in cities, but also in villages that are increasingly varied, such as the theft of animals by anesthetizing cows so as not to make noise in mountainous areas such as batuputih.

In Sumenep district is a crime-prone district, where crime of motorcycle theft often occurs with violence, the purpose of violent crimes is in Indonesian criminal law, the regulation on pencurina is explained separately in the Criminal Code's second book on crime, in Chapter XXII about theft.

Article 362 [2] explains in general that what is meant by theft is an act of taking, which is entirely or partially owned by another person with the intention to possess the goods against the law.

So far, the data and records of crimes in Sumenep Regency have only been used to prepare reports without any further processing that information can be used for the crime handling process. And the crime of motor vehicle theft is increasing every year, as in 2012 there were 134 cases of motor vehicle theft and many of them were stolen in August.

Forecasting is a prediction that can predict the future based on historical data held by the Sumenep police station. Forecasting is very necessary in the increase of a crime in a police force, so that it can calculate several levels of crime each year. Forecasting is a tool of a system for companies that is important in planning effective and efficient on a crime problem.

Many methods based on historical data used for a forecasting system among are *Exponential Smoothing*, *Trend Projection*, *Moving Average*, *Moment Method*, and other methods.

Exponential Smoothing method is one time series analysis, and is a forecasting method by giving weighting values to a series of previous observations to predict future values and is a development of the *Moving Average* method.

By looking at the above problems, a forecasting system is needed by applying the Trend Projection Method, because this method uses time series regression analysis that matches the trend line with variations in seasonal crime data against a series of past data projected to future problems [3].

The crime data used in this study is past data with the period 2012-2016 (5 years) based on previous year's data. The 2012-2015 data as training data, for 2016 data as test data.

2. Result

2.1. System Description

In the development of information technology analysis and design of a good forecasting system are needed. The forecasting system is expected to be able to provide convenience and solutions to the police to improve supervision in an accident-prone place and get good forecasting results. Analysis is a way to solve problems based on data obtained from the results of field studies. While system design is a step that must be taken to present a well-organized forecasting system.

2.2. System analysis

The design of this system was made to be the basis for designing a crime rate forecasting system application. The variables used in the research are crime history data from 2012 - 2015. Following are the data input & output processes applied to the design of this system.

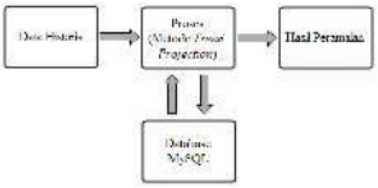

Figure 1 Process of input & output data

The figure 1 describes some crime data processing that will result from the results of forecasting, namely:

1. Historical Data
   Historical data uses crime data for annual recapitulation for each of the criteria Daily crime data in total per month. Daily data processing is processed using Microsoft Excel and the data is entered into the database.
2. The Trend Projection Method ProcessProcessed historical data is calculated as a trial using variables & parameters. From each trial will be evaluated the level of accuracy by comparing the results of forecasting with actual crime data.

3. Final results
   The results of these comparisons, can obtain an accuracy value between the value of the accuracy of the system and the actual data.

Crime Criteria Data

Based on conventional crime data in the Sumenep Regional police station reached more than 37 types of crimes, 3 crime criteria were chosen, namely:

1. Theft of Motor
   VehiclesTheft of transportation equipment such as motorbikes, cars, pick ups, trucks, ontel bikes, and others.
2. Theft of goods
3. Animal Theft

2.3. Flowchart System

Flowchart / flow diagram is an image or chart that shows the sequence and relationship between processes along with instructions expressed with symbols.

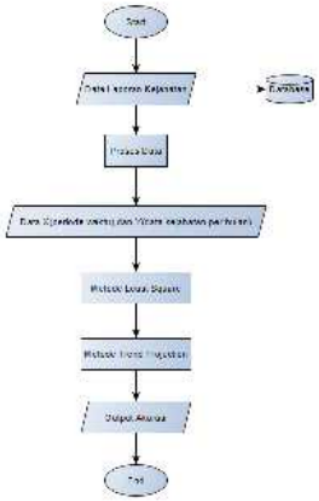

Figure 2. Process flow in the forecasting system

Figure 2 shows the process steps for running a forecasting system, as for the following steps:

1. Crime report data: is a data used in the system. Test data uses from 2012-2015 and 2016 data as training or testing data. The crime criteria are motor vehicle theft, theft of goods, and theft of animals.
2. Process data: is a stage that is carried out to analyze a data, for data missing value (empty data) it is still empty (0) because if the blank data is not filled it will affect the accuracy of the forecasting system.
3. Forecasting begins by giving an input value in the form of an x variabel variable which states the time and ȳ which state the value of crime at time x.
4. The next process gets the relationship between the variables x and y with the least square method.

After knowing the relationship between the two *x* and *y* variables, then the forecasting calculation is done by the Trend Projection method with seasonal data variations.

2.4 Scenario Testing

The 2016 crime forecasting data is obtained from the analysis results for the periode 2012-2015. Comparison of the value of forecasting data with actual crime data is given in the following table. This system testing is carried out on 5 data on motor vehicle theft on 5 sub district

Table 1. Comparison of actual crime data with forecasting data for 2016

	Forecast 2016	Actual Data 2016	Difference
January	7,25	11	3,75
February	3,5	13	9,5
March	5	9	4
April	3,25	8	4,75
May	4	3	1
June	4	6	2
July	8,25	2	6,25
Agustus	5,5	12	6,5
September	5	4	1
October	7,25	7	0,25
November	5,75	2	3,75
December	6,75	3	3,75

This system testing is carried out on 5 data on motor vehicle theft or 5 sub-districts.

Table 2 Sumenep City District System Testing

Month	Actual Data 2016	Forcast 2016	Difference	Prosentase %
January	11	7,25	3,75	34,09 %
February	13	3,5	9,5	73,07 %
March	9	5	4	44,44 %
April	8	3,25	4,75	59,37 %
May	3	4	1	33,33 %
June	6	4	2	33,33 %
July	2	8,25	6,25	312,5 %
Agustus	12	5,5	6,5	54,16 %
September	4	5	1	25 %
October	7	7,25	0,25	3,571 %
November	2	5,75	3,75	187,5 %
December	3	6,75	3,75	125 %

The test results in the table for forecasting the 12-month motor vehicle crime rate were obtained by testing the system as much as 985%: 12 = 82%

Table 3 System in the Batuan sub-district

Month	Actual Data 2016	Forcast 2016	Difference	Prosentase %
January	2	0,5	1,5	75%
February	1	0,5	0,5	50%
March	1	0,75	0,25	25%
April	3	0,25	2,75	91,66%
May	0	1	1	0
June	0	0	0	0
July	0	0,5	0,5	0
Agustus	1	0,75	0,25	25%
September	0	0,25	0,25	0
October	1	0	1	100%
November	3	0,5	2,5	83,33%
December	1	0,75	0,25	25%

The test results in the table for forecasting the 12-month motor vehicle crime rate were obtained by testing the system as much as 475%: 12 = 39%

Table 4 System Testing in Bluto District

Month	Actual Data 2016	Forcast 2016	Difference	Prosentase%
January	1	0,5	0,5	50 %
February	0	0,5	0,5	0
March	0	0,75	0,75	0
April	0	0,5	0,5	0
May	0	1	1	0
June	0	0,5	0,5	0
July	0	0,25	0,25	0
Agustus	0	1	1	0
September	0	0,25	0,25	0
October	0	0,25	0,25	0
November	0	0,5	0,5	0
December	0	0,25	0,25	0

The test results in the table for forecasting the 12-month motor vehicle crime rate were obtained by testing the system as much as 50%: 12 = 4%

Table 5 System Testing in Ambunten District

Month	Actual Data 2016	Forcast 2016	Difference	Prosentase%
January	0	0,75	0,75	0
February	0	0,25	0,25	0
March	0	0,5	0,5	0
April	1	0,5	0,5	50 %
May	0	0,25	1,75	87,5 %
June	0	0	0	0
July	0	0,5	0,5	0
Agustus	0	0,75	0,75	0
September	0	0,25	0,25	0
October	1	0	1	100 %
November	0	0	0	0
December	0	0,75	0,75	0

The test results in the table for forecasting the 12-month motor vehicle crime rate were obtained by testing the system as much as 237%: 12 = 20%

Table 6 Testing System in the Pragaan district

Month	Actual Data 2016	Forcast 2016	Difference	Prosentase%
January	0	0,5	0,5	0
February	0	0	0	0
March	0	0,75	0,75	0
April	2	0,75	1,25	62,5 %
May	0	0,25	0,25	0
June	0	0,75	0,75	0
July	0	0,5	0,5	0
Agustus	1	0	1	100 %
September	0	0,25	0,25	0
October	0	0	0	0
November	0	0	0	0
December	0	0,25	0,25	0

The test results in the table for forecasting the 12-month motor vehicle crime rate obtained by testing the system as much as 163%: 12 = 13%

From the results of 5 system tests for forecasting crime using the Trend Projection method, the value of system accuracy is 158%: 5 = 32%

3. Conclusion

After a trial analysis, conclusions that can be taken from the results of the research that have been done are as follows:

1. The test results for forecasting the 12-month motor vehicle crime rate were obtained by testing the system as much as 82% in the sumenep
2. The test results for forecasting the 12-month motor vehicle crime rate were obtained by testing the system as much as 39%in the batuan
3. The test results for forecasting the 12-month motor vehicle crime rate were obtained by testing the system as much as 4% in the bluto
4. The test resultsfor forecasting the 12-month motor vehicle crime rate were obtained by testing the system as much as 20% in the ambuten
5. The test results for forecasting the 12-month motor vehicle crime rate obtained by testing the system as much as 13% in the pragaan
6. From the results of 5 system tests for forecasting crime using the Trend Projection method, the value of system accuracy is 32%

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