* Visualization Design. How will you display your data? Provide some general ideas that you have for the visualization design: which visualization do you want to use for which aspect. Discuss three alternative prototype designs for your visualizations. Create one final design that incorporates the best of your three designs. Describe your designs and justify your choices of visual encodings. Describe how your visualizations address the analysis questions.
* Must-Have Features. List the features without which you would consider your project to be a failure.
* Optional Features. List the features which you consider to be nice to have, but not critical.
* Project Schedule. Make sure that you plan your work so that you can avoid a big rush right before the final project deadline, and delegate different modules and responsibilities among your team members. Write this in terms of weekly deadlines.

This proposal is the first part of your process book. As a ballpark number: your proposal should contain about 3-4 pages of text, plus 5-6 pages of sketches.

Based on your proposals we will assign a staff member to your team who will guide you through the rest of the project. You will schedule a project review meeting with a staff member. Make sure all of your team members are present at the meeting.

The proposal will be submitted to Canvas.

Proposal

1. Basic Info

The title of our project will be: Visualize the Impact of Meteorological Conditions on Utah 2017 Winter Traffic Patterns. Below is the information of group members.

|  |  |  |
| --- | --- | --- |
| Name | UID | Email |
| Shuying Zhao | U1474799 | Shuying.zhao@utah.edu |
|  |  |  |

The online repository of our project can be found here: <https://github.com/SicoJensennn/2024_Vis_Project.git>.

1. Background and Motivation

Shuying is a graduate student in the department of atmospheric sciences, and she studies atmospheric chemistry, more broadly, air quality. During her research, she found that the on-road vehicles can impact the air quality by multiple ways. On well-known path is that vehicles can emit carbon dioxide (CO2) and methane (CH4), which are significant greenhouse gases due to their high global warming potential (GWP). Another path is that the movement of vehicles can cause vehicle-induced turbulence to influence turbulent mixing which can lift and suspend particles on the road from the road surface. The suspended road dust can increase the concentration of fine particle matters with a diameter less than 2.5 mm (PM2.5) and coarse particle matters with a diameter between 2.5 mm and 10 mm (PM10). This will further impact human health. Moreover, the road salt applied in winter to prevent ice formation to maintain road safety can be suspended into the air and undergoes many chemical reactions to form chlorine nitrite (ClNO2). The formation of ClNO2 plays a significant role in wintertime atmospheric chemistry, as it can trigger reactions that affect the concentrations of PM2.5, PM10, O3 eventually upon sunrise.   
Studying the impact of meteorological conditions—such as wind speed, temperature, precipitation, and snowfall—on winter traffic patterns can provide valuable insights into seasonal variations in traffic flow.

By analyzing how weather influences driver behavior and traffic volume, we can develop predictive models to forecast traffic patterns more accurately during winter months. This, in turn, enables us to predict air quality more effectively, as traffic density and flow are major contributors to urban air pollution. Understanding these connections allows for better planning and management of both transportation and environmental health, helping reduce emissions and mitigate health risks associated with poor air quality during wintertime.

1. Data

|  |  |  |
| --- | --- | --- |
| Data | Source | Link |
| Traffic Volume | U.S. Department of Transportation | https://www.fhwa.dot.gov/policyinformation/tables/tmasdata/ |
| Traffic Monitor Stations | U.S. Department of Transportation | https://www.fhwa.dot.gov/policyinformation/tables/tmasdata/ |
| Meteorological Reanalysis Data | GEOS-Chem | https://geoschem.github.io |
| US Map |  | https://gist.github.com/mshafrir/2646763 |

GEOS-Chem is a global 3-D model of atmospheric chemistry drive by meteorological input from the Goddard Earth Observing System (GEOS) of the NASA Global Modelling and Assimilation Office. The grid resolution we are going to use is 0.25 \* 0.3125. And the time we selected are from Jan 2017 to Mar 2017.

1. Data Processing

There are a few of substantial data clean up we need to do.

1. For the traffic volume data, we need to select Utah data, uniform the data type, and set the traffic volume to 0 if the dates are not in the table.
2. For the traffic stations, we need to select stations in Utah.
3. For the meteorological data, we need to find the grids that cover Utah, and we need to select the variables like temperature, snowfall and so on for us to use.
4. Analysis Problems
5. Do traffic flows have different patterns during the week and on weekends
6. Do traffic flows have diurnal patterns
7. Is there any relationship between the weather conditions and traffic flow
8. Which meteorology factors impact the most
9. Do the traffic flows in Salt Lake City less affected by weather conditions than in other areas?
10. Visualization Design
11. Weekly Patterns (Question 1)

* Bar chart showing traffic volume by day
* Color coding for weekday vs weekend

1. Daily Patterns (Question 2)

* Line chart showing 24-hour traffic patterns
* Separate lines for weekday and weekend patterns

1. Weather Impact (Questions 3 & 4)

* Scatter plot of traffic volume vs temperature, precipitation and combine with the interactive gridded map each grid
* For each factor, make a gridded map

1. For the final design, we are going to use a gridded interactive map, when clicking each map, you can see the traffic patterns (Question 1 & 2), and you can see how much the weather impact the traffic (Question 3 & 4).
2. Must-have Features

Interactive, user-interface, consistent color scheme for data representation, weather correlation display, traffic flow distribution, traffic flow diurnal and weekly patterns.

1. Optional Features

Correlation heatmap, user can filter the data like custom date range selection, zoom capabilities for detailed time period, animation of traffic patterns over time.

1. Proposal Schedule