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Estimating Matrix Travel Light Vehicle Observations by Volume Sleeve Approach Inference Bayes

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Abstract: The process can change the assignment of a knowledge matrix of travel $[T_{ij}]$ into the estimated flow of arms, the two main points of the assignment process is the proportion of travel between zones i and j zone on an arm and balance assignment. The problem is the number of arms in the measurement of traffic volume is less than the sum of n - origin destination pairs (dual problem), thus resulting in the problem has a solution that is much that is difficult to solve. For that to look for a single solution to solve these problems. In terms of the calculation method of Inference Bayes approach is very interesting, because the assumptions the calculation of the proportion of the matrix accurate travel and arrival rate multivariate normal distribution vehicles. From the data processing, wherein the matrix of the posterior and matrices trip on field observations seen the total number of matrices trip posterior 299.66 and the total amount of the average matric trip observations 320.5 on light vehicles (KR) , where in the matrix trips posterior smaller than the matrix of travel observations. This figure shows that the increase in the number of light vehicles around 7 in one year.

Keywords: transportation, Bayesian Inference, prior, posterior, origin destination.

1 Introduction

Transportation is not economically efficient will be detrimental to the public of whom congestion / delays, accidents, impaired mobility and accessibility due to high transport costs [6]. Although there are differences between the streets in various cities in Indonesia and in other countries, movements in urban areas have some of the same characteristics, which applies in almost all the streets in small towns and big cities. This characteristic is a basic principle which the transportation study began. Because transportation already an activity that always us do every day, whether for work, school, recreation, or other [4]. The need for transportation is always cause problems in the community, especially at a time when everyone does trip to a common purpose, in the same place and at the same time anyway. So that congestion, delays, air pollution, environmental pollution and vibration is a part of the problems posed by the need for transport [3]. To overcome these problems need to know information about travel patterns. Therefore, in order for a traffic management can be successfully applied said is very important to know about the current state of travel patterns and also estimate travel patterns in the future. Malang city local government is currently facing the problem of congestion on some roads Juas in the city's transportation network, especially at intersections, as well as the intersection of Veterans and road Sumbersari. To over come this problem, we need some program settings and good transport planning that can be represented by Matrix Origin Destination (OD) [2]. The use of non-conventional methods are very cost-effective and extremely exciting time to be used. Specifically estimation matrix Origin-Destination (OD) can be obtained by observing the volume roads for a method proportion of assignment, where the data traffic volume sufficient to provide information for the study, while not taking into account the capacity of the road from the roads studied, but parameters of the sample data volume of vehicles is necessary to estimate the origin-destination matrix that research conducted more accurate [5]. Suppose there is a four way intersection and traffic flow entering (inflow) and outgoing flows (outflows) respectively g_1, g_2, g_3, g_4 and a_1, a_2, a_3, a_4.

Therefore in this study will try application of a method of Bayesian Inference to estimates a matrix of trip

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Table 1: Matrix Origin Destination Intersection

From/To	1	2	3	4	Total
1	0	12	13	14	a_1
2	21	0	23	24	a_2
3	31	32	0	34	a_3
4	41	42	43	0	a_4
Total	g_1	g_2	g_3	g_4	x

Source: Results Analysis

at the crossroads Veteran and Sumbersari. This method is very interesting because using only the information volume calculation data traffic flows will be obtained a matrix of latest journey, [7]. Moreover this method has three convenience, the observations made free, observations made without error and could predict the trip with little value matrix prior information [8].

1.1 Formulation of Problem

Congestion that occurs on some streets and at intersections in the city of Malang is a problem that needs special attention for the perpetrators of transport, especially for transporters passing through the intersection of ITN (crossroads Veteran and Sumbersari). From the description above, the formulation of the problem in this study is: How Light Vehicles traveling assessment matrix based on observations from Volume arm with Bayesian Inference approach, at the Crossroads Veteran - Sumbersari Malang.

1.2 Research Objectives

Objective is: To determine the assessment matrix journey Light Vehicle based on the observation arm volume with Bayes Inference Approach at the intersection of Veterans - Sumbersari city of Malang.

2 METHOD

2.1 Stages of Work

As has been explained that the purpose of this study was to determine the valuation matrix of travel based on the observation arm volume with Bayes Inference Approach. To achieve the desired aims and objectives necessary to formulate a research stage. Stages include starting work on the inventory data relating to volume traffic at the intersection. In general, the phase of the study consisted of:

1.The preparation phase,
2.Data collection phase, and
3.Phase analysis, conclusions and suggestions

Overall phases of the work that has been done can be started from the preparation process in this research included a literature study and review of previous studies. The second stage is the stage of data collection and compilation of data, and the third stage is the start of the data analysis, discussion and come to conclusions and suggestions.

2.2 Preparation

At this stage of the study back to the background and current issues and strategies that are designed in accordance with the objectives to be achieved. It is necessary for the following steps:

a.Initiation of the study in the form of a consolidated team, literature, and stabilization methodology.
b.Inventory data needed for the study, these data include: geometric data path, and other data.
c.Preparation of a survey form survey method selection, preparation of forms and survey equipment, determining the location of the survey and human resources (HR) executive.
d.Identification of regulatory and previous studies involving legislation, government regulations and the methods and models related to traffic.
e.The tools used at the time of the survey, including: counter (to count the number of vehicles passing through the road), ironing board noted, form, stopwatch, stationery, odometer (to measure the width of the street, shoulder of the road and path length), digital camera (for documentation of the condition of the road on the roads surveyed in order to be a real field conditions).

2.3 Data Collection Phase

This phase is carried out a preliminary survey of the roads that made the object of research to look at the field level, in order to avoid a mismatch between the initial objectives and the knowledge of researchers to study the actual condition of the object. It is to design of the survey, the number of surveyors needed, surveying tools are required, and the position of the observation point as well as the strategy used. The research location chosen was the crossroads Veteran and Sumbersari street in the city of Malang (ITN intersection). Criteria site selection is based on a consideration of where the intersection of the most frequent traffic jams on the pick time. And in data collection for the study was conducted in January 2015.

2.3.1 The required data consist of primary data and secondary data

a.Primary data includes: traffic volume, the number of arms, vehicle speed, and land use.

Table 2: Total Matrix Journey Prior KR

From/To	1	2	3	4	Total
1	0	69	185	243	497
2	161	0	48	0	209
3	174	18	0	0	192
4	256	107	16	0	379
Total	591	194	249	243	1277

Source: Results Analysis

Table 3: Average Journey Posterior Matrix KR

From/To	1	2	3	4	Total
1	0	16.73	52.59	8.15	77.47
2	46.37	0	13.86	0	60.16
3	50.09	4.95	0	0	55.04
4	72.95	29.29	4.75	0	106.99
Total	169.34	50.97	71.2	8.15	299.66

Source: Results Analysis

b.Secondary data include: a map of the road network, and data traffic.

Furthermore, the data is processed, in each arm is recorded volume of vehicles, origin-destination vehicles classified, and that includes the Lightweight Vehicle (KR) is a car, minibus and others. Such data is included: the volume of traffic at 12 intersections arm, the total volume of 12 arms, and trip origin destination matrix. Having obtained the primary data and secondary data, then do grouping and analyzed in accordance with the existing problems, then tested with the following statistics: distribution conformance test in this case using a discrete distribution. To simplify the process of data processing researchers using computer tools and the statistical program SPSS [1].

2.3.2 Research Sites

The research location is a crossroads at the intersection ITN Malang, deployed at the intersection of these frequent traffic jams, in this case will make the high cost of operating motor vehicles which pass through the intersection, so it is not economical and inefficient. This study will put more emphasis on the analysis of the matrix of travel at the intersection ITN approached Inference Bayes Method using data traffic volume of vehicles on each arm.

3 RESULTS AND DISCUSSION

Prior Travel Matrix Matrix prior trip is the initial information in estimating the matrix of the posterior trip observation arm volume, with the Bayesian inference method [3]. Matrix prior trips obtained from a survey by Transport Laboratory of Civil Engineering of UB, conducted in January 2014 which can be seen on the trip prior Matrix Light Vehicle (KR).

3.1 Posterior Matrix of Traveling

The results of data processing matrix traveling to calculate the values of the magnitude required in analysis. The average posterior matrix for Light Vehicles searched using the equation:

$$\mu_1 = \mu_0 + V_0 H' \left(\Sigma + H V_0 H'\right)^{-1} (g - H\mu_0)$$

where:

Σ	=	Matrix dispersion observations
g	=	average volume arm observations origin-destination
μ_0	=	Volume average arm prior origin-destination
V_0	=	matrix dispersion prior
H	=	proportion matrix prior trip
H'	=	proportion of trips observation matrix.

Trip posterior matrix form is obtained from the average volume arm posterior trip matrix which are arranged in a matrix form Origin-Destination (OD) So to have calculated the amount it describes all the above, then obtained an average volume arm posterior trip matrix as follows :

$$\begin{aligned}\mu_1 &= \mu_0 + V_0 H' \left(\Sigma + H V_0 H'\right)^{-1} (g - H\mu_0)\\ &= \{40,25;43,5;64;17,25;4,5;26,75;46,25;12;4;11,56;0;0\}\\ &+ \{6.05;6.59;8.95;(0.52);0.45;2.54;6.34;1.86;0.75;(3.41);0;0\};\\ &= \{46.30;50.09;72.95;16.73;4.95;29.29;52.59;13.86;4.75;8.15;0;0\}\end{aligned}$$

While travelling posterior matrix form is obtained from the average volume arm posterior trip matrix which are arranged in a matrix form Origin-Destination (OD) and obtained the following table:

3.2 Discussion on Results and Calculation

To determine the accuracy of estimation techniques Bayesian Inference method, necessary to determine the level of accuracy of the trip posterior matrices obtained from the estimation process by comparing the results of the trip matrix obtained from field observations. The results of the estimation process is determined by using several statistical tests, among others: Comparison Matrix Posterior journey with Journey Observation Matrix for Light Vehicle as seen in the table below.

From the table above shows the total number of matrices trip posterior 299.66 and the total amount the average observation trip 320.5 matrix, where in the matrix is smaller than the posterior trip matrix observation trip. This figure shows that the increase in the number of light vehicles as much as 7 in one year.

Table 4: Average journey Posterior Matrix KR

From/To	1	2	3	4	Total
1	0	16.73	52.59	8.15	77.47
2	46.3	0	13.86	0	60.16
3	50.09	4.95	0	0	55.04
4	72.95	29.29	4.75	0	106.99
Total	169.34	50.97	71.2	8.15	299.66

Source: Results Analysis

Table 5: Average journey Posterior Matrix KR

From/To	1	2	3	4	Total
1	0	54.5	36.75	80.75	172
2	24.25	0	6.5 0	30.75	
3	25.5	6.25	0	0	31.75
4	47.75	37.5	0.75	0	86
Total	97.5	98.25	44	80.75	320.5

Source: Results Analysis

4 Conclusion

In a case study in ITN intersection,

a. Bayes Inference Methods used to modify or repair the trip distribution matrix prior to the trip matrix of the posterior distribution. Matrix trip posterior distribution obtained is incorporation value matrix information prior trip and travel matrix of observations made, is the basis for calculating traffic volume be searched. Then the posterior distribution of travel matrix is proportion to produce a matrix of travel.

b. From the data processing, where in the matrix of the posterior and matrices trip total number of observations in the field of matrices trip posterior 299.66 and the total amount of the average matric 320.5 observation trip in Light Vehicle (KR), where in the matrix is smaller than the posterior trip matrix observation trip. This figure shows that the increase in the number of light vehicles around 7 in one year.

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