ENV 211 Sustainable Cities

Lilit Ghandilyan

Fall 2018

Data Analytics for Yerevan's Transportation

Final Project

Today, 54 percent of the world's population lives in urban areas, and this proportion is predicted to grow up to 68 percent by 2050 [1]. With a growing urban population, the issues cities need to address are becoming more and more complex. Although Yerevan's population has not risen substantially over the last years, the number of cars has significantly increased [2]. This growth results in more traffic congestions, parking difficulties, long commuting and more accidents. Many countries have been using data analytics to improve their traffic flow and mobility in the cities. This paper is a proposal to Yerevan's municipality to apply similar data analytics project to Yerevan.

The quantity of data we produce daily has been growing exponentially over the last decade [3]. This data comes from multiple sources, such as smartphones, drones, GPS devices, road cameras, etc. Although unstructured and hard to process, it contains valuable insights that can be useful in different fields. One such example is transportation, and as many precedents show, data analytics can help make significant improvements in this field.

Transportation affects the lives of many. Bad traffic, long commutes, unsafe driving, the inability to park can be not only frustrating but also harmful to the health of the public. The UN Sustainability Goals include goals such as Improving Road Safety (Goal 3), improving energy efficiency in the transport sector (Goal 7), development of quality, reliable, sustainable and resilient transport infrastructure (Goal 9), improvement of the urban public transportation system (Goal 11) [4].

My intervention for this project is analyzing data from a major taxi company in Armenia called GG. Although the most useful information for traffic data analysis is real-time data, past data can show some insights that can be extracted from rows and columns of data. The data contains information on the taxi orders in 2016. Every row is a separate order and the most useful columns for the scope of this project were the order origin and destination coordinates, the time when the order was created and completed. The data could be used to answer questions such as which, days and hours (See Fig. 1,2) are the busiest. As an example, this information can be used to plan further steps for traffic management and control on these special times. Decisions such as when to add more public transportation means can be effectively based on such analysis.

day <S3: POSIXct>	count <int>
2016-12-26	35955
2016-11-01	29123
2016-09-16	27678
2016-12-27	27397
2016-12-23	24756
2016-12-28	24727
2016-12-16	23087
2016-12-29	22285
2016-12-20	21085
2016-12-19	20503

Figure 1. Taxi dates with the most number of orders. The blue circle dates are the dates which fall around New Year.

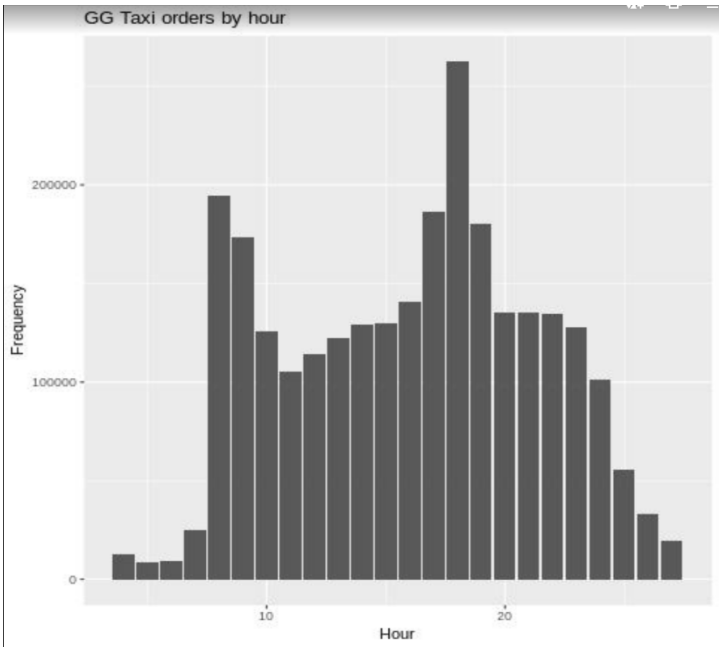

Figure 2

Some other questions that I was curious to find answers were where people go for lunch (See Fig. 3) or when people come to the American University of Armenia (See Fig. 4). For the first one, I chose only the data points from 1 pm to 2 pm (the most typical lunchtime). Although the result is noisy, the general trend is coming to Kentron area. To answer the second question, as the data is geographical, I isolated the orders which had the destination coordinates pointing to the AUA area. The result is

predictable. The peak hours are from 9 am to 11 am. These are just some examples of how insights can be extracted from raw data.

Figure 3

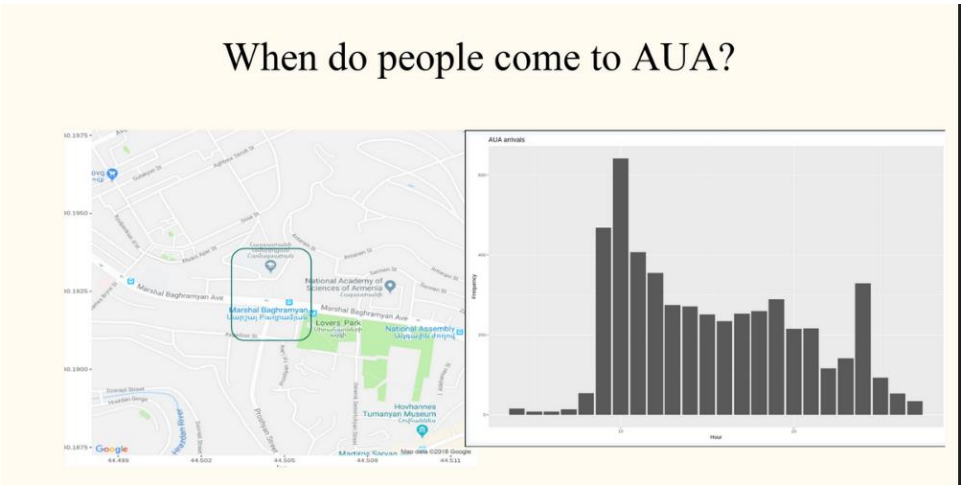

Figure 4

Examples of successful data analytics projects include Dublin and Stockholm [5]. The goal of the Dublin City Council was to improve the bus system of the city, reduce the increasing traffic congestions without making a significant modification to the city's historic infrastructure. They used GPS devices from 1000 buses, bus timetables, traffic sensors to find the optimal time to start the bus lanes, the best place to add more lanes. The result was improved traffic and mobility. The city of Stockholm used data from 20.000 vehicles mostly from taxi drivers and trucks. Combined with historical traffic data this resulted in more accurate predictions for future traffic. The results serve firefighters, ambulance and policeman to find the fastest routes as well as public and urban planners.

Data analytics offers lots of benefits, but it can be challenging too [5]. These projects deal with tasks such as storage and processing vast amounts of data, usage of both unstructured and structured data, development of real-time traffic monitoring applications, etc. Many big data analytics solutions

offer an abstraction of the engineering effort to deal with the storage and computation requirements. Another challenge can be lack of professionals in the field which can be solved by workshops and specialized courses.

As the number of cars in Yerevan is increasing, it is time to add data analytics to our toolbox to have a smarter and more sustainable city. It can help the city of Yerevan to reduce traffic congestions, identify traffic problems, better monitor and manage the traffic, improve traffic flow and mobility.

References

[1] 68% of the world population projected to live in urban areas by 2050, says UN. (2018). Retrieved from https://www.un.org/development/desa/en/news/population/2018-revision-of-world-urbanization-prospects.html.

[2] Number of insured cars in Armenia has grown from 390,457 in 2011 to 457,878 in 2015. (2016). Retrieved from http://www.armbanks.am/en/2016/02/03/94938/

[3] Marr, B. (n.d.). How Much Data Do We Create Every Day? The Mind-Blowing Stats Everyone Should Read. *Forbes*. Retrieved from https://www.forbes.com/sites/bernardmarr/2018/05/21/how-much-data-do-we-create-every-day-the-mind-blowing-stats-everyone-should-read/#62de35360ba9.

[4] 17 Goals to Transform Our World. (2018). *UN*. Retrieved from https://www.un.org/sustainabledevelopment/.

[5] Ayed, A. B. (2015). Big Data Analytics for Logistics and Transportation. *ResearchGate*.