Basic Information.

Title: “Traffic routes in the state of Utah” (may change at a later date).
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Project Repository link: https://github.com/xiaoyatang/Final-Project-VIS-2022.git (Since our repository is private, we have added the TAs accounts to the collaborators.)

Background and Motivation (from proposal).

Background:
Background work that was done on this subject is the reading of “Topological Analysis of the Evolution of Public Transport Networks”. This article analyzed the topology of Stockholm's tram lines, calculated multiple metrics like the Pearson coefficient and closeness centrality, and visualized node charts with those metrics for coloring. This project showed that topological analysis describes the significance of important stations through the amount of their connections and age of creation, as the backbone of the network tends to be made first.

Motivation:
Topological Analysis is a powerful tool for understanding the relationships within complex data. Applying this to public transportation networks is useful for route planners and riders. An example is that route planners can analyze the connections of a traffic route with respect to how close it is to a core of the network. A dashboard for visualizing these properties could prove to be a powerful tool for better planning.

Milena:
What motivated me to do this project was the possibility of creating dynamic visualizations as well as the project's close connection to topology. I am currently working under Professor Bei Wang-Philips, who is known for her love for topology, so after learning many new things as her laboratory rotation student, I plan to implement them in this project. Creating a project using a programming language I have not used for projects before is very challenging but exciting at the same time, so I am looking forward to seeing how we all do our best to achieve set goals.

Tark:
I think this project will apply everything we’ve learned in this class so far while providing more challenges due to the preprocessing work. New techniques we will have to learn are how to zoom on maps, combine state and city views, and display routes onto maps.

Xiaoya:
I am thrilled to apply what I learn from this class to a truly meaningful project. The first idea came to us is to make a route map of the public transportation in Utah, especially in Salt Lake ++City. Traffic routes on maps are often not intuitive. I think a nice-illustrated public transportation network can be truly helpful in route planning and time schedule, especially for newcomers like us. What we also want to do is to see the changes of traffic routes in this city during recent years, and to explore its connection with human and economic factors like population distribution or annual tourism revenue in a city. There are many fascinating visual analyses that can be done if we want to go further.

Project Objectives (from proposal).
The most important entities for our project will be bus stops, railway stations and their connection to different routes in a large range of years (depending on how many datasets we can find). We hope users can choose the correct paths using our visualization and we can also see the obvious change of traffic routes in the state of Utah over the years from our visualization.
If we further find some dataset of on-board people during different time slots in one day, we will give a better and detailed transportation map for people who see our work. It will allow people to better schedule their time and to plan the routes. Besides, we may acquire some additional data like population distributions and apply it to the changes of traffic routes(to be determined). We plan to find some interesting connections between the public transportations and some human and economic factors in the city. Also the traffic routes may have some connections with some special facilities like schools, hospitals, supermarkets. We may give them highlights in the map, and we hope to do more fantastic interactions and explorations in our visualizations, besides just including the knowledge acquired from this class.
Some questions that our visualization would provide answers to:

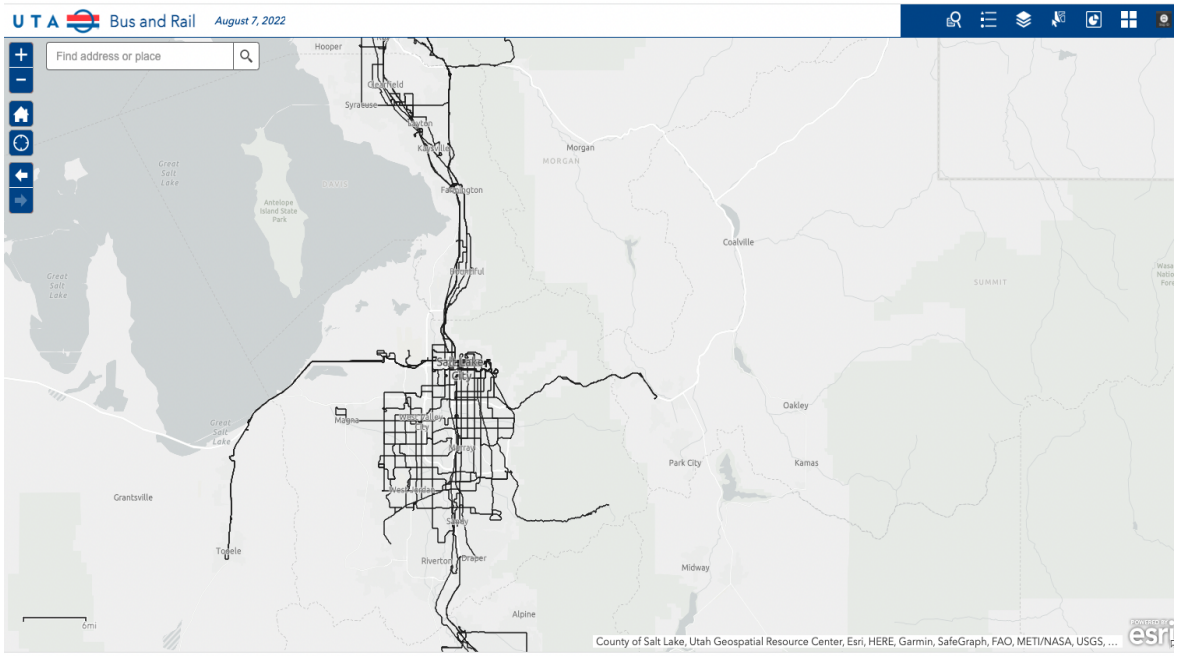
1) How were the routes of different buses changing over the years, and why?
2) Which route (in a selected city) has the best availability? Which has the worst availability?
3) Is there a relationship between usage and number of stops?
4) Does usage of routes correspond to the number of other route connections?
5) What are the connections between most used traffic routes and the nearby facilities?
6) The busiest time slots of the public transportation(potentially).
7) Is there any chance of optimizing public transportations according to our findings?
8) What are the connections between the traffic network and the population distributions in the city, and is there any drawback of the route's design considering the distribution(potentially)?
9) Which city has the best bus transportation availability? (potentially)

Data (from proposal).
One of the main resources our group is using to collect data is the UTA website: https://data-rideuta.opendata.arcgis.com/.
Routes Data URL:
https://data-rideuta.opendata.arcgis.com/datasets/rideuta::uta-routes-and-most-recent-ridership/about
Bus Stops Data URL:
https://data-rideuta.opendata.arcgis.com/datasets/rideuta::uta-stops-and-most-recent-ridership/about

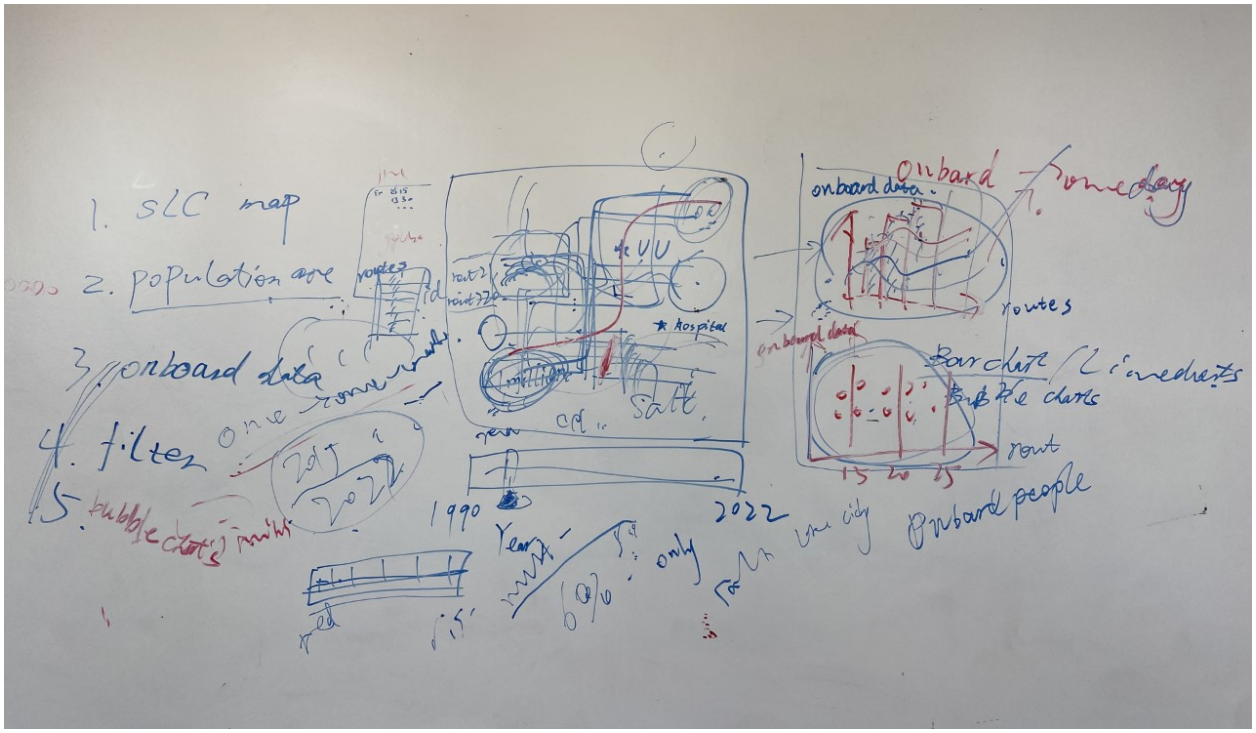
Data Processing (from proposal).
1) Traffic Routes.
Routes JSON file:
https://services.arcgis.com/5QAphMT1g51Tw2X4/arcgis/rest/services/UTA_Routes_0419/FeatureServer/0/query?outFields=*&where=1%3D1&f=geojson
Attributes: route abbreviation, route name, frequency(minutes), route type, city, county, most recent average weekday boardings, shape_length.
Data cleanup: We have concluded that substantial data cleanup is not required, except for adding some "NaN" instead of missing data for certain columns, if we see fit.
2) Bus and rail stops.
Stops JSON file:
https://services.arcgis.com/5QAphMT1g51Tw2X4/arcgis/rest/services/UTA_Stops_and_Most_Recent_Ridership/FeatureServer/0/query?outFields=*&where=1%3D1&f=geojson
Attributes: stop name, city, zip code, county, routes served, stop number (integer), stop abbreviation (text), mode (bus or rail), average weekday boardings and alightings, latitude, longitude.
Data cleanup: We have concluded that we might require some substantial data cleanup but due to the fact that this dataset is secondary, we have not proceeded with it yet.

Here begins the **skeleton**.

1. Inspiration comes from:



2. Our sketch about the final goal:



It includes:

Data:

map.json(Aug. 2022)✅;

stops.json(Nov. 2022)✅;

onboard data(WKD,SAT,and SUN from 2017-2022).csv✅;

Stop Boardings - Bus(WKD,SAT,and SUN from 2020-2022).csv✅

Population(2017).csv/json✅(optional)

highlight positions locations❎; annual data of routes❎(requested)

Graphs:

a. **Map** graph of traffic route in SLC:

*different **colors** for routes and **scale bar** for routes sort by ID (left) (e.g.,use red for buses and different saturated red for bus lines);

***timeline** at the bottom of map(e.g.,from 2017-2022);

***highlight special positions** on map(e.g., hospitals, schools, supermarkets);

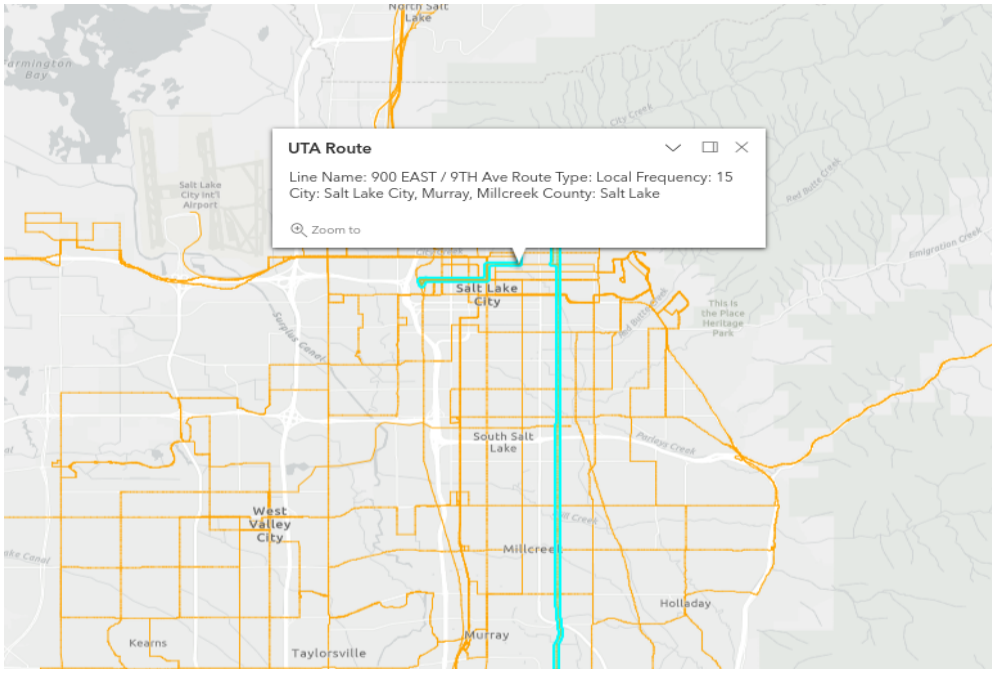
***filter** by time intervals(left side of map, small boxes for 15 mins, 20 mins and 30 mins);

*Use different saturated red to show population distribution in the city.(optional)

Progress: We used the ArcGIS API to visualize transit routes as lines. The map view starts at the northern part of Salt Lake City, but panning and scrolling are supported. The second image shows transit stops as points. Clicking either routes or stops highlights the selection and shows a tooltip with more information.

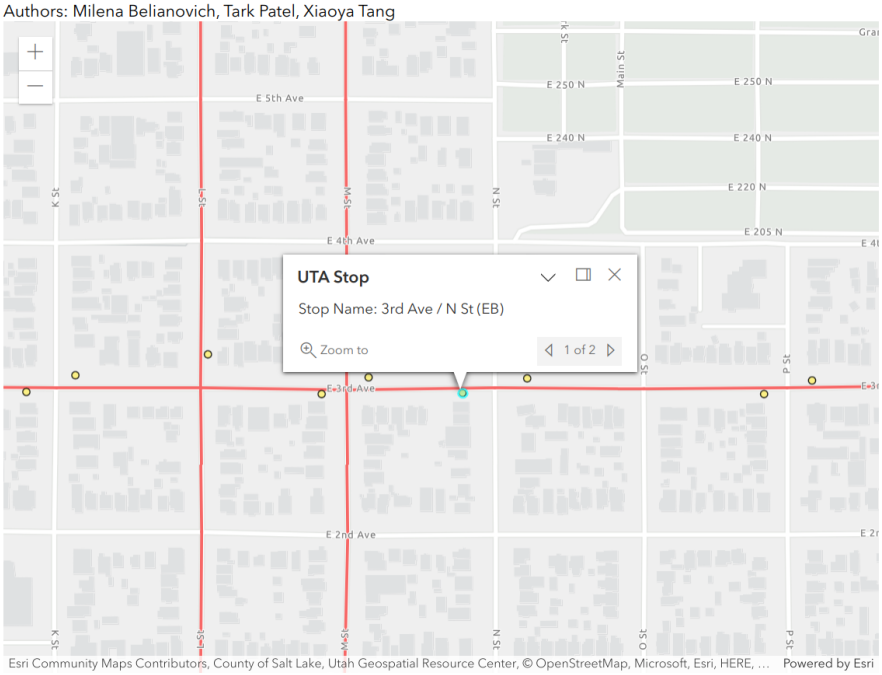
The UTA's official map website uses the ArcGIS API too. We chose this over D3's map because it allows better interaction. Another benefit we found is that clicking selects

multiple elements and there are arrow buttons in the tooltip to switch between them. This is particularly useful when the zoom is far and the number of possible selections is large.



UTA Transit Routes

Authors: Milena Belianovich, Tark Patel, Xiaoya Tang



b. **Bar chart** for interactions with map:

***Basic settings:**

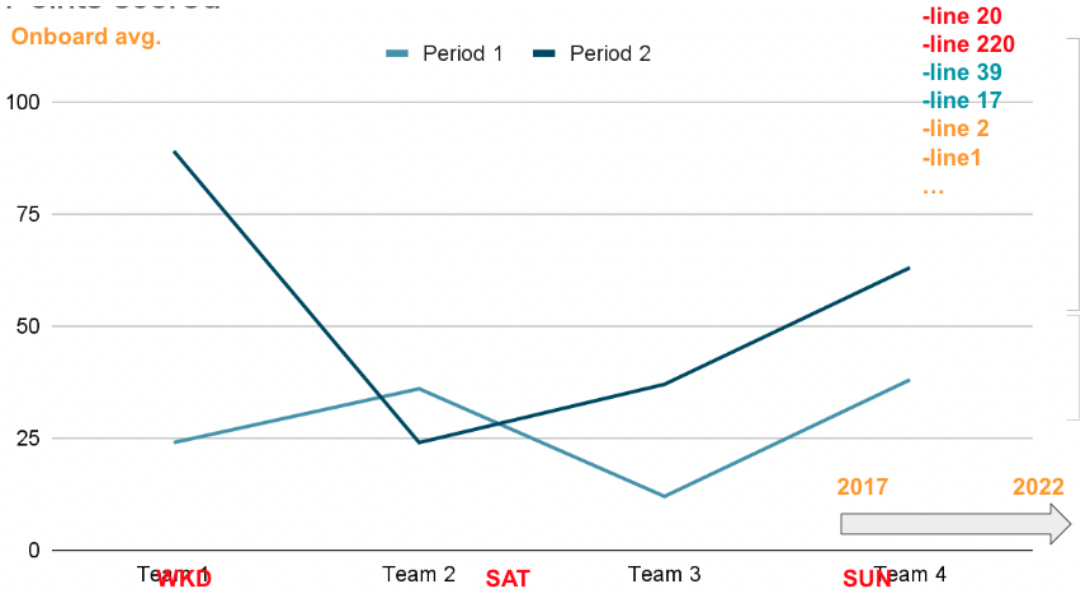
x-axis: WKD, SAT,SUN, y-axis: Onboard data(choose 10 typical lines in different time intervals);

Color: same in map;

Label: sort by ID, same in map;

Timeline: 2017-2022, same in map;

*Interactions: click on any routes in map it will add to line chart, also highlighted;

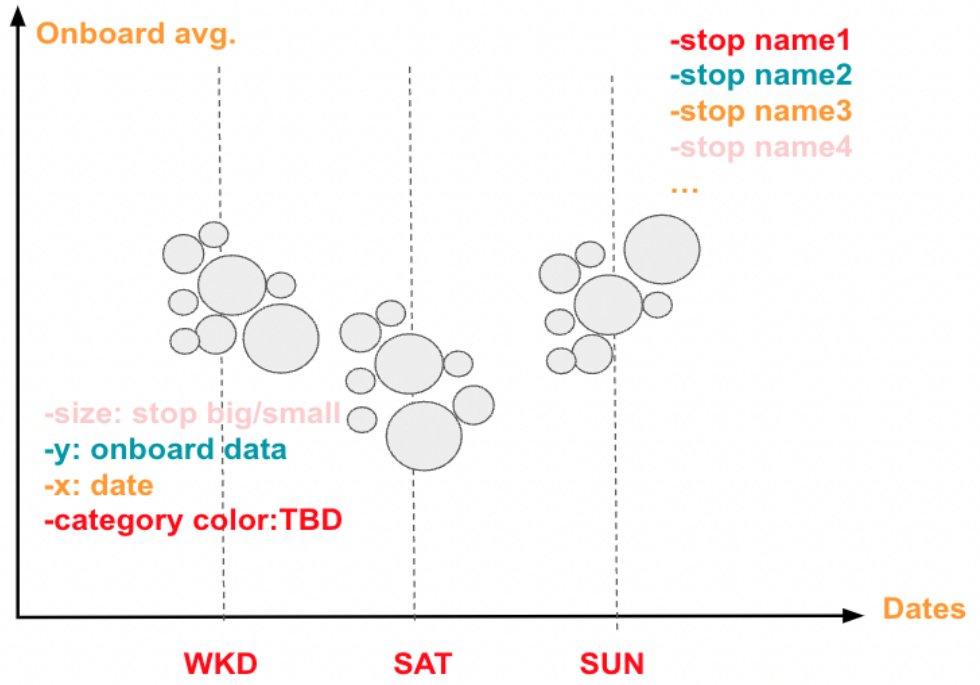


c. **Bubble charts** for interactions with map:

***Basic settings:**

x-axis: WKD, SAT,SUN, y-axis: Stop boarding data(there are 2000 bus stops in SLC); Size of circles: stop big or small? I.e., how many routes serves the stop? Color of circles: TBD.

Interactions: choose boarding or alighting; choose 2020, 2021 or 2022.



3. Timetables:

Overall timetable:

Week	Milena's part	Tark's part	Xiaoya's part	End result for the week
Week 1 (fall break)	Send the request for data acquiring, document the progress. Work on the proposal, upload sketches.	~	Discussing the ideas. Work on the proposal.	Acquired data for traffic routes, proposal draft.
Week 2	Acquire data for bus stops, add files to the data folder on GitHub, upload the proposal.	Help with data preprocessing	Collaborating with the dataset preprocessing. Updating the repository.	Data processing, submit the proposal.
Week 3	Division of working space through different divs, data binding (routes).	Set up basic map view of Utah and cities	Collaborating with the map view.	Initial space division for the map and its extras.
Week 4 (Peer Review)	Data binding (routes) finish, get the feedback for the project.	Add bus and rail stops	Add highlighted locations on the map.	Transit data added to views. Acquire the peer review.
Week 5	Graph ideas & some implementation (if time allows)	Add selecting cities from map vs	Collaborating with the interactivity for routes map and graphs.	Add interactivity for map routes and stops, add filters, add graphs.

Week 6 (Project Milestone)	Peer feedback, debugging (if needed)	Add info on route selection	Finishing the must-have visualizations.	Finish graphs and filters, debugging.
Week 7	Start graph implementing.	TBD	Optimizing the vis. Add potential analysis.	Potential extra work for the visualization as described above.
Week 8	TBD	TBD	Collecting the required files.	Finalize the changes made, make the presentation video, combine all the required files for submission.

Milestone 1 timetable(Nov. 7th - Nov. 11th)

Date	Milena's part	Tark's part	Xiaoya's part	End result for the week
Nov. 7th				1. Hand in our code and our process book in its current state. * Completed data acquisition, data structures are in place. * Working visualization prototype. * GitHub repository updated and opened (or closed with link for instructors). 2.Review with the each other 3. Upload feedback review
Nov. 8th			Write the skeleton of process book, clarify graph details; Specify timetable and tasks.	
Nov. 9th			Data acquisition listed above. Data processing to the right structures.	
Nov. 10th	Write the feedback review file.	Map graph draft, with background and routes on it.		
Nov. 11th	Upload the feedback review file on Github. Edits on the process book.	Create a release on github.	Update the process book. Commit changes to github.	