Methods of Advanced Data Engineering (MADE)

Analysis Report

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1. Introduction

The main objective of this report is to **analyze and understand the major impact of weather and climate conditions on average daily traffic counts**. With traffic congestion being a significant issue in urban areas, comprehending how different weather conditions influence traffic patterns can provide valuable insights for city planners, emergency services, and the general public. **This study focuses on the city of Chicago, examining data from the year 2006**. By correlating traffic data with weather conditions, this analysis aims to highlight how various climatic factors affect daily commuting, which can be instrumental in developing strategies to mitigate traffic-related problems and improve public health and safety.

2. Used Data

In this analysis, two main datasets were utilized: **traffic count data and weather data for the city of Chicago for the year 2006**. The traffic data comprises average daily traffic counts, providing insights into the volume of traffic flow on a monthly basis. The weather data includes detailed information about daily weather conditions, average temperature, precipitation, snow, wind speed and other relevant climatic factors.

id	month	traffic
1	JAN	104600
2	FEB	220400
3	MAR	3854900
4	APR	1002000
5	MAY	698100
6	JUN	35200
7	JUL	12600
8	AUG	6481000
9	SEP	3751900
10	OCT	6903400
11	NOV	1621400
12	DEC	211900

Figure 1: Traffic Data

id	month	avg_temp	snowfall	precipitation	wind_speed
1	JAN	-2.16	73.46	0.1	17.23
2	FEB	-9.0	59.16	0.05	17.21
3	MAR	-2.15	66.22	0.08	17.52
4	APR	2.77	55.69	0.12	18.0
5	MAY	8.57	64.86	0.1	14.25
6	JUN	11.6	57.32	0.11	14.36
7	JUL	18.01	65.04	0.1	13.77
8	AUG	16.91	66.24	0.14	13.42
9	SEP	11.74	68.74	0.13	13.62
10	OCT	3.5	63.04	0.19	16.07
11	NOV	0.84	64.21	0.09	14.23
12	DEC	-3.13	68.29	0.1	16.75

Figure 2: Weather Data

- **Data sources licenses & obligations:** Traffic and Weather data sets have been collected from public sources and available for free use. **Data.Gov** provide license for the used traffic data set and **Meteostat** provides weather data licensed under non-commercial terms (CC BY-NC 4.0), allowing for sharing and non-commercial use.

3. Analysis

Finding the correlation between average daily traffic numbers and meteorological conditions required multiple phases in the investigation. Regression modeling, correlation analysis, and descriptive statistics were among the techniques employed. These techniques were used in order to guarantee a solid comprehension of the data and to extract significant insights.

- **Descriptive Statistics**: At first, the data were compiled using descriptive statistics to give an overview of the distribution of traffic counts and meteorological conditions. This involved figuring out the means, medians, and standard deviations as well as utilizing line charts and histograms to visualize the data.
- **Correlation Analysis**: The direction and strength of the association between traffic counts and different weather conditions were ascertained by correlation analysis. For example, traffic count vs temperature, traffic count vs precipitation, and traffic count vs snowfall were among the pairings of variables for which Pearson correlation coefficients were computed.
- **Regression Modeling**: Multiple linear regression models were developed in order to investigate the link in more detail and forecast traffic patterns based on meteorological conditions. The dependent variable in these models was the number of traffic, while the independent variables were the weather.

After analyzing the traffic and weather data set the findings showcased in which way the traffic is being affected by the weather condition.

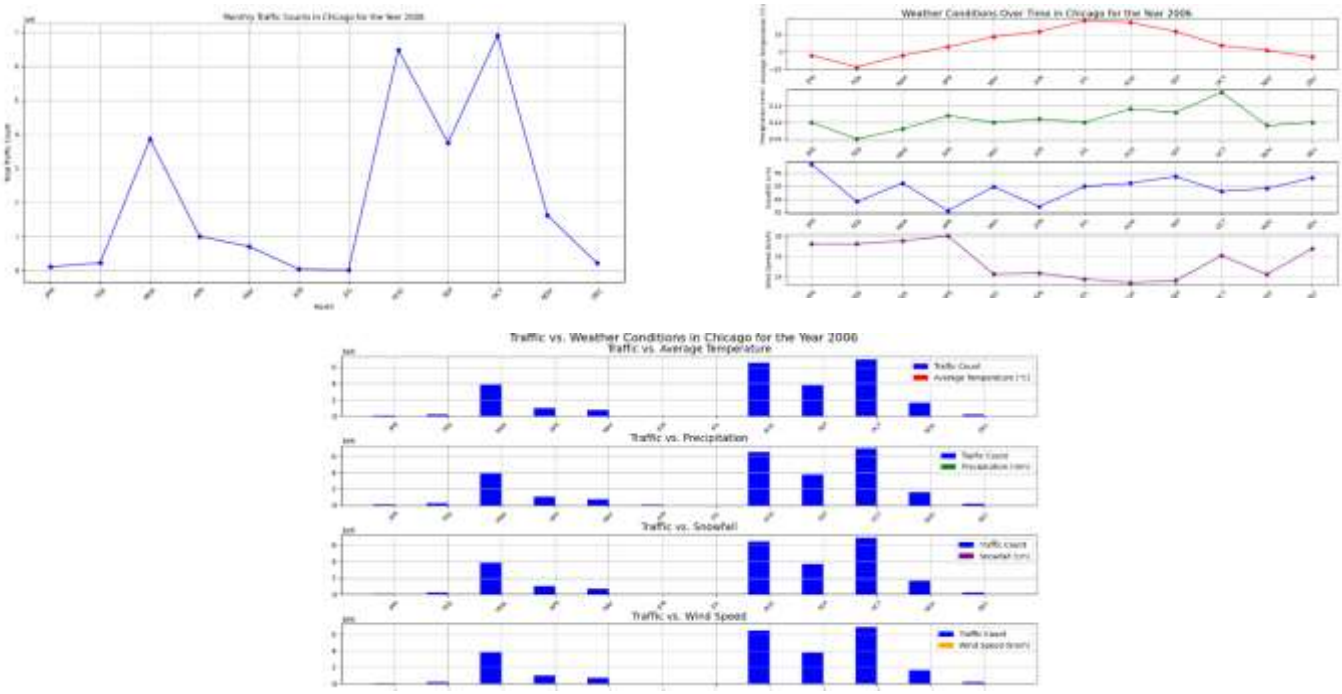

Figure 3: A brief graphical overview of Data Set

- **Temperature**: There was a noticeable decrease in traffic counts on extremely cold days. Warmer temperatures generally correlated with higher traffic counts, indicating that adverse cold conditions discourage travel.

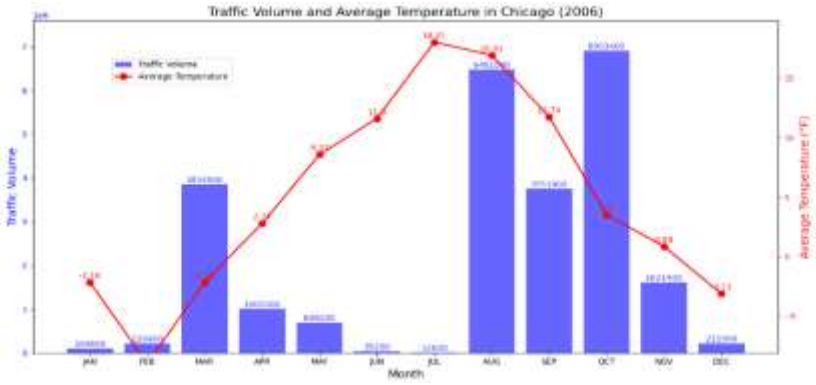

Figure 4: Traffic & Temperature Relation

- **Precipitation**: Rainfall had a significant impact on reducing traffic counts. Heavy rainfall days saw a substantial drop in traffic, suggesting that people prefer to stay indoors or use alternative modes of transportation during such conditions.

Figure 5: Traffic & Precipitation Relation

- **Snowfall**: Snow had the most pronounced effect on reducing traffic counts. Snowy days recorded the lowest traffic counts, highlighting the disruptive impact of snow on daily commutes.

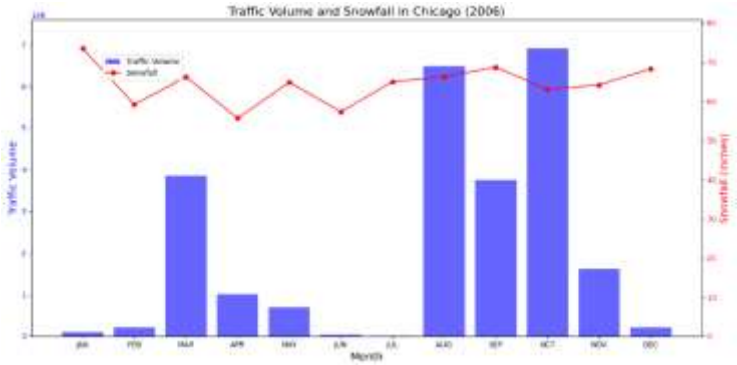

Figure 6: Traffic & Snow Fall Relation

These findings indicate that weather conditions have a tangible impact on daily traffic volumes, with extreme weather (both hot and cold) and precipitation (rain and snow) leading to reduced traffic counts. If we further dig down into this scenario, we find the correlation and impact of weather condition on our daily traffic volume. In accordance with that the ration of changes can be seen season wise as well.

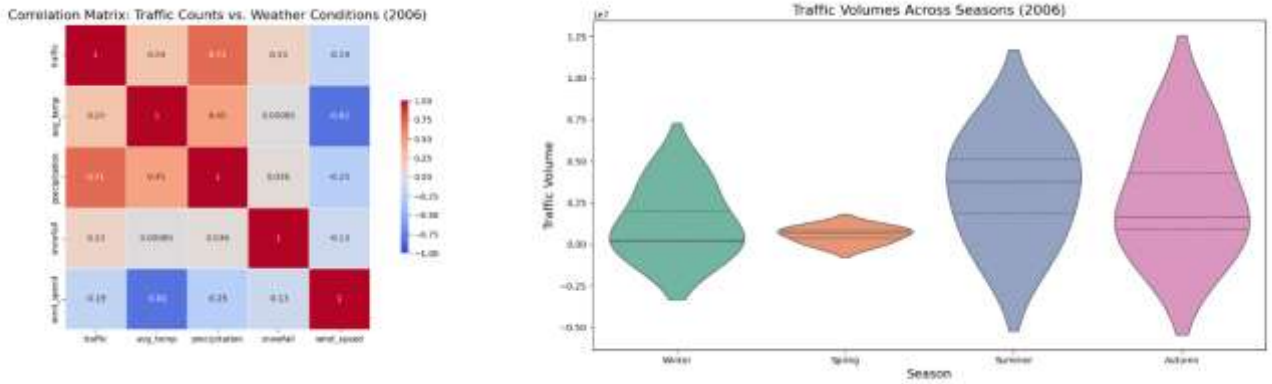

Figure 7: Detailed Graphical overview of Data Set

4. Conclusions

The analysis conclusively shows that weather and climate conditions significantly impact average daily traffic counts in Chicago. Extreme temperatures, heavy rainfall, and snowfall are associated with decreased traffic volumes, as they likely deter people from traveling. This understanding can be particularly beneficial for several stakeholders:

- **Emergency Travelers**: By providing insights into how weather conditions affect traffic, emergency services can better plan routes and avoid heavily impacted areas, ensuring timely and efficient response.

- **Public Health Awareness**: The findings can raise awareness about the health impacts of traffic congestion and air pollution. Reducing unnecessary travel during adverse weather can mitigate health risks associated with prolonged exposure to traffic emissions.
- **Environmental Impact**: Understanding traffic patterns in relation to weather can help in formulating policies to reduce air pollution. For instance, encouraging public transportation during adverse weather can decrease the number of vehicles on the road, thereby reducing pollution levels.

In conclusion, there are limits even if the analysis offers valuable insights into how traffic patterns and meteorological conditions are related. Because the study only included data from Chicago for one-year, various time periods or locations may yield different results. To confirm and generalize the results, other research might build on this by examining several years and locations. Notwithstanding these drawbacks, the present research provides a vital basis for comprehending and mitigating the effects of weather on daily traffic, hence enhancing urban planning and public health approaches.