Project Proposal - Data Visualization

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# Basic Info

The title of our project will be INRIX Origin-Destination visualization. Our team will consist of these three members:

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# Background and Motivation

The University of Utah’s Marković Research Group is trying to convince transportation organizations to purchase services for managing trajectory data. Part of the service they’re trying to propose involves creating a tool that people in operations research and transportation planning can use to better understand traffic patterns. They would like to have a prototype of that tool and we would like to make it for them. One of the most important factors in transportation planning and maintenance is having a good understanding what traffic occurs between traffic analysis zones (TAZ.) We’ll be creating a prototype of the tool that would be used to visualize TAZ flow by using counties in the place of TAZ.

# Data

## Trajectory Data

INRIX is a company that provides trajectory data. Their data contain approximate longitude-latitude coordinates with timestamps for different devices as well as classifications for the device. They use multiple classifications, including the category of device ownership, which is split into corporate, personal, and governmental. The University of Utah’s Marković Research Group, which includes one of our team members, Seth, purchased data from this company for the month of September 2018, and we’ll be using that data for our project. Our data came separated into two sets, trip overviews (origin location, destination location, start time, vehicle weight class) with unique keys indicating the trip ID. The second set contained the locations and time stamps for each GPS probe classified by their appropriate trip ID.

## Geographic Data

As a part of our visualization we need to visualize the map of state Utah and its counties. We have prepared the required data. The details are given in the following section.

# Data Processing

## Trajectory Data

The processing of this data took roughly six months for the Marković research group to perform. It included looking for trips that INRIX had incorrectly classified and mapping approximate GPS probe locations to the appropriate roadway. The data cleanup and preparation were extensive and would take too long to detail in a proposal. The data we have from the research group consists of a simple list of trips with their starting counties, ending counties, and departure times. We will just need to find the counts for each origin/destination combination during departure time intervals. This is a simple process. We just create a list of all possible origin-destination combination (841 total) and count them for our time interval or intervals.

## Geographic Data

Our geographic data includes the map of state Utah and its counties. We have followed the following steps to prepare it:

* We downloaded the shape file of state Utah from [this](http://census.ire.org/data/bulkdata.html).
* We generated the GeoJSON file from [this](http://www.mapshaper.org/).

The map data its ready now, and we have also uploaded the data on GitHub repository.

# Must-Have Features

We need to ensure that we have three features. First, we need to show the viewer clearly where the regions are for origins and destinations. Second, we need to show the viewer an overview of which regions are the most significant, those being the ones with the highest count. Third, we need to allow the user bring focus to any given specific region of interest.

# Optional Features

We have several features we’d like to include but most of them are well out of the scope of this class and aren’t even possible to do entirely in JavaScript. Something doable, though likely out of the scope of a project this size is to improve the ability of the user to select origins and destinations. For example, it would be nice if the user could change the map to show cities, postal regions, or traffic analysis zones. Even better would be to make it so the user can manually draw regions on the map. This would be completely out of the scope of the course because it requires managing a database and querying it with a website. Setting different classes of origin and destination zones would be much more practical.

We’d also like to help the users visualize information about probably travel times between locations. Something reasonable to add would be a plot of different times of day and average travel times between regions that the user could select. Counties are too granular for travel time information to be relevant, but it would be an excellent addition if the users could select smaller regions.

# Visualization Design

Sketches of all our designs can be found in the appendix. We’ve decided to use three graphics, each having their own purpose. First, we’ll have a Circos plot to give a general overview of all trip counts within the state because it’s very good at highlighting the most significant areas. Another major advantage of using a Circos plot is its memorability factor because most people are not familiar with Circos plots. Circos plots have a major flaw though in that they make it very difficult to see important details. Especially when there are multiple origins and destinations, the bands will overlap making seeing fine details practically impossible.

To supplement this difficulty, we’re going to be using bar charts that vary based on user input. When the user hovers their mouse over an element of the Circos plot, it will generate bar charts for trips entering the selected area and exiting the area; one selection of bars for trips entering, and one adjacent selection of bars for trips exiting. Bar charts make it easy for the user to compare differences because of all potential indicators, length is perceived most accurately by humans.

To tie these two elements together, we’ll have a map. The map will operate similarly to the Circos plot where hovering over a region will update the bar charts. We’ll also tie the Circos plot and the map so when the user hovers over one, the other one shows the same as though it had been selected. For more details see the Sketch of Chosen Design in Appendix I.

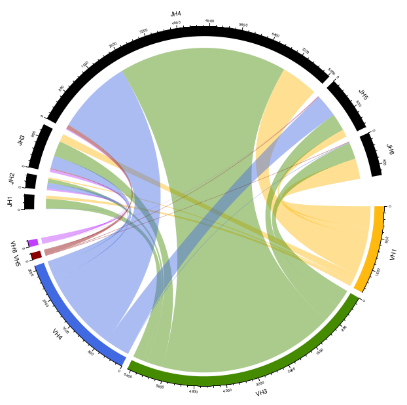
# Project Schedule

Since our group has two people, we’ll be dividing our project into two types. Seth will create the Circos plot, while Mitra will create the map and the bar charts. We’ve also created a schedule for our work. By October 25th, we’ll complete our outline and proposal. By November 1st, we’ll make the style sheets, html files, and JavaScript files. For the JavaScript files, we’ll write functions that can be called to make updates. That way we can ensure that sections of the visual drawn by the other group member will interact appropriately.

By November 8th, we’ll submit our project milestone. By then we’ll need to have a Circos plot, a map, and our bar charts drawn properly but won’t make them interactive yet. By the following week we’ll make sure they’re all user interactive and in the final week we’ll make sure they’re interacting with each other appropriately. That will give us half a week to finalize our process book.

# Appendix I – Designs

## See the source imageSketch of Chosen Design



Circos Plot of All Trips in Utah Split by County – Hovering over out circle selects location and highlights place on map map and sets bar chart to location

Map of all counties in Utah, hovering over specific county highlights in Circos Plot and sets bar chart to location

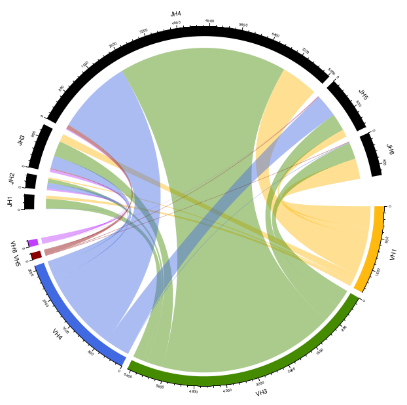
Trip Count ***Leaving*** Selected Location

Trip Count ***Entering*** Selected Location

## Design 1See the source image

Circos Plot of All Trips in Utah Split by County – Hovering over out circle selects location and highlights place on map

Map of all counties in Utah, hovering over specific county highlights in Circos Plot



## See the source imageDesign 2

Map of all counties in Utah, hovering over specific county sets bar chart to location

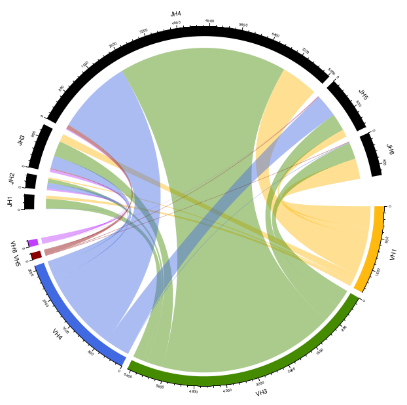
Trip Count ***Leaving*** Selected Location

Trip Count ***Entering*** Selected Location

## Design 3

Heatmap of all trips in Utah split by County – hovering over a row or column with the county name updates the Circos plot.

Circos Plot of All Trips in Utah Split by County – Hovering over out circle puts boarders of the square of the heatmap for specific location



|  |  |  |  |
| --- | --- | --- | --- |
|  | Utah | SL | Weber |
| Utah | 50 | 10 | 5 |
| SL | 9 | 50 | 6 |
| Weber | 20 | 30 | 30 |

# Appendix II – Ciros Plot and Map Sources

<https://geology.com/county-map/utah.shtml>

<https://www.biostars.org/p/298547/>

<http://census.ire.org/data/bulkdata.html>

<https://mapshaper.org>