Modeling Travel Times to Determine Shortest Path on UTK Campus

Kristina Wilson and Noah Dahle

2022

Contents

1 Brainstorming

Goal:
Find the fastest route from point A to point B.
Questions:
How does travel time change depending on the time of day or other factors?
Is it faster to walk or to drive?

Noah's Job:

• given travel times between each intersection, develop algorithm to find best route.

• use **Dijkstra's Algorithm** or **Topological Sort**

How are we going to collect the data?

1. Use Google Maps data (check periodically for travel times)
2. Could physically go and drive roads to time it, then compare with GM Data

Find a way to model the travel times based on parameters:
Basically, total travel time is distance times average speed.

$$T = D * S$$

But adding in other factors like red lights, pedestrians, and traffic, we get something like:

$$T = D * S + R + P + t$$

These factors have different levels. Traffic can be green, yellow, orange, or red on GPS systems. Pedestrian levels change based on class change, time of day, and time of year. Time at a red light may depend on if the light system is on a timer.
For example, on a Saturday during Football Season you would expect travel times to change like this:

- sports games affect area around stadium

2 Notes

May 27- Meeting with Dr. Prosper. She suggested we create an overleaf document with all of our ideas and data. Next meeting will most likely be next Thursday at 9:00 am. Kristina worked on creating the project document and Noah worked on learning Python and researching the algorithm.

May 29- Today we worked on making a labeled map for our first path, which is Hodges Library to Neyland Stadium (see section Labeled Map of Knoxville). Then Kristina collected data through Google Maps, and Noah built the graph in his program and started the algorithm. We decided how Kristina should output the modeling function so Noah's algorithm can read it:

Model Output: Number of nodes. Node to, Node from, Weight, Node to, Node from, Weight, ...

The data collected from Google Maps is not very helpful because it rounds to the nearest minute. We need another method to determine travel times. We found a traffic simulator on Google Maps with adjustable days and times. This could be a way to study traffic behavior without having to constantly check the GPS throughout the day.

3 Sketch of Timeline

Week 0: May 22- May 29

Goals:

• ~~Create project document~~
• ~~Create sketch of timeline for first couple weeks~~
• ~~Create plan to collect data~~ (Google Maps Traffic Simulator)
• ~~Determine project name~~
• ~~Create labeled map of Knoxville~~
• ~~Write program to create map~~

Week 1: May 30 - June 5

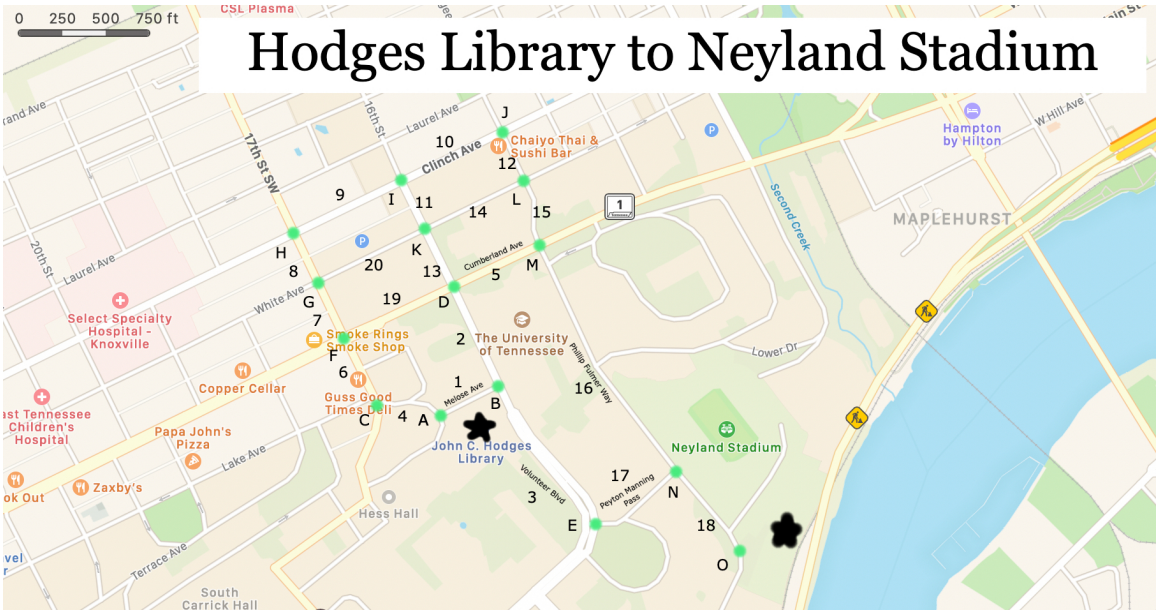
Goals:

• Write program algorithm
• Explore Google Maps' Traffic Simulator, determine a way to record and study the data from it.
• Collect 40 data points for 4 days? on Google Maps, Waze, Apple Maps
• Brainstorm equations to fit these data points
• Feed some of these data points into Noah's algorithm and compare to what the GPS says.

Week 2: June 6 - June 12

4 Labeled Map of Knoxville

We need to figure out a system to label nodes and edges.
Starting Point: Hodges Library
End Point: Neyland Stadium



5 Data

Date: May 31 2022
Hodges to Neyland Stadium
Google Maps

Time of Day	Travel Time (min)	Distance	Edge
5:45 pm	1	377 feet	1A
	1		1B
	1	0.1 mi	2B
	1		2D
	1	0.2 mi	3B
	1		3E
	1	367 ft	4A
	1	0.1 mi	5D
	1		5M
	1	430 ft	6C
	1		6F
	1	400 ft	7F
	1		7G
	1	302 feet	8G
	1		8H
	1	0.1 mi	9H
	1		9I
	1	0.1 mi	10I
	1		10J
	1	300 ft	11I
	1		11K
	1	318 ft	12J
	1		12L
	1	350 ft	13K
	1		13D
	1	0.1 mi	14K
	1	400 ft	15L
	1		15M
	2	0.4 mi	16M
	2		16N
	1	0.1 mi	17E
	1		17N
	1	0.1 mi	18N
	1		18O
	1	0.1 mi	19D
	1		19F
	1	0.1 mi	20K

6 Modeling

Output format:
NUM (number of nodes)
(if it is a two way) A B (weight) B A (weight)
(if it is a one way) A B (from to) (weight)

7 Algorithm

discussion of the algorithm results

8 Works Cited

Labeled Map of Knoxville Map is from Apple Maps Data collected from Google Maps

9 Time Log

9.1 NOAH

MAY

Week 0	5/23	5/24	5/25	5/26	5/27	5/28	5/29	
	Mon	Tue	Wed	Thu	Fri	Sat	Sun	
					9:00		3:30	
					10:00		7:00	
					8:00			
					11:00			
Total:	0:00	0:00	0:00	0:00	4:00	0:00	3:30	**7:30**

JUNE

Week 1	5/30	5/31	6/1	6/2	6/3	6/4	6/5	
	Mon	Tue	Wed	Thu	Fri	Sat	Sun	
Total:	0:00	0:00	0:00	0:00	0:00	0:00	0:00	**0:00**

Week 2	6/6	6/7	6/8	6/9	6/10	6/11	6/12	
	Mon	Tue	Wed	Thu	Fri	Sat	Sun	
Total:	0:00	0:00	0:00	0:00	0:00	0:00	0:00	**0:00**

Week 3	6/13	6/14	6/15	6/16	6/17	6/18	6/19	
	Mon	Tue	Wed	Thu	Fri	Sat	Sun	
Total:	0:00	0:00	0:00	0:00	0:00	0:00	0:00	**0:00**

Week 4	6/20	6/21	6/22	6/23	6/24	6/25	6/26	
	Mon	Tue	Wed	Thu	Fri	Sat	Sun	
Total:	0:00	0:00	0:00	0:00	0:00	0:00	0:00	**0:00**

Week 5	6/27	6/28	6/29	6/30	7/1	7/2	7/3	
	Mon	Tue	Wed	Thu	Fri	Sat	Sun	
Total:	0:00	0:00	0:00	0:00	0:00	0:00	0:00	**0:00**

JULY

Week 6	7/4	7/5	7/6	7/7	7/8	7/9	7/10	
	Mon	Tue	Wed	Thu	Fri	Sat	Sun	
Total:	0:00	0:00	0:00	0:00	0:00	0:00	0:00	**0:00**

Week 7	7/11	7/12	7/13	7/14	7/15	7/16	7/17	
	Mon	Tue	Wed	Thu	Fri	Sat	Sun	
Total:	0:00	0:00	0:00	0:00	0:00	0:00	0:00	**0:00**

Week 8	7/18	7/19	7/20	7/21	7/22	7/23	7/24	
	Mon	Tue	Wed	Thu	Fri	Sat	Sun	
Total:	0:00	0:00	0:00	0:00	0:00	0:00	0:00	**0:00**

Week 9	7/25	7/26	7/27	7/28	7/29	7/30	7/31	
	Mon	Tue	Wed	Thu	Fri	Sat	Sun	
Total:	0:00	0:00	0:00	0:00	0:00	0:00	0:00	**0:00**

AUGUST

Week 10	8/1	8/2	8/3	8/4	8/5	8/6	8/7	
	Mon	Tue	Wed	Thu	Fri	Sat	Sun	
Total:	0:00	0:00	0:00	0:00	0:00	0:00	0:00	**0:00**

9.2 KRISTINA

MAY

Week 0	5/23	5/24	5/25	5/26	5/27	5/28	5/29	
	Mon	Tue	Wed	Thu	Fri	Sat	Sun	
					9:00		3:30	
					11:00		7:00	
					6:00			
					6:30			
Total:	0:00	0:00	0:00	0:00	2:30	0:00	3:30	**6:00**

JUNE

Week 1	5/30	5/31	6/1	6/2	6/3	6/4	6/5	
	Mon	Tue	Wed	Thu	Fri	Sat	Sun	
Total:	0:00	0:00	0:00	0:00	0:00	0:00	0:00	**0:00**

Week 2	6/6	6/7	6/8	6/9	6/10	6/11	6/12	
	Mon	Tue	Wed	Thu	Fri	Sat	Sun	
Total:	0:00	0:00	0:00	0:00	0:00	0:00	0:00	**0:00**

Week 3	6/13	6/14	6/15	6/16	6/17	6/18	6/19	
	Mon	Tue	Wed	Thu	Fri	Sat	Sun	
Total:	0:00	0:00	0:00	0:00	0:00	0:00	0:00	**0:00**

Week 4	6/20	6/21	6/22	6/23	6/24	6/25	6/26	
	Mon	Tue	Wed	Thu	Fri	Sat	Sun	
Total:	0:00	0:00	0:00	0:00	0:00	0:00	0:00	**0:00**

Week 5	6/27	6/28	6/29	6/30	7/1	7/2	7/3	
	Mon	Tue	Wed	Thu	Fri	Sat	Sun	
Total:	0:00	0:00	0:00	0:00	0:00	0:00	0:00	**0:00**

JULY

Week 6	7/4	7/5	7/6	7/7	7/8	7/9	7/10	
	Mon	Tue	Wed	Thu	Fri	Sat	Sun	
Total:	0:00	0:00	0:00	0:00	0:00	0:00	0:00	**0:00**

Week 7	7/11	7/12	7/13	7/14	7/15	7/16	7/17	
	Mon	Tue	Wed	Thu	Fri	Sat	Sun	
Total:	0:00	0:00	0:00	0:00	0:00	0:00	0:00	**0:00**

Week 8	7/18	7/19	7/20	7/21	7/22	7/23	7/24	
	Mon	Tue	Wed	Thu	Fri	Sat	Sun	
Total:	0:00	0:00	0:00	0:00	0:00	0:00	0:00	**0:00**

Week 9	7/25	7/26	7/27	7/28	7/29	7/30	7/31	
	Mon	Tue	Wed	Thu	Fri	Sat	Sun	
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AUGUST

Week 10	8/1	8/2	8/3	8/4	8/5	8/6	8/7	
	Mon	Tue	Wed	Thu	Fri	Sat	Sun	
Total:	0:00	0:00	0:00	0:00	0:00	0:00	0:00	**0:00**