ROUTE CHOICE ESTIMATION BASED ON CDR DATA IN YANGON

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ABSTRACT: Traditional methods for traffic forecasting and planning need a lot of data and time. Traditional traffic detection systems (camera, loop detector, etc.) require costly infrastructure and can't able for overall road network. Lately, the new technologies are used for traffic modeling such as CDRs (Call Detail Records) from mobile phone. These signaling data of mobile phones can be used as valuable information for traffic design, traffic controlling and also commercial application. This paper aim to express the route choice estimation based on mobile signaling data at the selected urban area in Yangon by using GIS .By tracing the mobile phones CDRs data road choice estimation can be determined. If traffic modeling can be done from CDRs data in developing countries, this method can be saved time and money because it does not need additional infrastructure. This route choice estimation is important for traffic modeling and transportation planning.

1. INTRODUCTION

Understanding the dynamic change in traffic distribution and people flow is very important issues in urban areas, especially in rapidly growing cities for urban planners. For the effective survey, detailed and up-to-date information of the current person flow is required.

The conventional method to understand people movement rely mainly on quickly outdated survey or segmented information an traffic flow and travel time. Nowadays, many researchers are focusing on understanding human mobility features using mobile phone data. CDRs data are attractive that they are already being collected to help operate the networks, so that additional uses of CDRs data are low cost.

In urban road traffic network the route choice behavior of vehicles is a real challenge. The paper proposes to estimate route choices of travelers by associating mobile phone data with traffic assignment using Network analyst tool in ArcGIS.

Route choice involves finding the shortest or the fastest route between any two given points. The shortest is obtained by minimizing the distance between the origin and destination points (Dr.Francisco et al.2010). The origin and destination points are derived from CDRs data and those points are inputted in GIS to estimate the shortest route by using Network analysis tool. The finding of shortest route is based on travel time. As GIS have been widely used in transportation management and planning, the author hope to provide the useful way of route choice or route finding method in this field. Without attempting to provide a detailed survey, we refer to way for

route choice estimation based on mobile network data.

This paper is organized as follows. Section 2 explains the nature of CDR data and voronoi zones. Next, we explain the procedures of OD pairs extraction from CDR. Data usage is one person, one day trips and we used the secondary OD data to estimate the route choice. After that, the step by step procedures of route finding method are explained.

2. CDRs Data (Call Detail Records)

CDR is a data record produced by a telephone exchange or mobile operator that documents the details of a telephone call or communications transaction that passed through that facility or device. The data includes the time stamp and the location for every phone call made by all user of a particular carrier. We can estimate trips by tracing the mobile signaling data. The main potential of the signaling events is the opportunity to use them without any additional infrastructure. Though new data sources such as CDRs do not provide the same detailed demographic and contextual information about individuals or trips, they do provide an opportunity to measure travel more deeply. It is possible to estimate travel demand and other transportation elements due to mobile phone has become one of the main sensors of human mobility at a large scale.

2.1 Voronoi Zones

A GSM telecommunication network consists of radio cells. A cell represents geographic coverage area of a base transceiver station. Mobile signaling data are automatically recorded by cell towers with their coverage area for billing purposes. Voronoi diagram can be created by using ArcGIS. If the voronoi diagram of the mobile network is known and mobile data are captured, route choice estimation can be done.

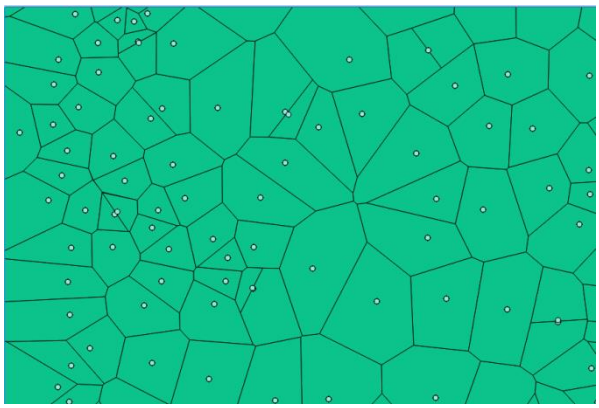


Figure 1.Voronoi Zones

3. Route Choice Estimation

Route Choice Estimation is important parts of the classic four steps modal. In the four steps modal consists of trip generation, trip distribution, modal split and route assignment. Trip generation aims to define the total numbers of trips generated by the set of origins and attracted by the set of destinations within the study area. The trip distribution step intends to predict the number of trips concerning each OD pairs. The estimation of modal split gives

the percentage of travelers using a particular type of transportation. The last element of the traffic fore casting process is the distribution of traffic among transportation network. The route choice estimation is carried out by using the GIS tool. There are several methods for route choice from OD pairs. But we aim to use shortest path method from Network analysis. This method is weighted by travel time and can give the possible solution. The data requirement for rout choice estimation in ArcGIS are OD data, Road network data (nodes and links).

4. Methodology for OD pairs

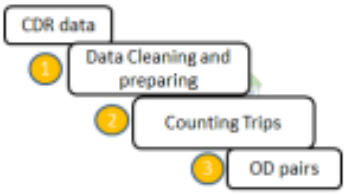


Figure 2. Methodology for OD pairs

The procedure can be summarized as follow .
- Data preparing (Data usage is one person, one day trips)
- Counting trips
- OD pairs

4.1. Data Preparing of CDRs Data

There are two files in CDR data. i.e, data files and voice file At first, we have to clean the data due to errors and noise. Extract the common column in data and voice files such as GSM-ID, Cell-ID, location of cell tower, Date and time column. Merged these column with the same GSM-ID, Cell-ID and location column of these two data files.

4.2. Counting Trips

For the trips, voronoi zones are defined as OD zones . A Trips is defined as when the same mobile phone user is occurred in different voronoi zones within one hour. (Wang.et.al). Count all the trips of one person who make trips during one day by tracing the CDRs data.

4.3. OD pairs

At least, two signaling events are needed to create a chain of cell. After counting the trips, the origin and destination cells of the trip forming an OD pairs. OD flows can also be defined such as a path starting in the origin region and ending in the destination region. The location of origin and destination points can know by the CDRs data recorded by cell towers. However, all trips can't be OD pairs because some are extract which take more than one hour during origin and destination points.

4.4 Data used

Mobile phone data and Yangon Road network data.

NO	SIM_ID	Lon	Lat	D&T
1	9592034956	96.33289	16.91825	12/1/2015 7:30
2	9592034956	96.29718	16.95762	12/1/2015 7:47
3	9592034956	96.29718	16.95762	12/1/2015 10:27
4	9592034956	96.2354	16.96291	12/1/2015 10:38
5	9592034956	96.2354	16.96291	12/1/2015 10:38
6	9592034956	96.27025	16.93077	12/1/2015 11:18
7	9592034956	96.27025	16.93077	12/1/2015 11:20
8	9592034956	96.27025	16.93077	12/1/2015 11:27
9	9592034956	96.27025	16.93077	12/1/2015 14:36
10	9592034956	96.14559	16.85888	12/1/2015 14:47
11	9592034956	96.14559	16.85888	12/1/2015 14:47
12	9592034956	96.18051	16.8056	12/1/2015 15:03
13	9592034956	96.18051	16.8056	12/1/2015 15:03
14	9592034956	96.17706	16.80752	12/1/2015 15:07

Figure 3. Number of trips for one person for one day

1	9592034956.00	96.33289	16.91825	96.29718	16.95762	12/1/2015 7:30	12/1/2015 7:47
2	9592034956.00	96.29718	16.95762	96.2354	16.96291	12/1/2015 10:27	12/1/2015 10:38
3	9592034956.00	96.2354	16.96291	96.27025	16.93077	12/1/2015 10:38	12/1/2015 11:18
4	9592034956.00	96.27025	16.93077	96.27025	16.93077	12/1/2015 11:20	12/1/2015 11:27
5	9592034956.00	96.27025	16.93077	96.14559	16.85888	12/1/2015 14:36	12/1/2015 14:47
6	9592034956.00	96.14559	16.85888	96.18051	16.8056	12/1/2015 14:47	12/1/2015 15:03
7	9592034956.00	96.18051	16.8056	96.17706	16.80752	12/1/2015 15:03	12/1/2015 15:07

Figure 4. OD pairs

5. Application and results

Figure 5. Application procedures

The OD data is only one mobile subscriber for one day CDRs records. The road network data is Yangon road network data set and these are obtained from the JACA organization. Figure 6 shows the Yangon road network. Roads are classified based on their functional classification.

Figure 6. Yangon Road network

Network Analyst extension was added to ArcGIS from the network analyst toolbar. The Yangon road network data and OD pairs are also added to the ArcGIS.

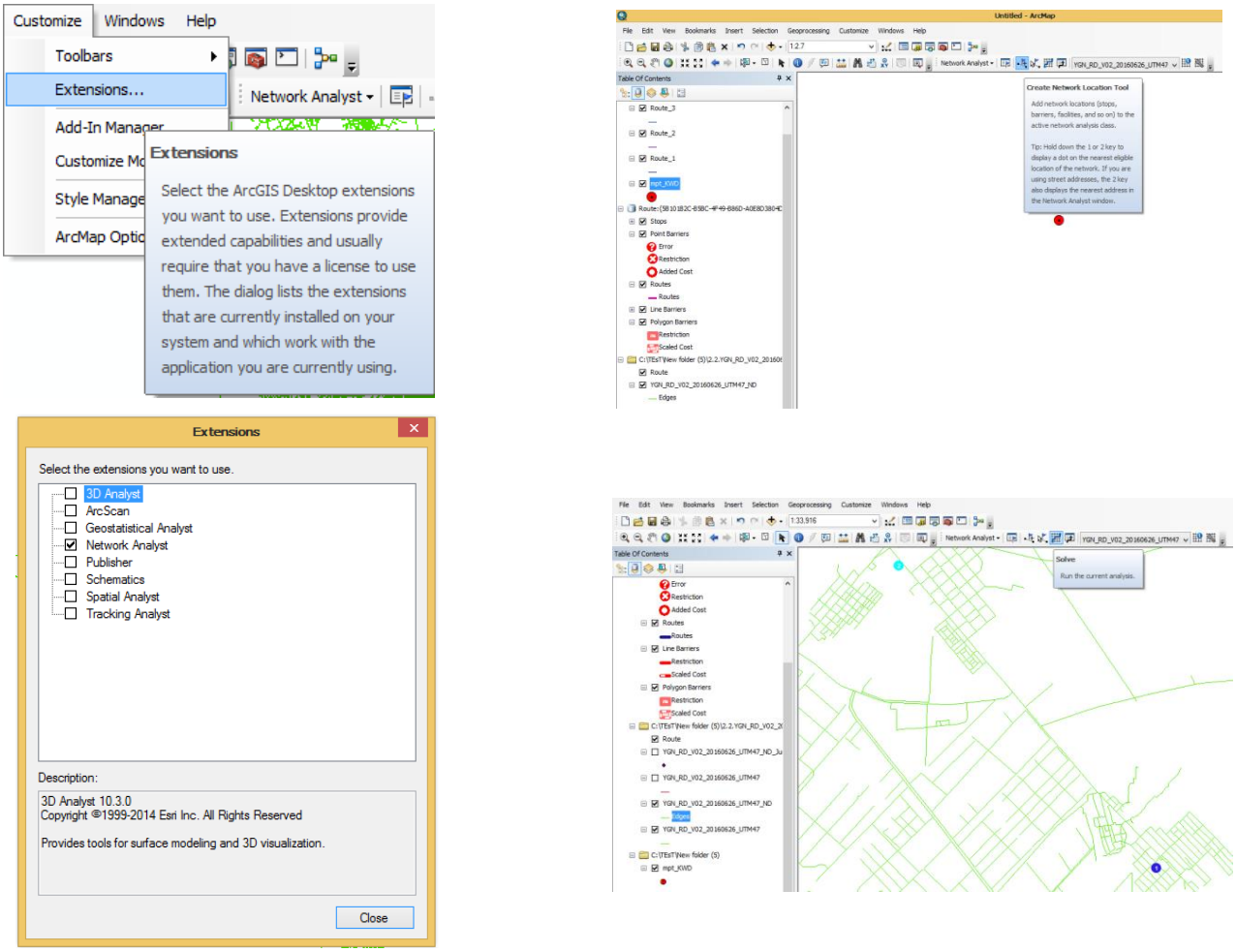


Figure 7 . Network Analyst

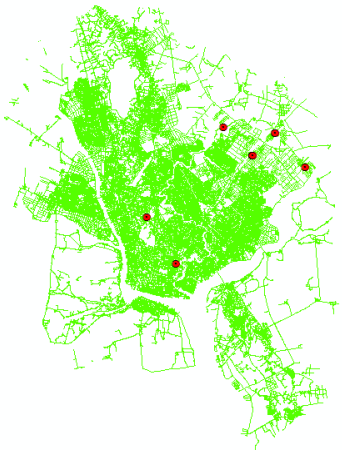


Figure 8. Adding Road network and OD pairs

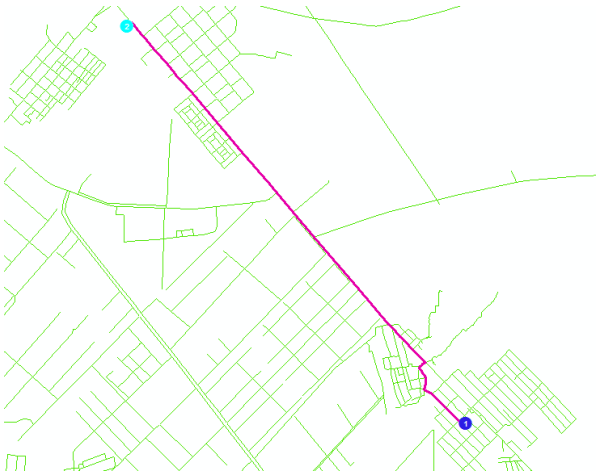
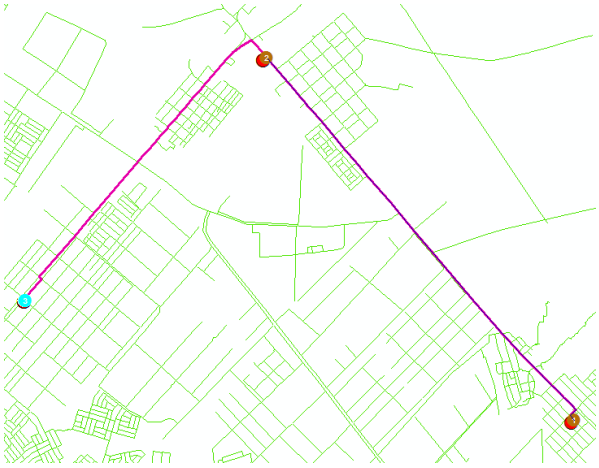
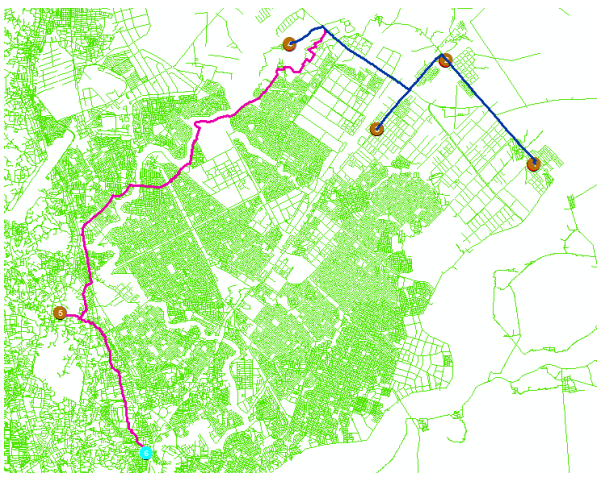


Figure 9. Shortest route found by Network Analyst



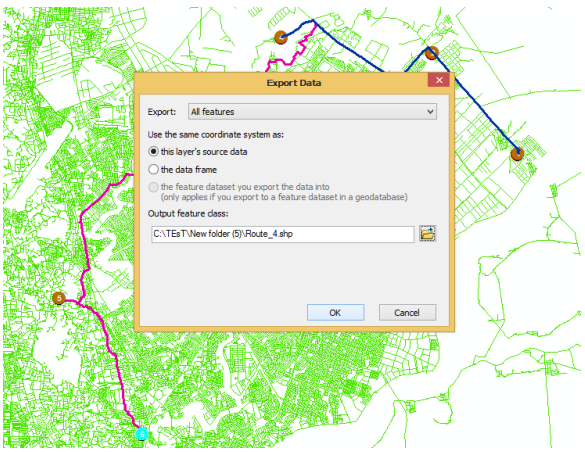
(a)

(b)

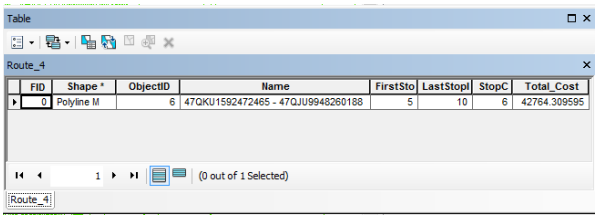


(C)

Figure 10. (a),(b),(c)showing shortest path of each OD pairs



(a)



(b)

Figure 11. (a),(b) Showing data export and Attribute table

6. Conclusion and Discussion

In this paper, we estimated the road choice for each OD pairs by using ArcGIS from CDR(Call Detail Records). The objective of this paper is to the find possible route choice based on CDRs OD pairs by Using ArcGIS. There are limitations by using CDRs data. That is CDRs data are not possible to determine the precise location of the mobile phone users throughout the day due to location data are obtained when the mobile users use telecommunication. The number of trips from the CDRs data is very small and we have to expend these trips to get the actual trips by using demographic data. This paper is mainly focus on GIS procedures and the route choice estimation is made by shortest path method in network analyst and the correlation and reliability is low. Therefore,We hope better methods for route choice in transportation planning are developed in future.

7. References

[1] Wang, P.et al. 2012. Understanding road usage patterns in urban areas. Scientific reports.2, (Jan.2012), 1001.

[2] Yoko.et al, Yoshihide Sekimoto, et al. Transportation Melting Pot Dhaka: Road-link Based Traffic Volume Estimation from Spares CDRs data.

[3] Framcorse, et al, Designing Origin-Destination Flow Matrices from Individual Mobile Phone Path.

[4] Dr. Francisco Olivera, Finding a Reliable Rout Between Two Points in a Transportation Network Using GIS