

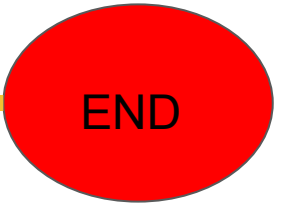
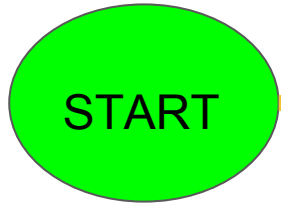


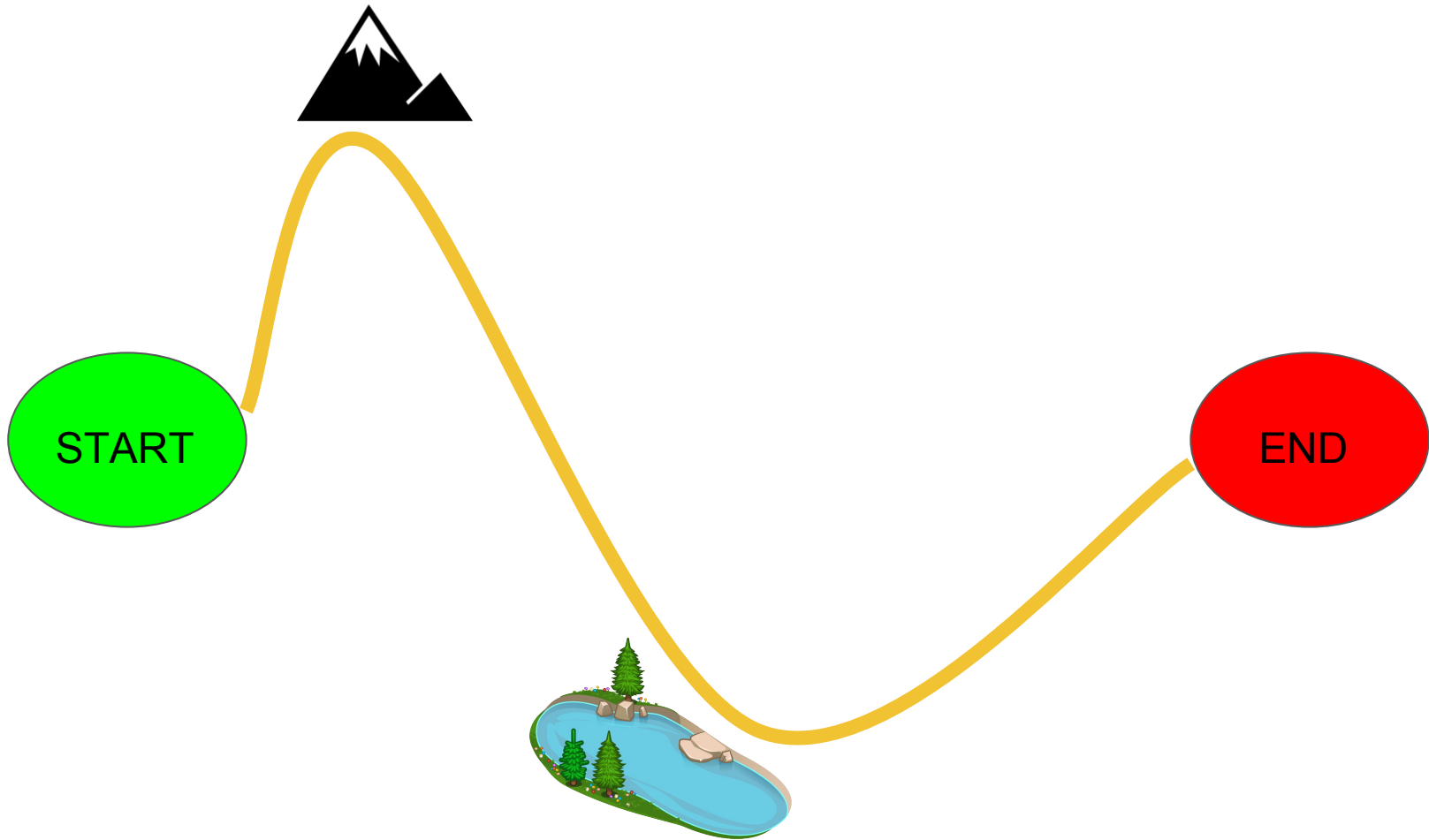
GoScenic

Emily Kampa, Evie Rosenberg, Allie Warren, Phoebe Wooldridge

GoScenic









Start Location

End Location

0

Hours

0

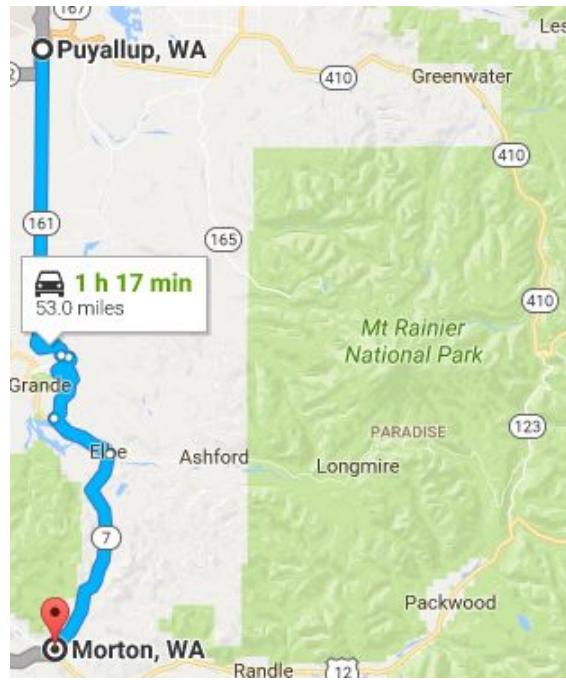
Minutes

Select Scenery



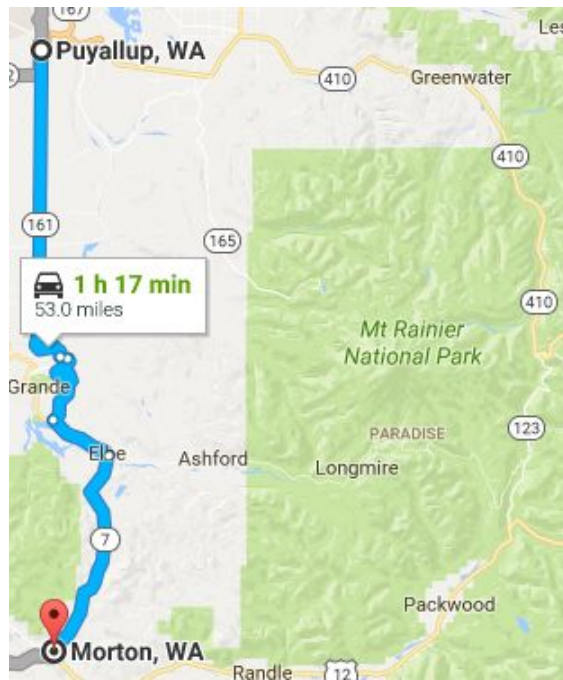


1 hour, 17 minutes

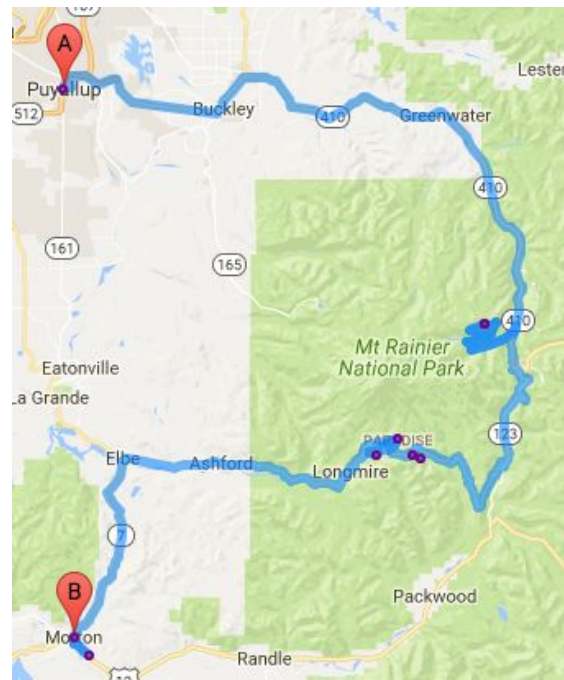




1 hour, 17 minutes

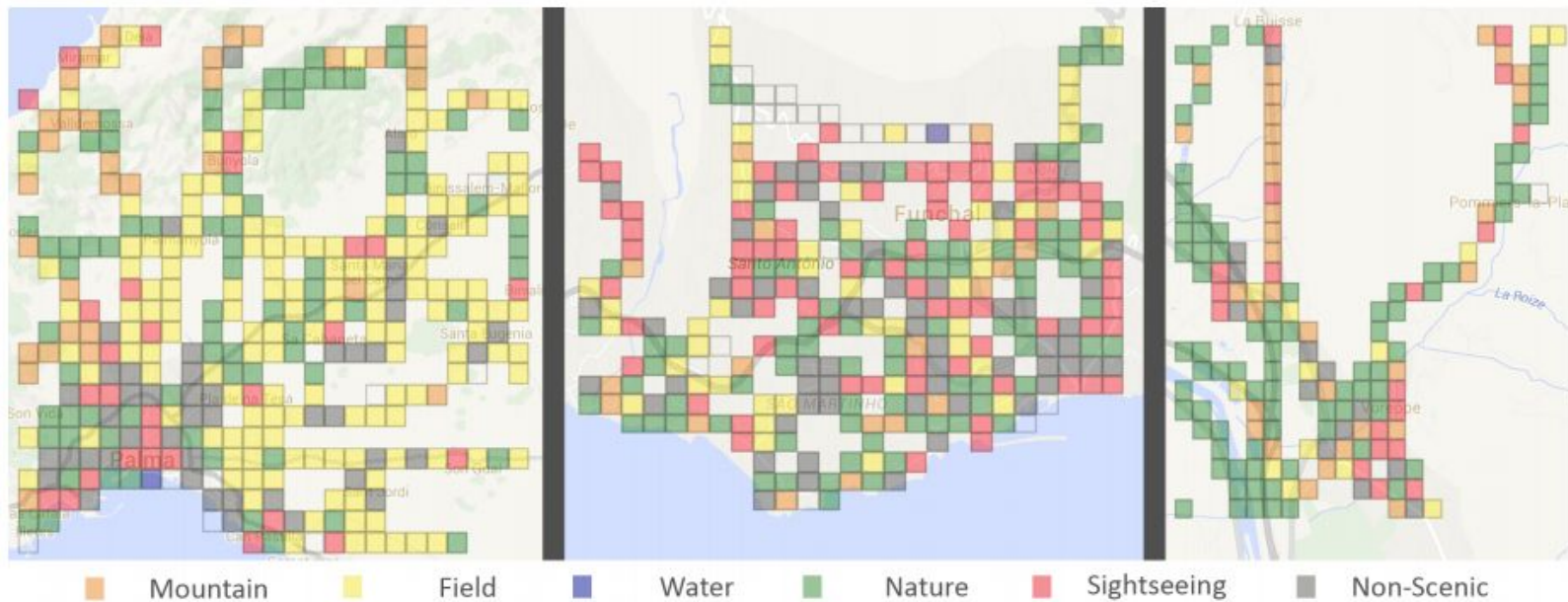


4 hours, 22 minutes
9 scenic points



No more Autobahn! Scenic Route Generation Using Googles Street View





The Shortest Path to Happiness: Recommending Beautiful, Quiet, and Happy Routes in the City



(a) Flickr Beauty in London



(b) Flickr Beauty in Boston



(c) Shortest in Boston

GoScenic “Roadmap”

1. Classify the scenic area.
2. Build the best route between our scenic points.
3. Output route to user.
4. Explore!

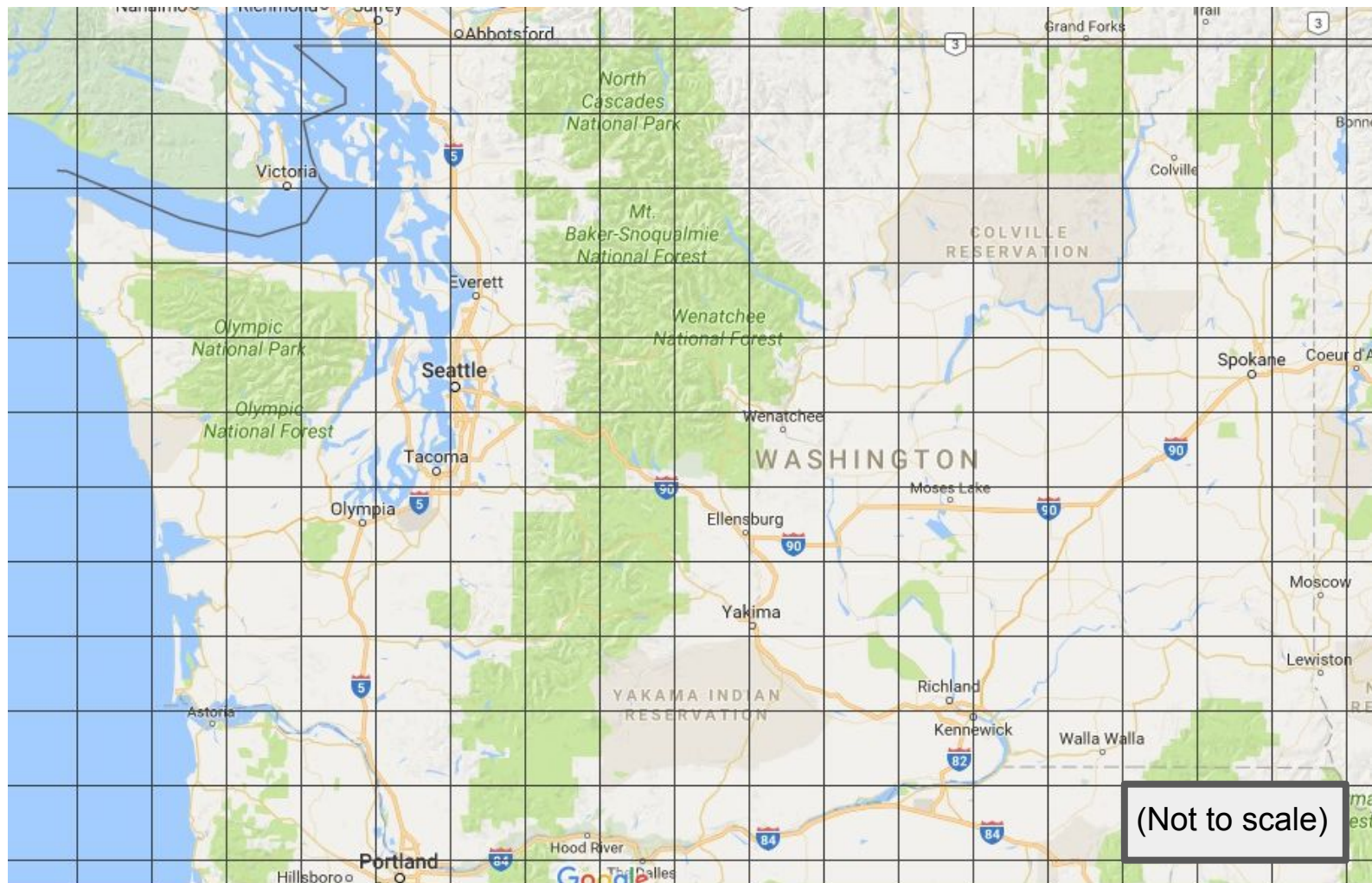


GoScenic “Roadmap”

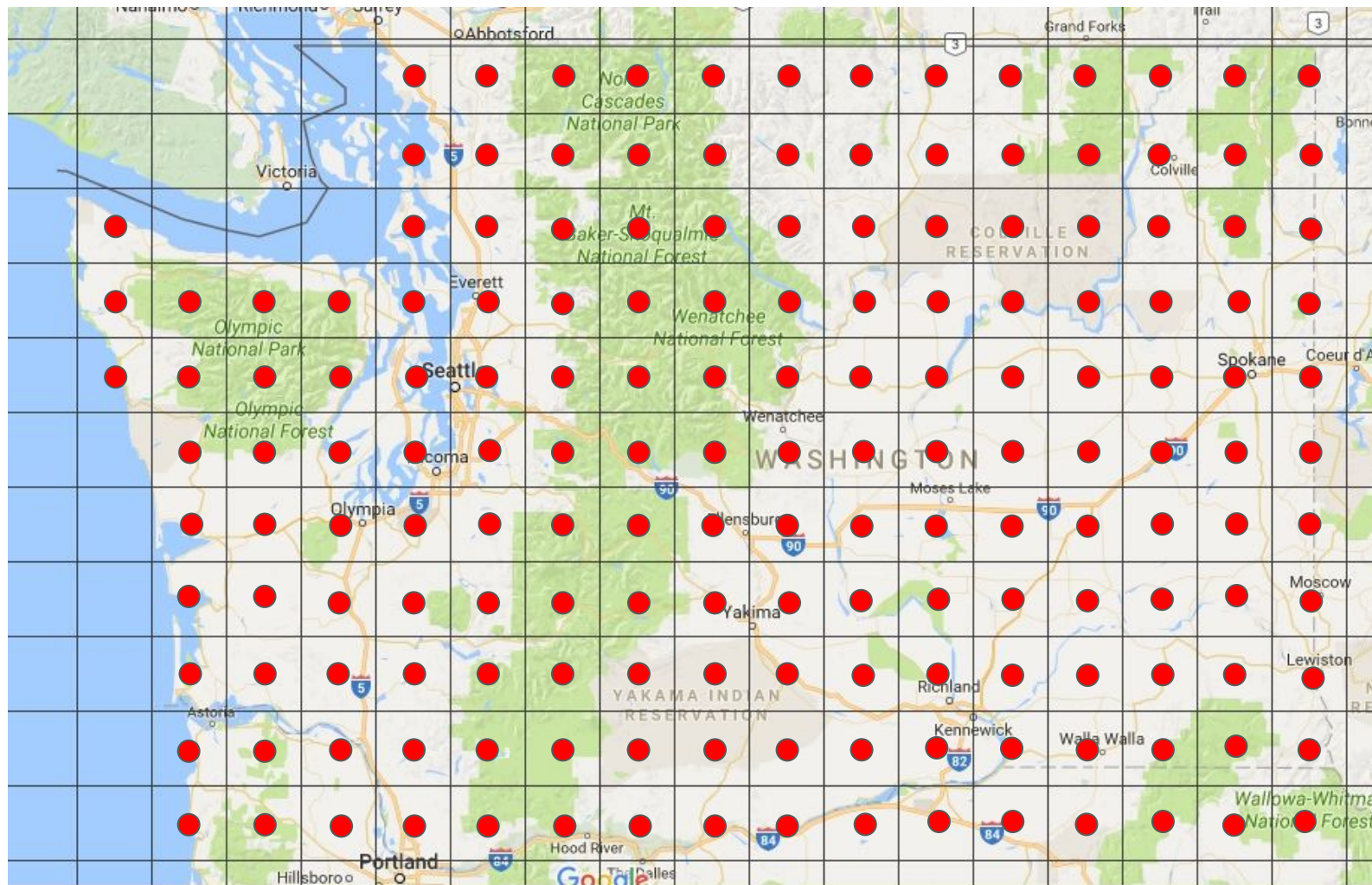
1. Classify the scenic area.
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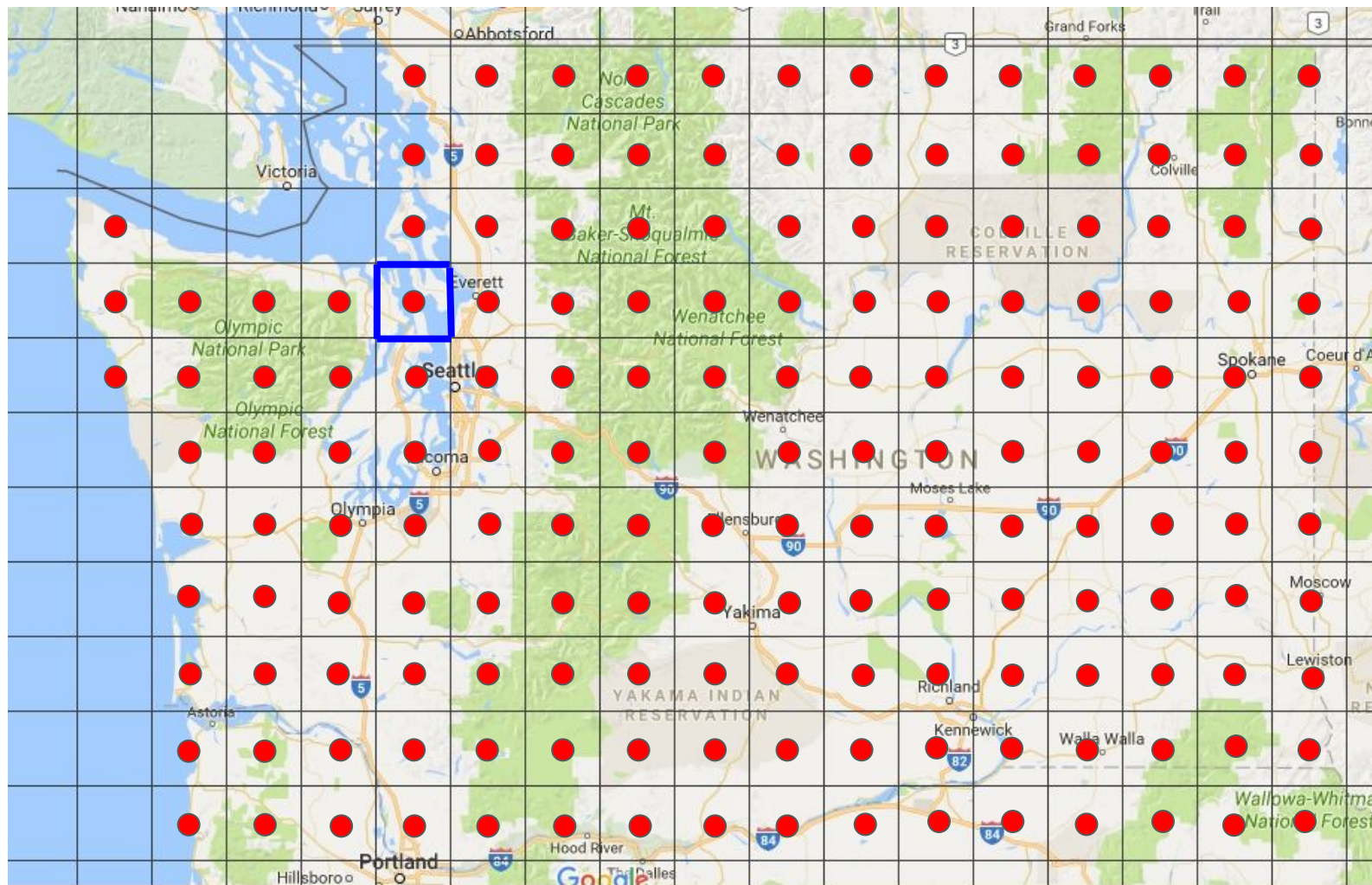




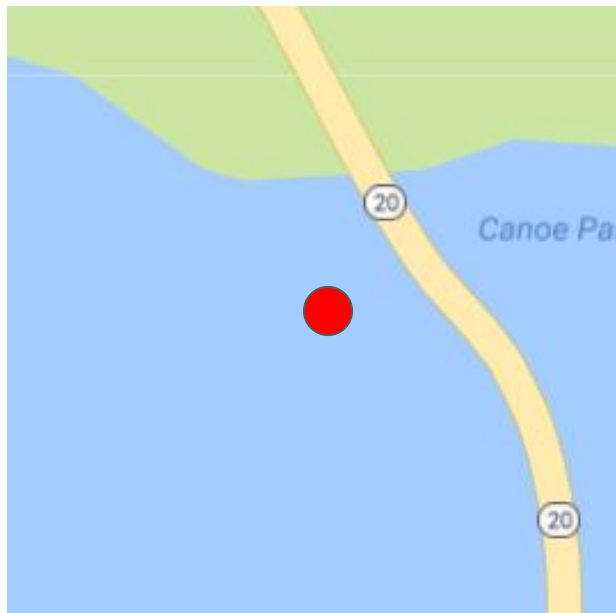


(Not to scale)

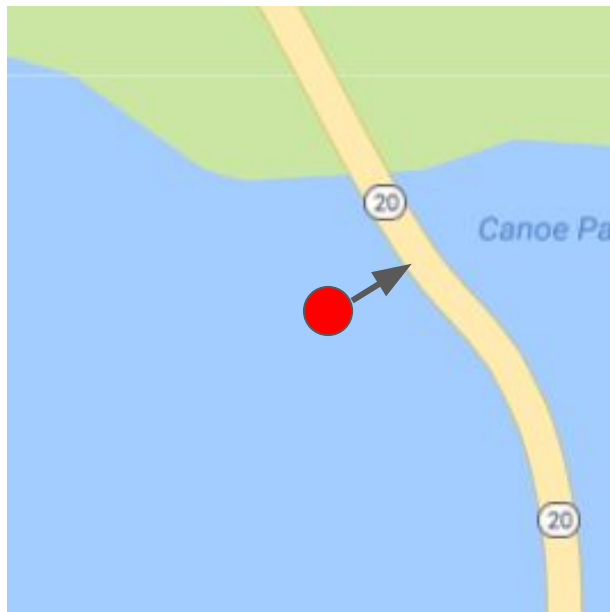




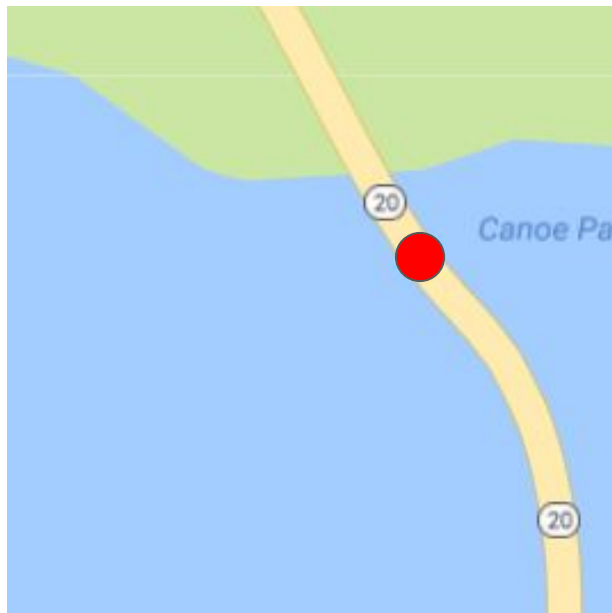
Latitude: 48.408584, Longitude: -122.645638



Latitude: 48.408584, Longitude: -122.645638



Latitude: 48.408641, Longitude: -122.645220



Latitude: 48.408641, Longitude: -122.645220





Maximally accurate

Maximally specific

cat

1.79559

feline

1.74239

domestic cat

1.71551

tabby

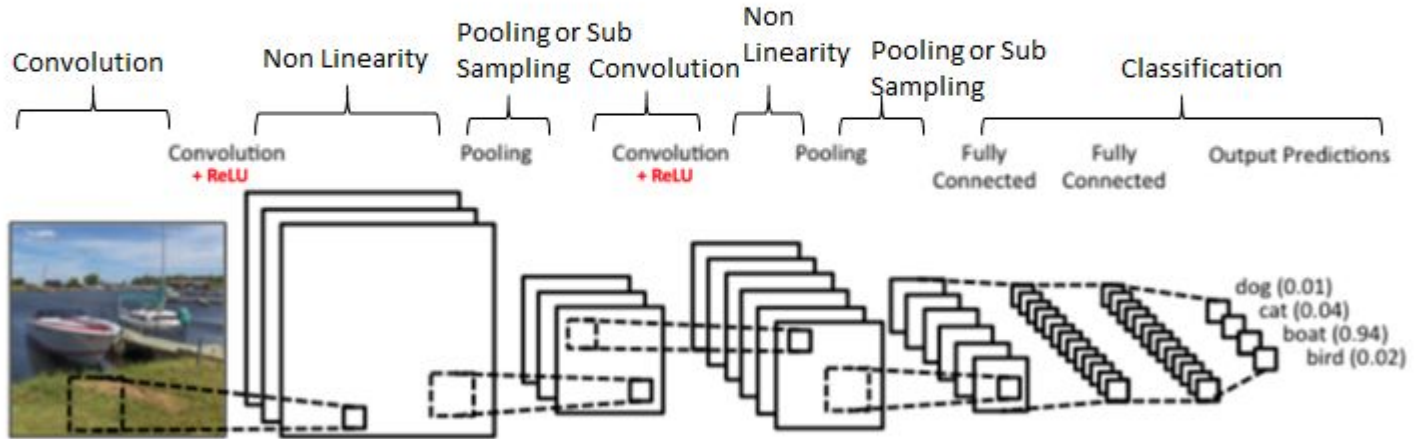
0.95449

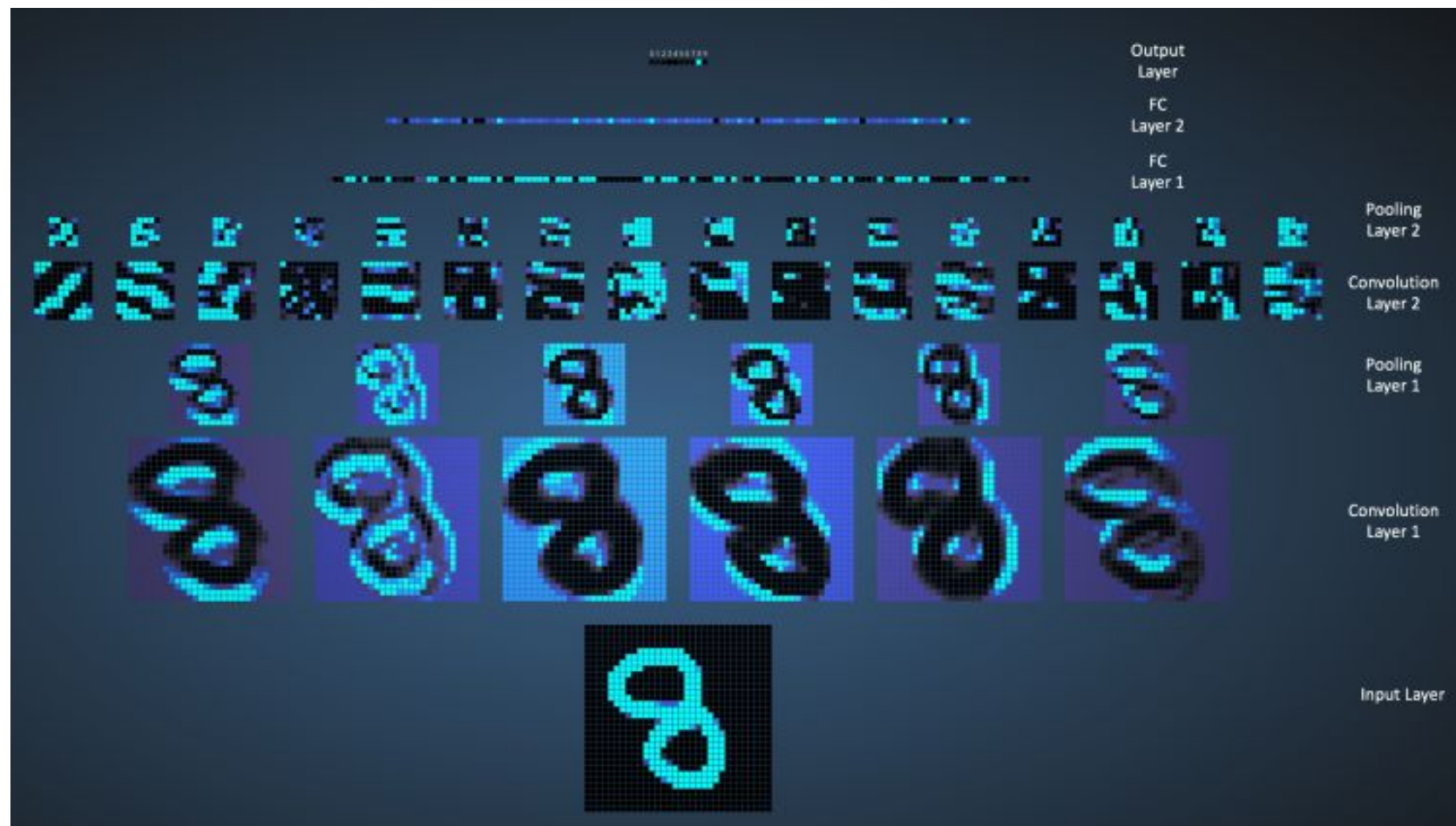
domestic animal

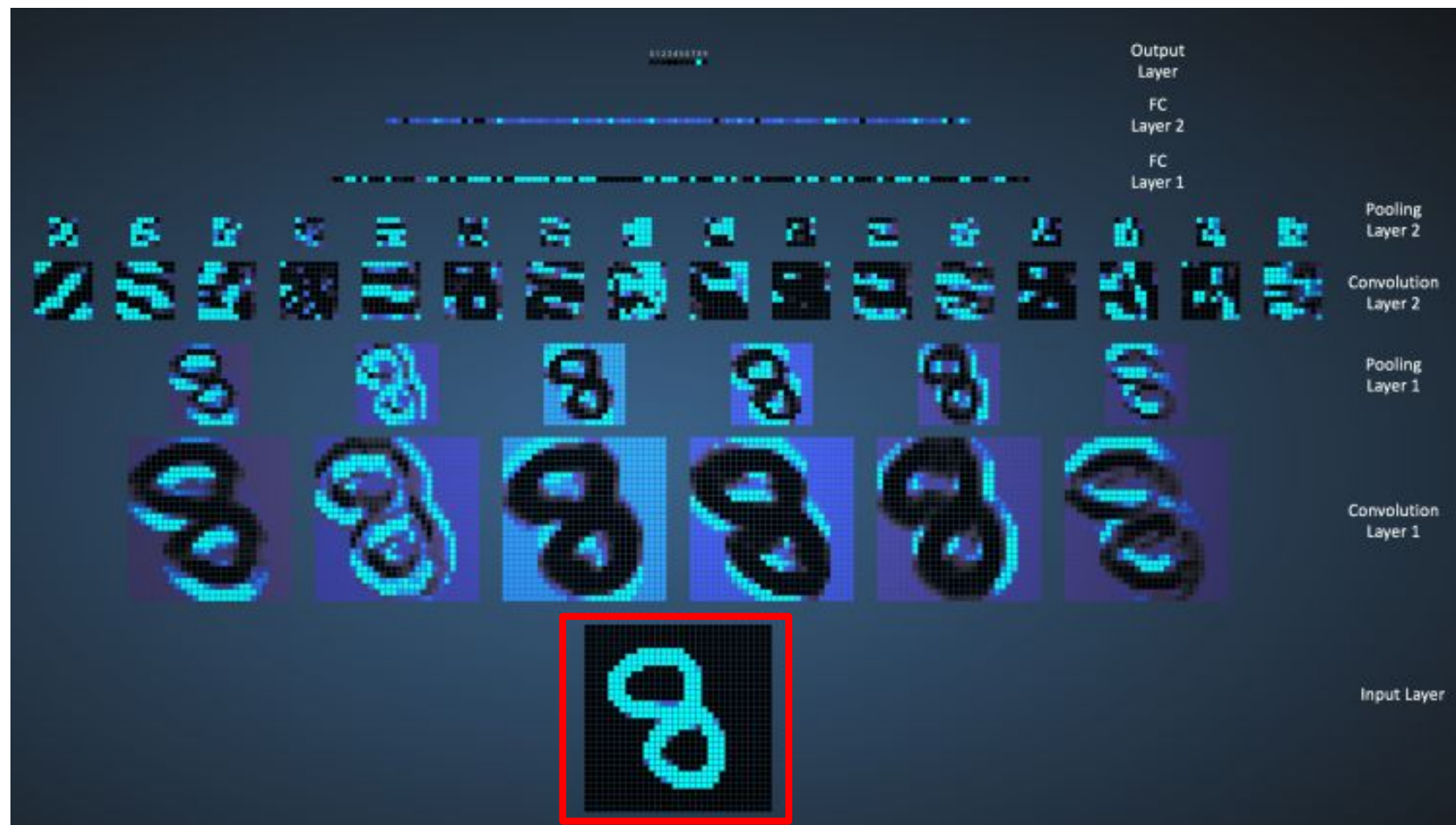
0.77145

CNN took 0.063 seconds.

Convolutional Neural Network







Convert to Matrix of Pixel Values

[illegible]

Convert to Matrix of Pixel Values

0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	1	12	0	11	39	137	37	0	152	147	84	0	0	0
0	0	1	0	0	0	41	168	258	255	235	162	255	238	206	11	13	0
0	0	0	16	9	9	150	251	45	21	184	159	154	255	233	48	0	0
10	0	0	0	0	0	145	146	3	18	0	11	124	253	255	187	0	0
0	0	3	0	4	15	236	216	0	0	38	109	247	240	169	0	11	0
1	0	2	0	0	0	253	253	23	62	224	241	255	164	0	5	0	0
6	0	0	4	0	3	252	258	228	255	255	234	112	28	0	2	17	0
0	2	1	4	0	21	255	253	251	255	172	31	8	0	1	0	0	0
0	0	4	0	163	225	251	255	229	128	0	0	0	0	0	11	0	0
0	0	21	162	255	255	254	255	126	6	0	10	14	6	0	0	9	0
3	79	242	255	141	66	255	245	189	7	0	0	0	5	0	0	0	0
26	221	237	98	0	67	251	255	144	0	0	0	0	7	0	0	11	0
125	255	141	0	87	244	255	288	3	0	0	13	0	1	0	1	0	0
145	248	228	116	235	255	141	34	0	11	0	1	0	0	0	1	3	0
85	237	253	246	255	210	21	1	0	1	0	0	6	2	4	0	0	0
6	23	112	157	114	32	0	0	0	0	2	0	8	0	7	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

255	238	206
154	255	233
124	253	255

Convolution

1	1	1	0	0
0	1	1	1	0
0	0	1	1	1
0	0	1	1	0
0	1	1	0	0

Original Image

1	0	1
0	1	0
1	0	1

Filter or Feature
Detector Matrix

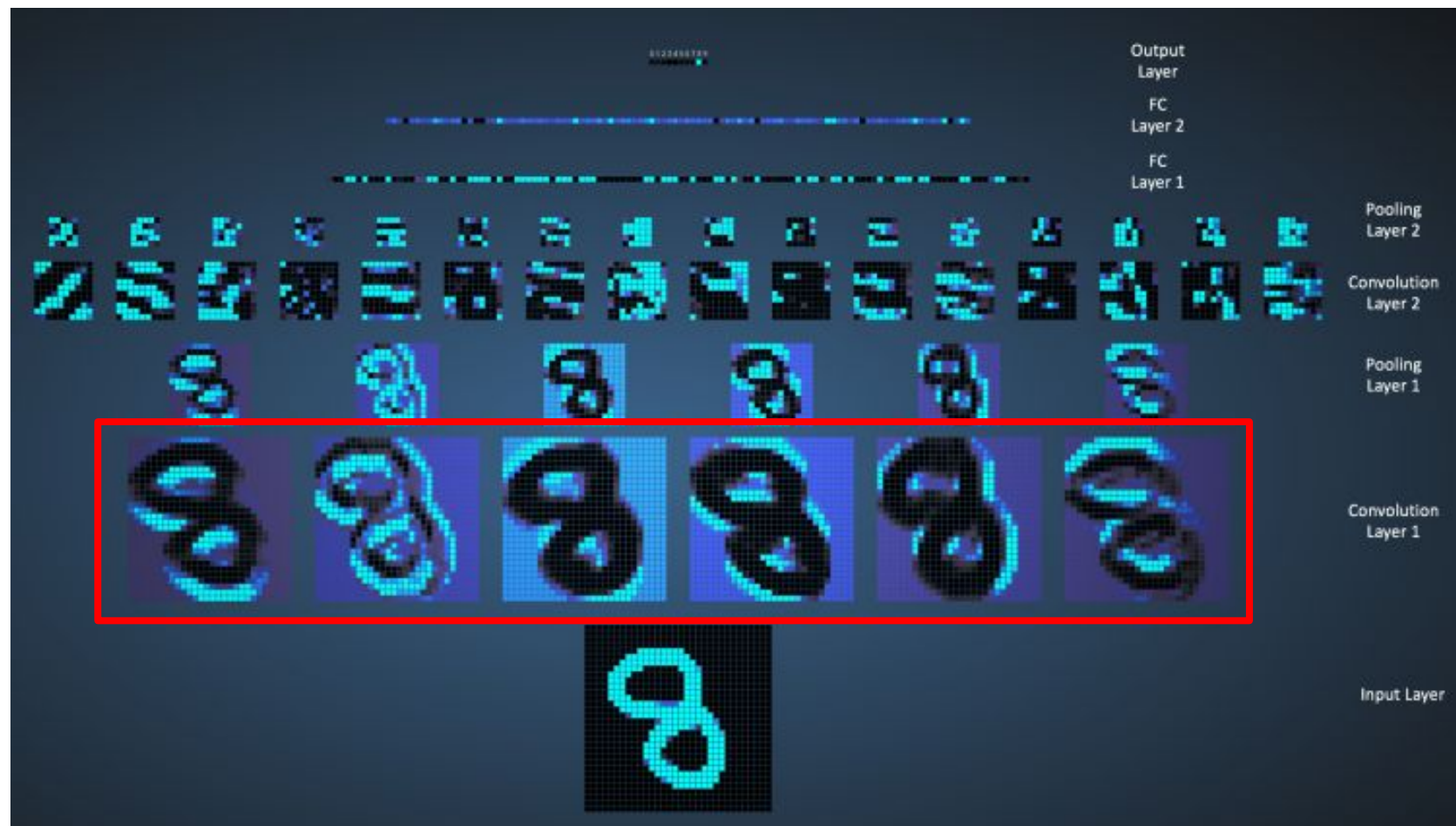
Convolution

1 _{x1}	1 _{x0}	1 _{x1}	0	0
0 _{x0}	1 _{x1}	1 _{x0}	1	0
0 _{x1}	0 _{x0}	1 _{x1}	1	1
0	0	1	1	0
0	1	1	0	0

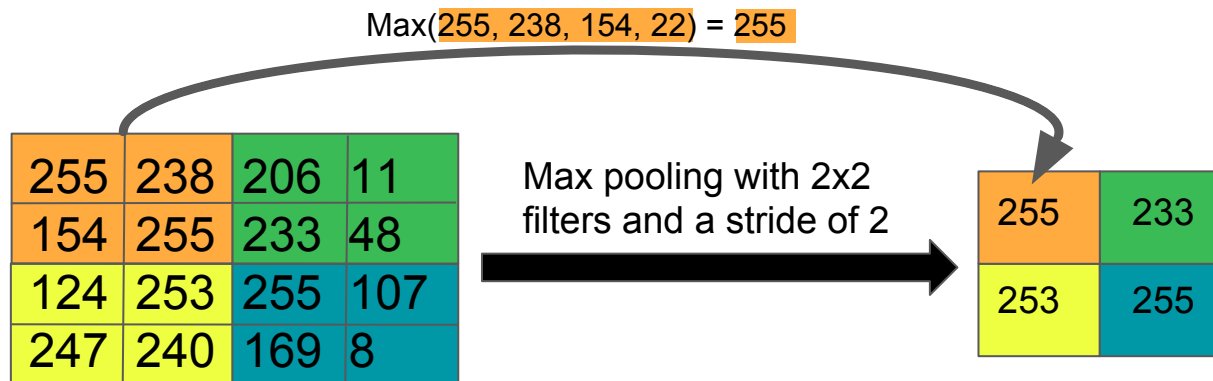
Image

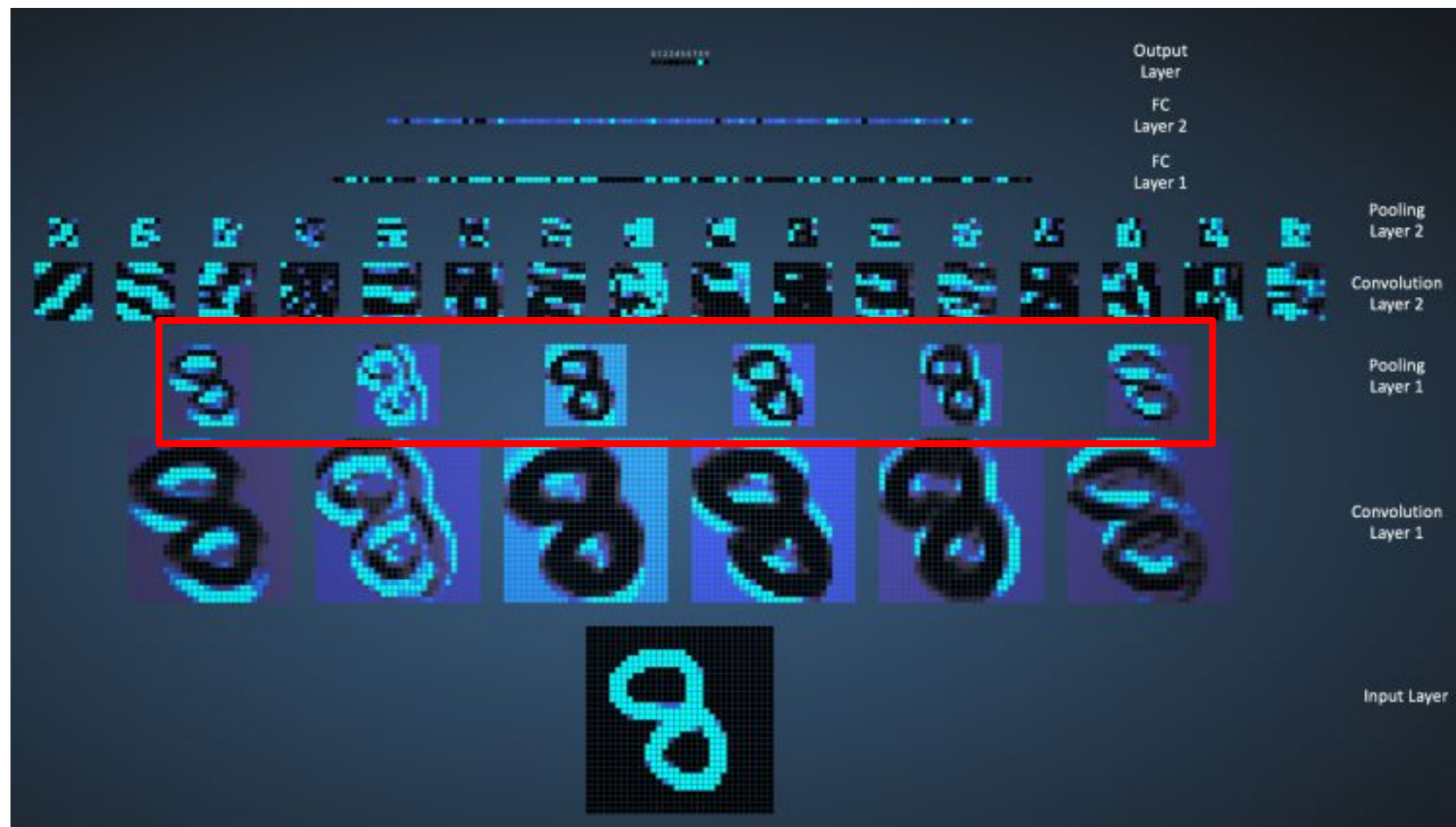
4		

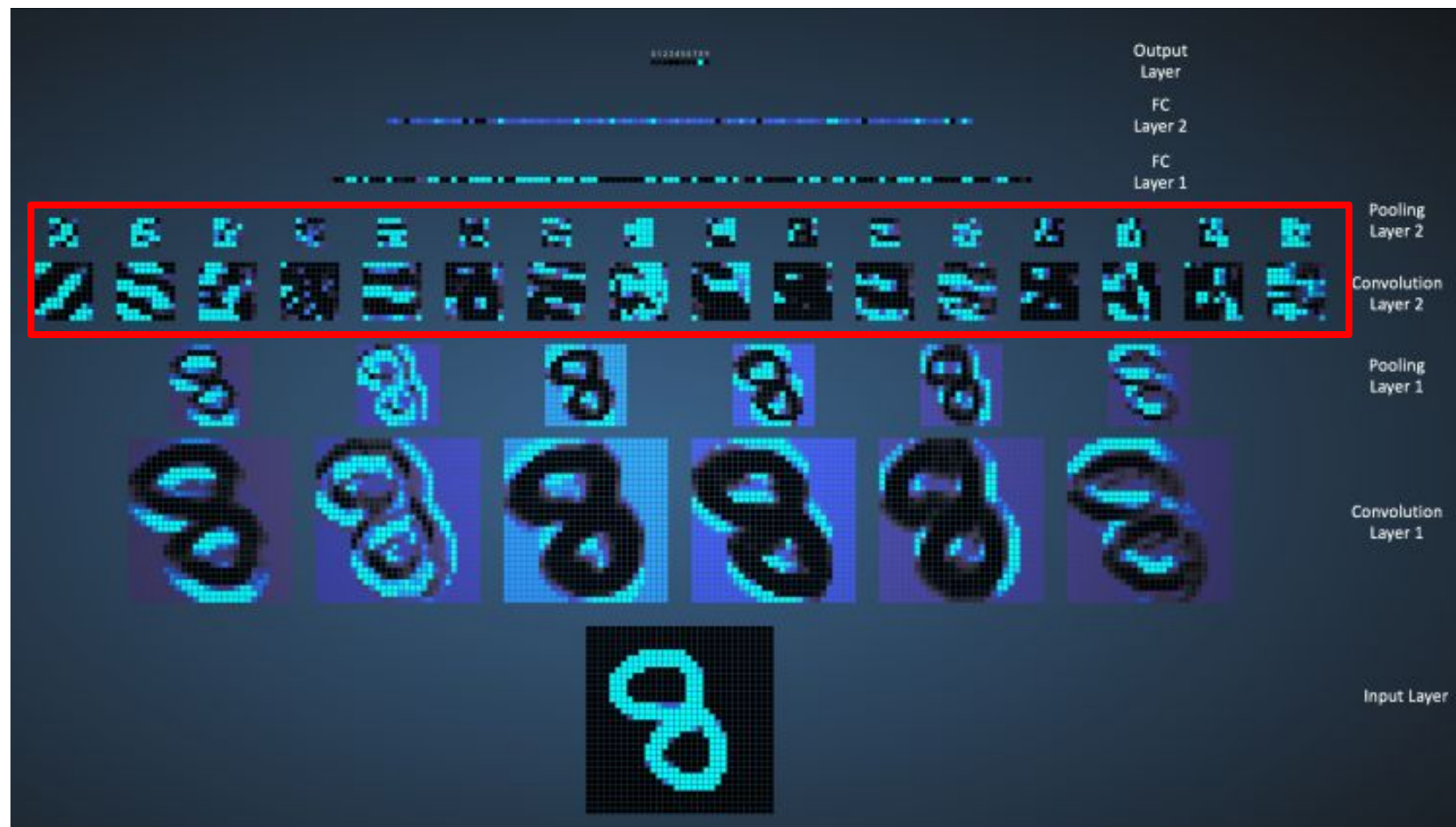
Convolved
Feature

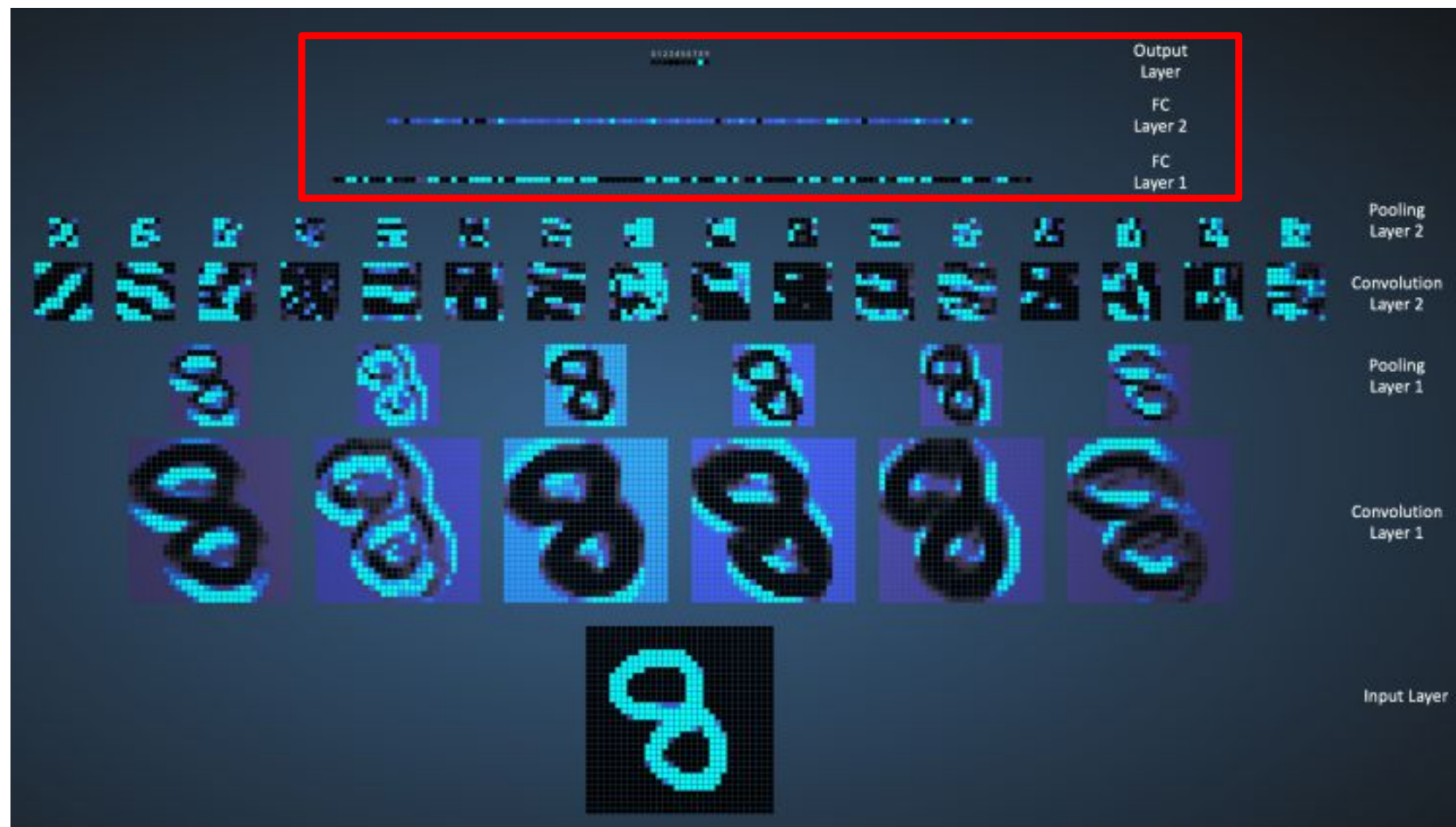


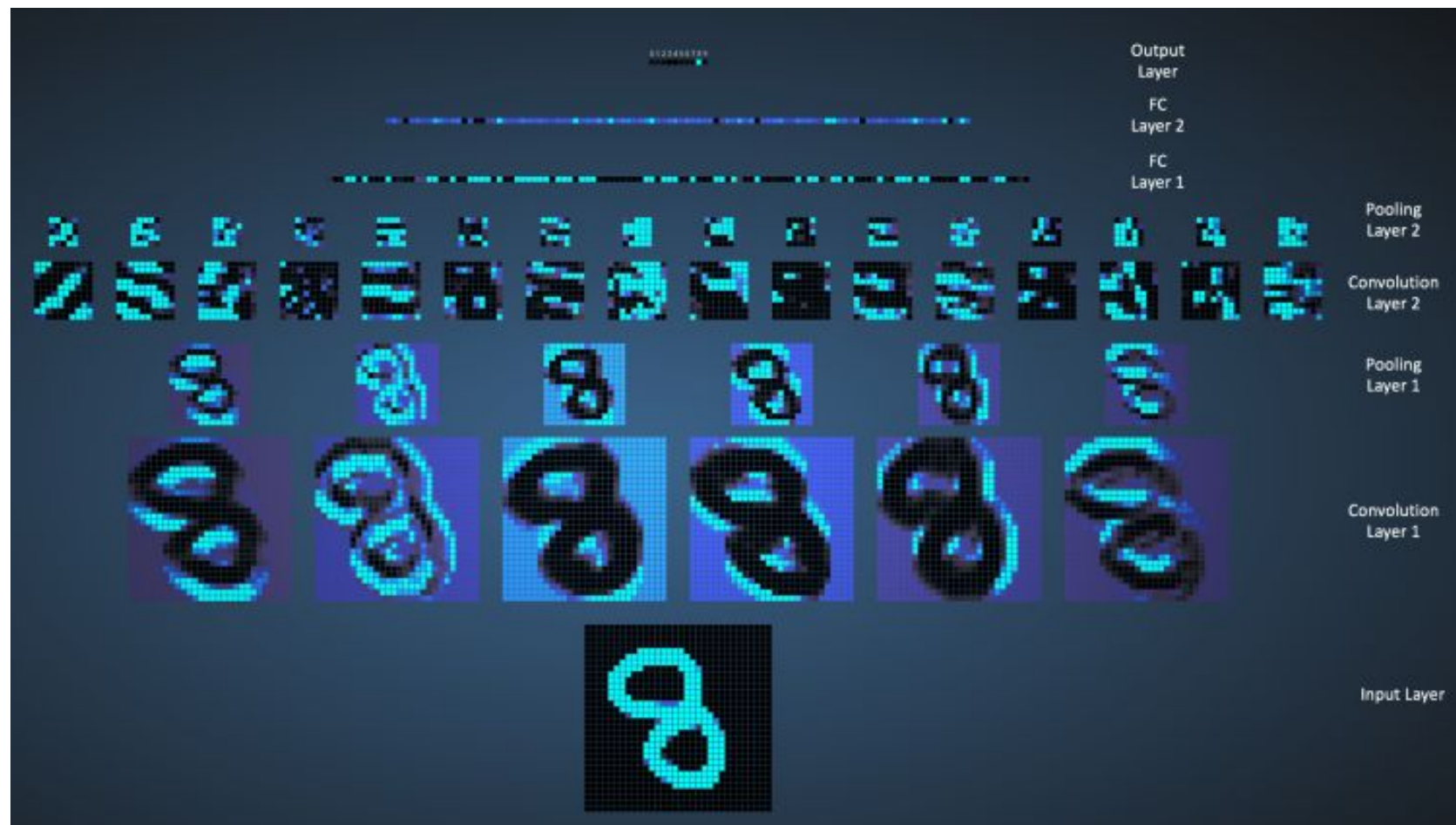
Pooling



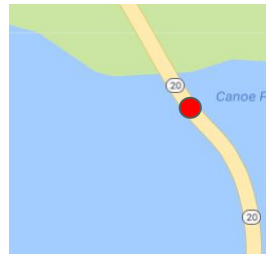








Latitude: 48.408641, Longitude: -122.645220



ocean (Water; $p=0.260$)

sky (Nature; $p=0.173$)

river (Water; $p=0.169$)

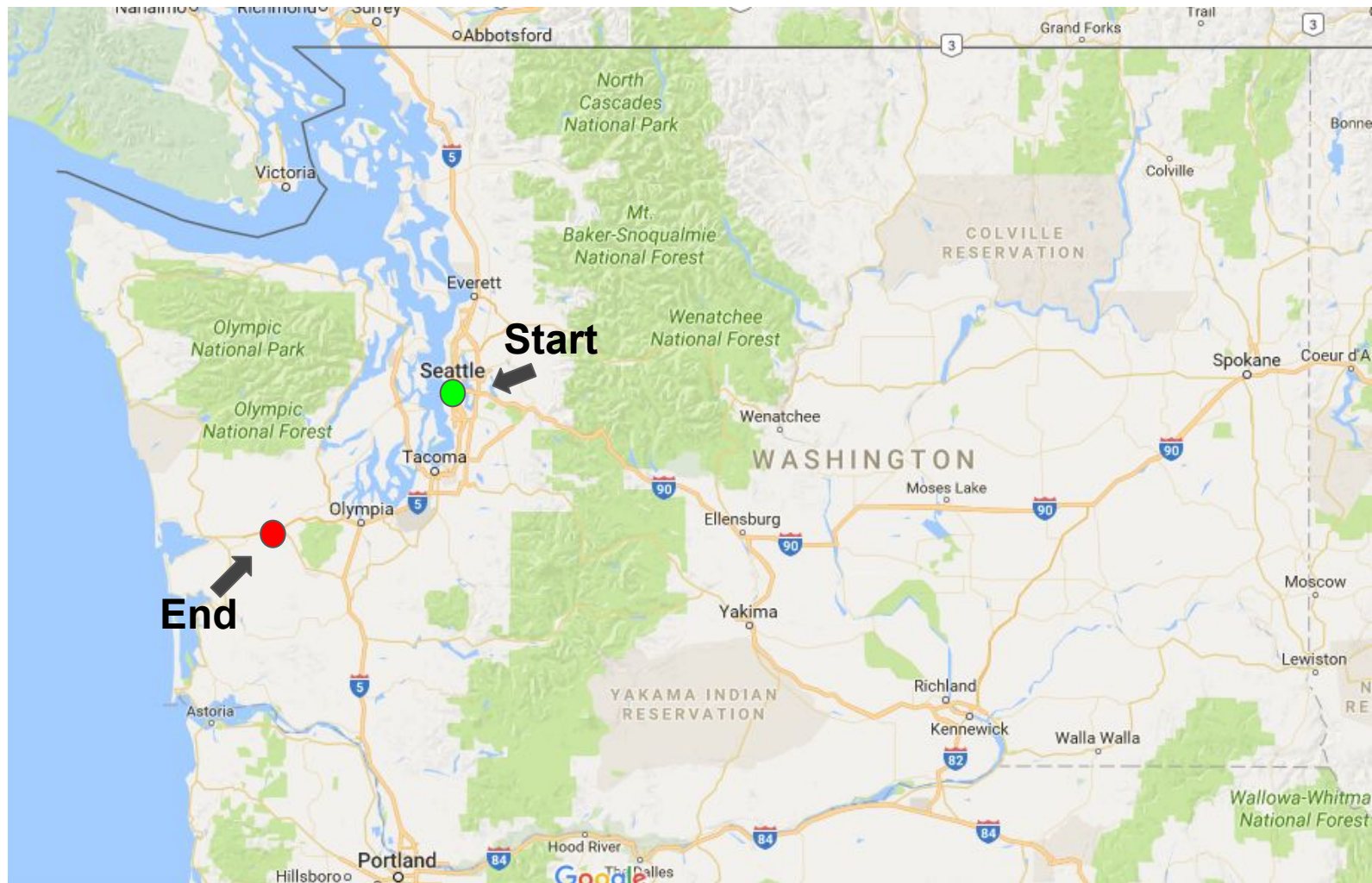
coast (Water; $p=0.151$)

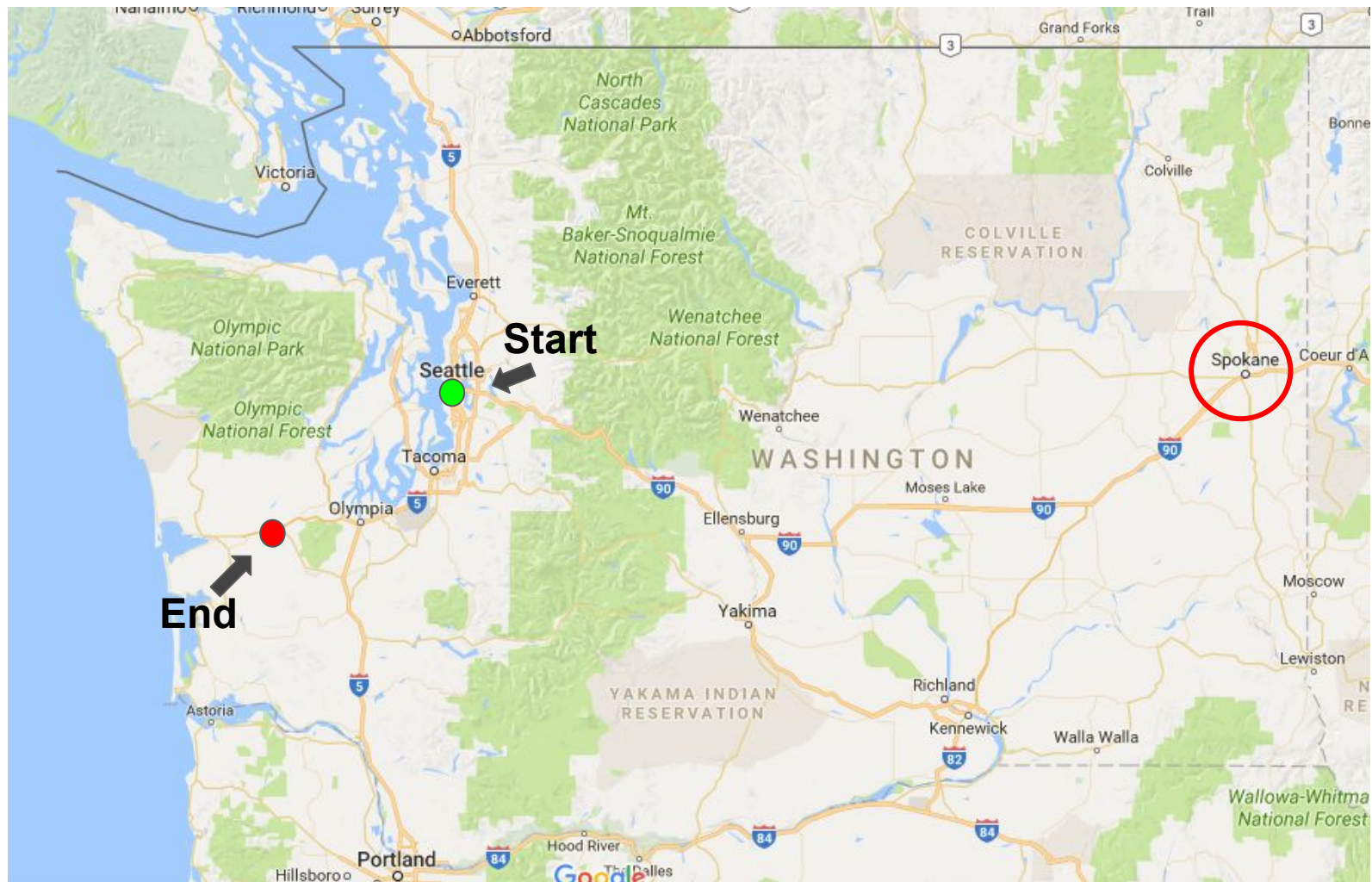
highway (Street; $p=0.124$)

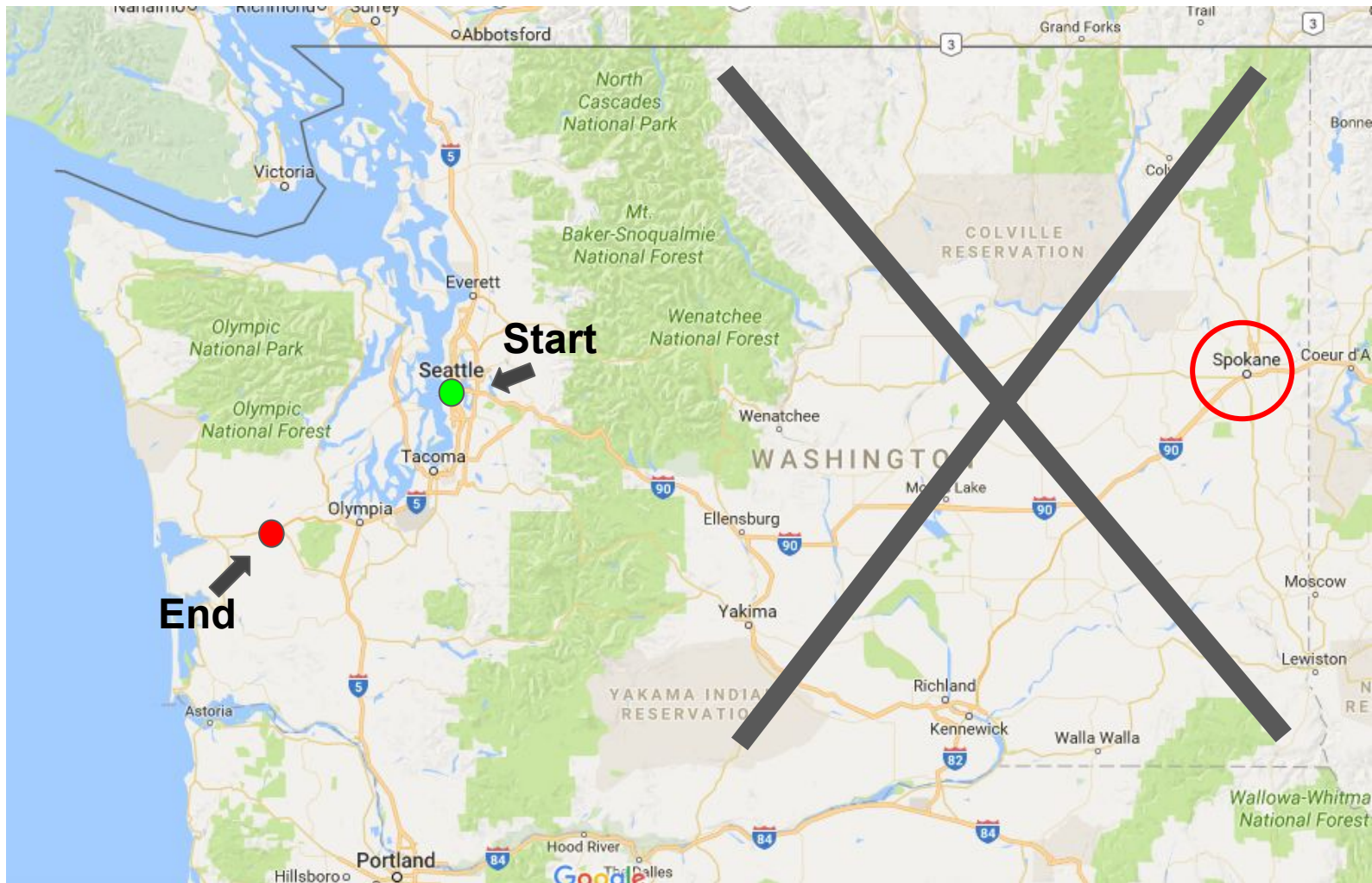
GoScenic “Roadmap”

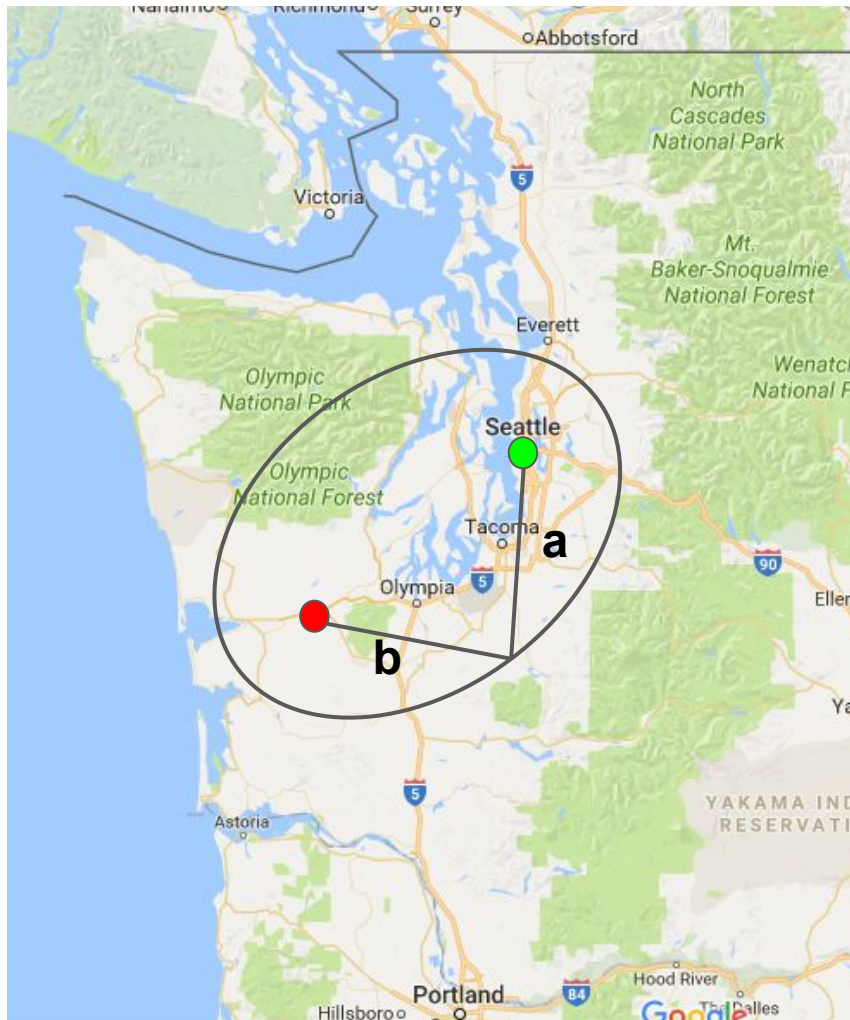
1. Classify the scenic area.
2. Build the best route between our scenic points.
3. Output route to user.
4. Explore!









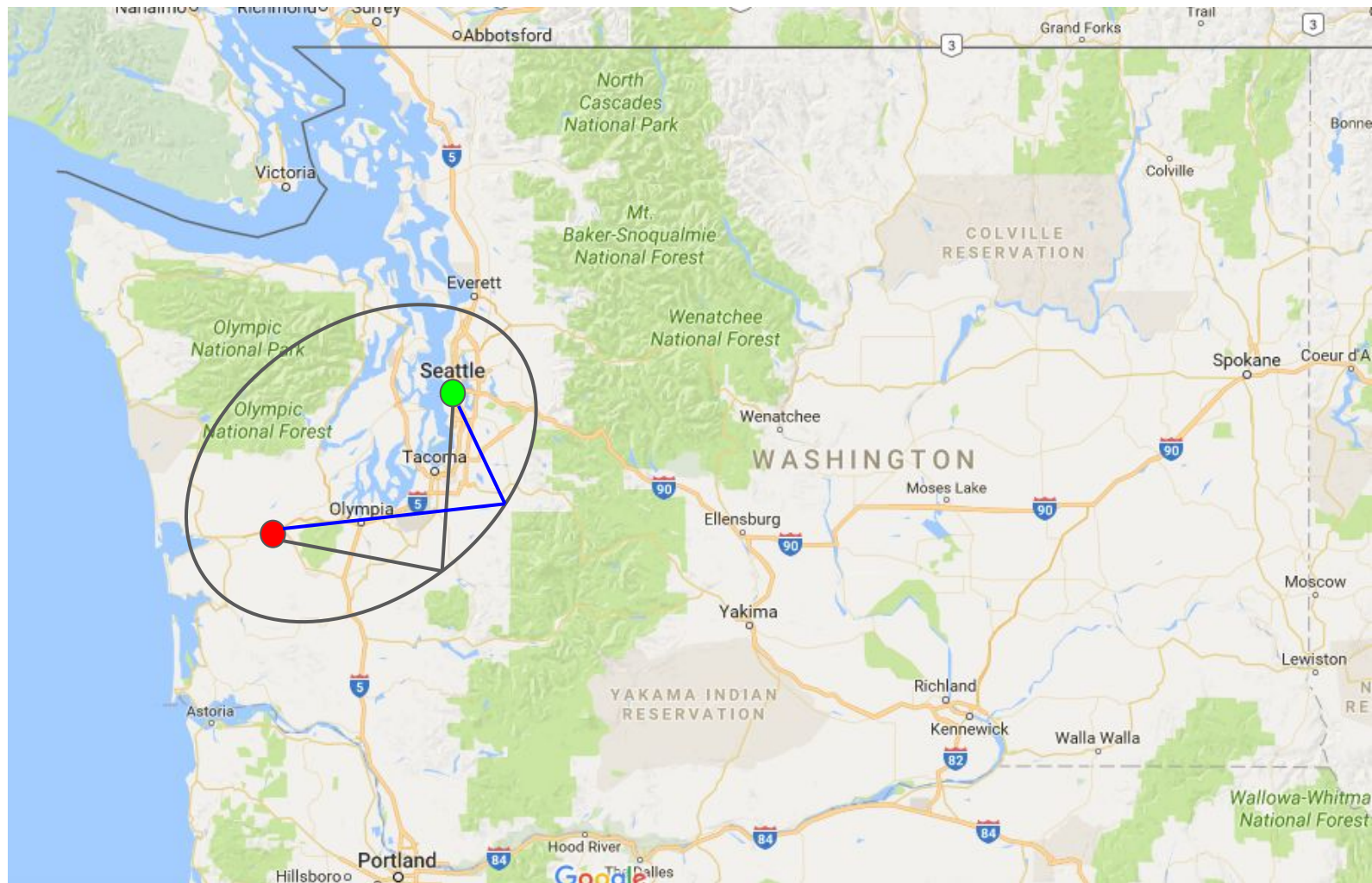


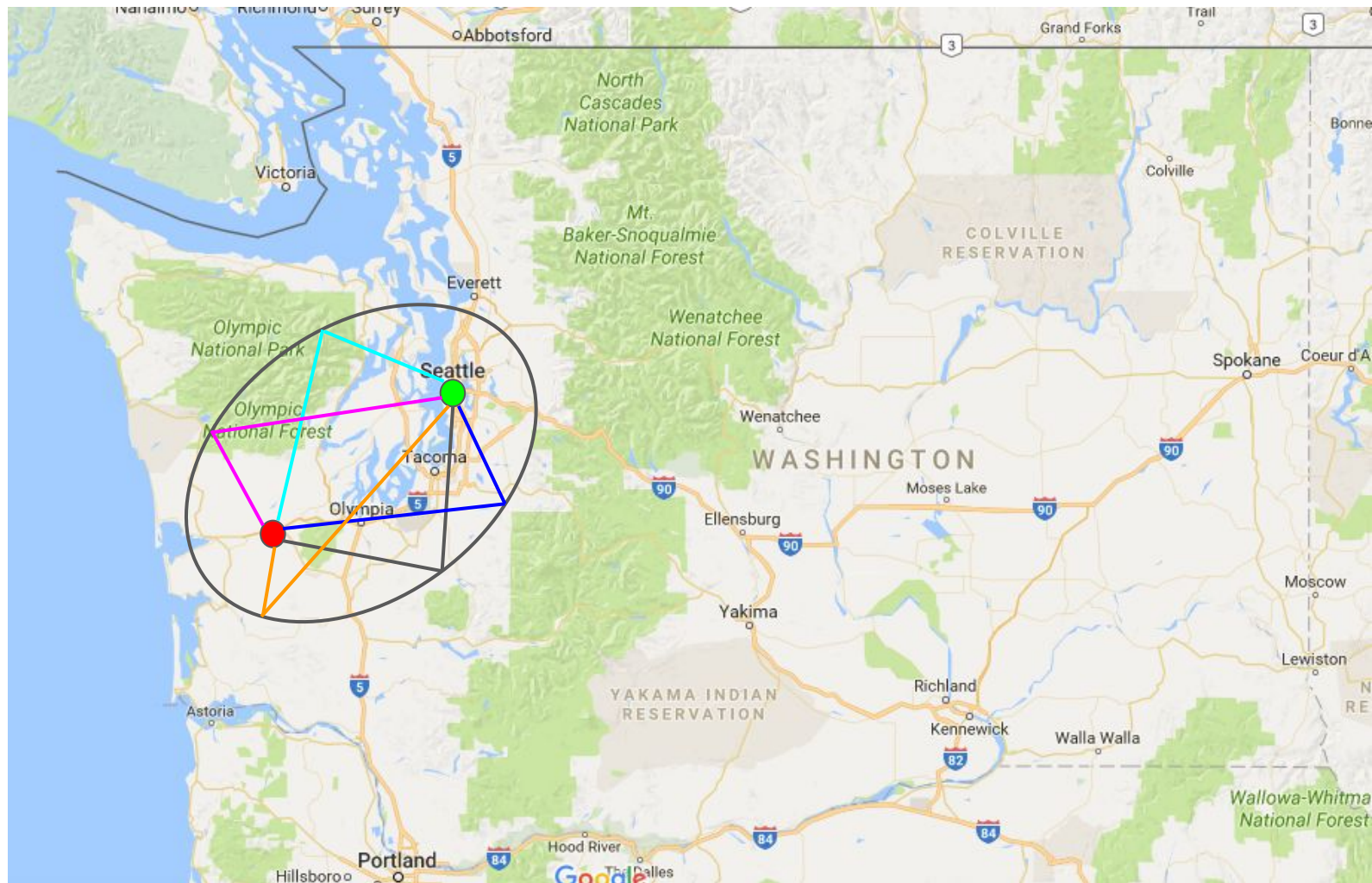
Determining Relevant Area

● Start location

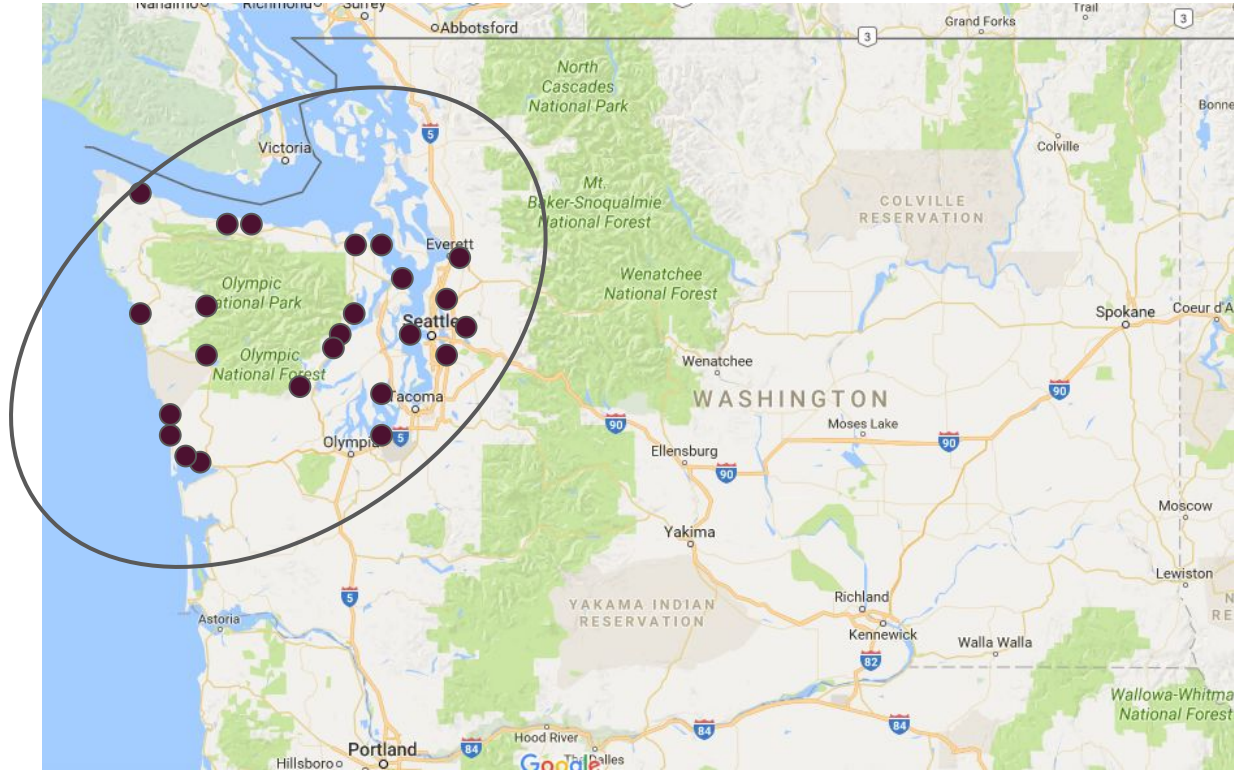
● End Location

a + b = maximum time constraint

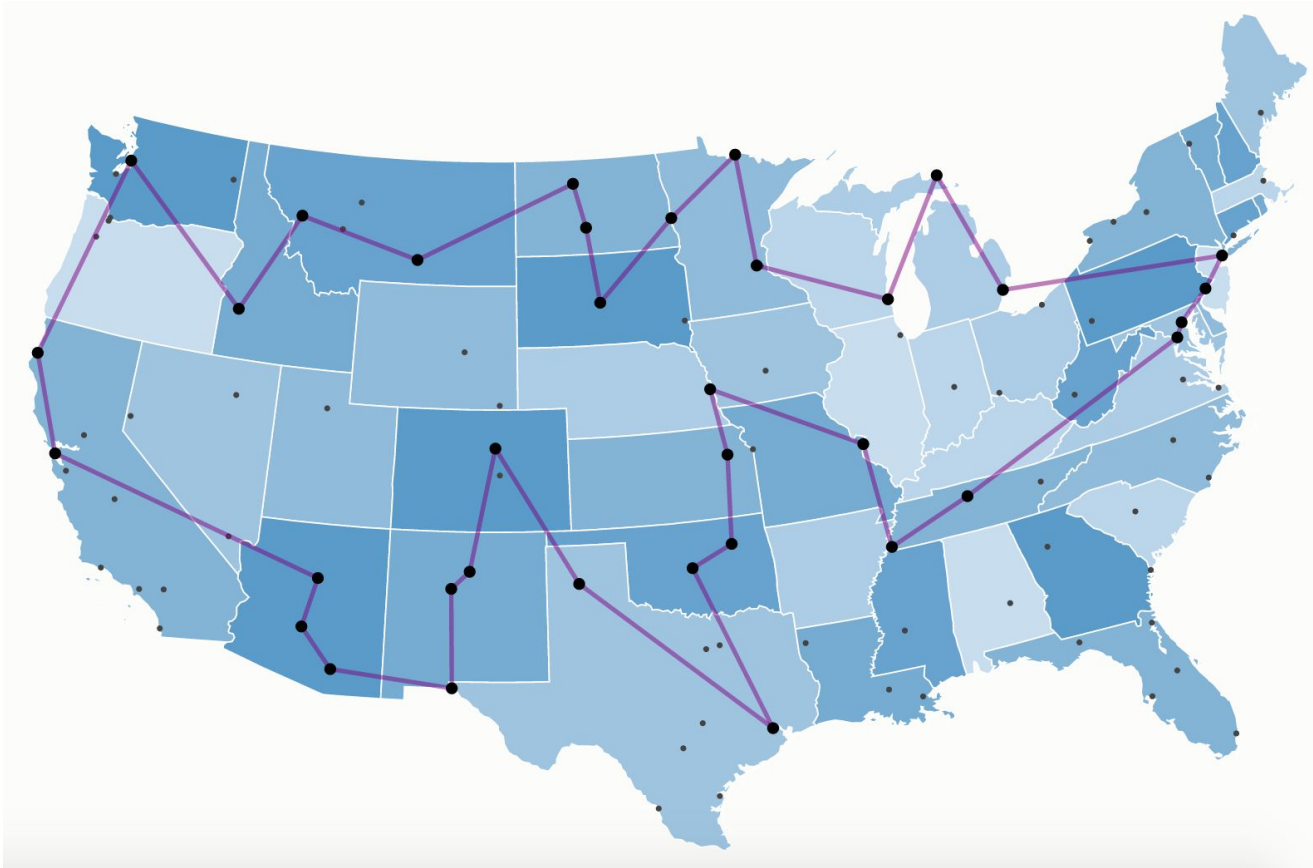




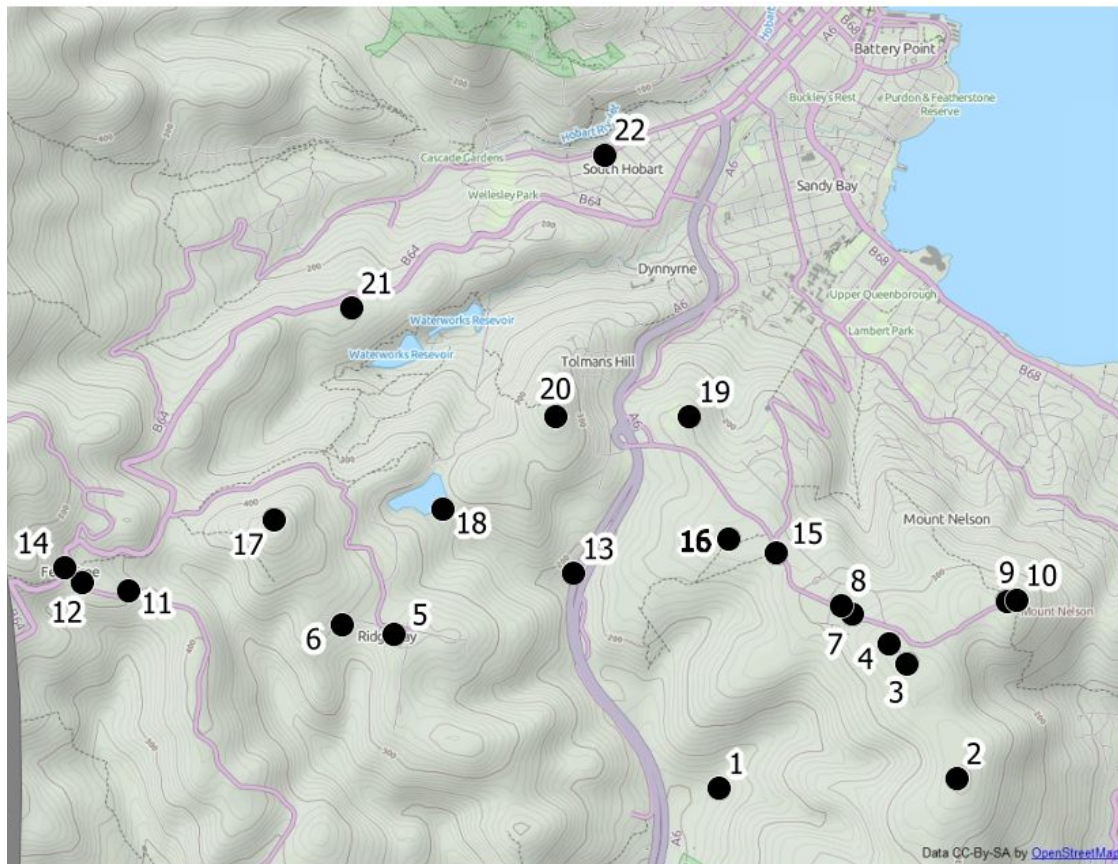
Route-Finding Algorithm



Traveling Salesman Problem

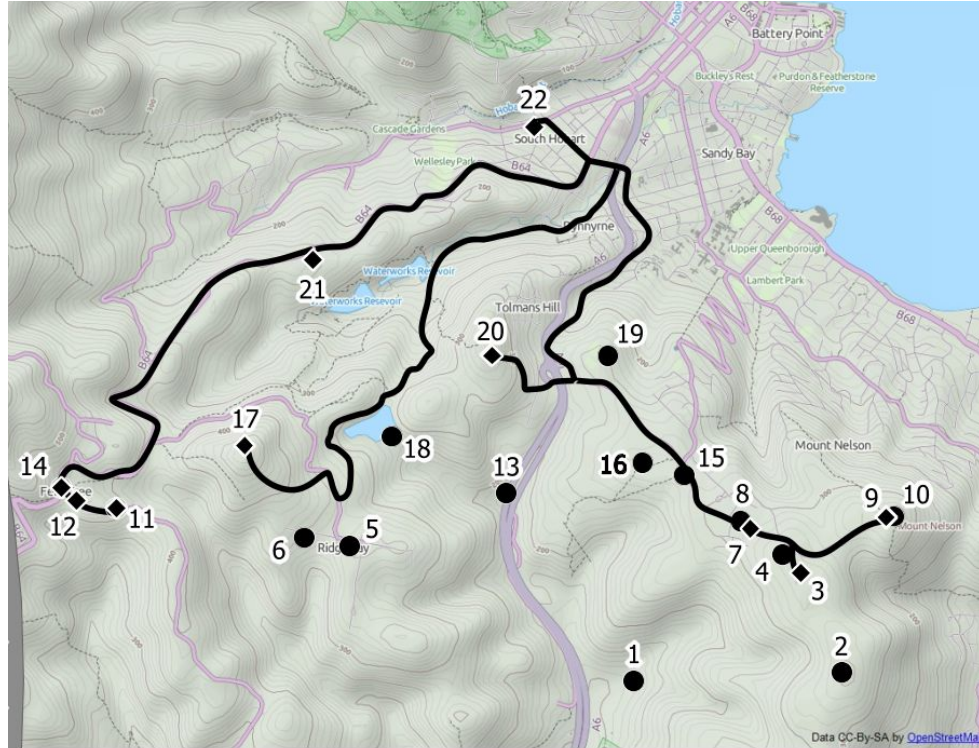


Orienteering Problem



i	S_i
1	10
2	10
3	30
4	30
5	20
6	10
7	30
8	10
9	20
10	10
11	30
12	30
13	10
14	10
15	10
16	10
17	20
18	20
19	10
20	20
21	20
22	30

Orienteering Problem



ILP Solution (objective function)

$$k = ([lat_1, long_1], [lat_2, long_2])$$

$$y[k] = \begin{cases} 1 & k \in route \\ 0 & else \end{cases}$$

Objective:

$$\max \sum_{k=0}^n y[k]$$

ILP solution (constraints)

Constraints:

(1)

$$\sum_{k=1}^n (y[k] * \text{time of segment } k) \leq \text{max time}$$



Time of route cannot exceed max time

(2)

$$\sum_{k=0}^{n-1} y[k] \text{ for any point } k[0] \leq 1$$

(3)

$$\sum_{k=0}^{n-1} y[k] \text{ for any point } k[1] \leq 1$$



Don't visit any point more than once

(4)

$$\sum_{k=0}^{n-1} y[k] \text{ for a point } k[0] = \sum_{k=0}^{n-1} y[k] \text{ for a point } k[1]$$



If you visit a point you must also leave that point (except the start and end point)

ILP solution (constraints)

Constraints:

(5)

$$\sum ([y[k] \text{ for } k[0] \text{ is the start point}] = 1$$

(6)

$$\sum ([y[k] \text{ for } k[1] \text{ is the start point}] = 0$$

(7)

$$\sum ([y[k] \text{ for } k[1] \text{ is the end point}] = 1$$

(8)

$$\sum ([y[k] \text{ for } k[0] \text{ is the end point}] = 0$$

}



You must leave the start point, but never enter it

}

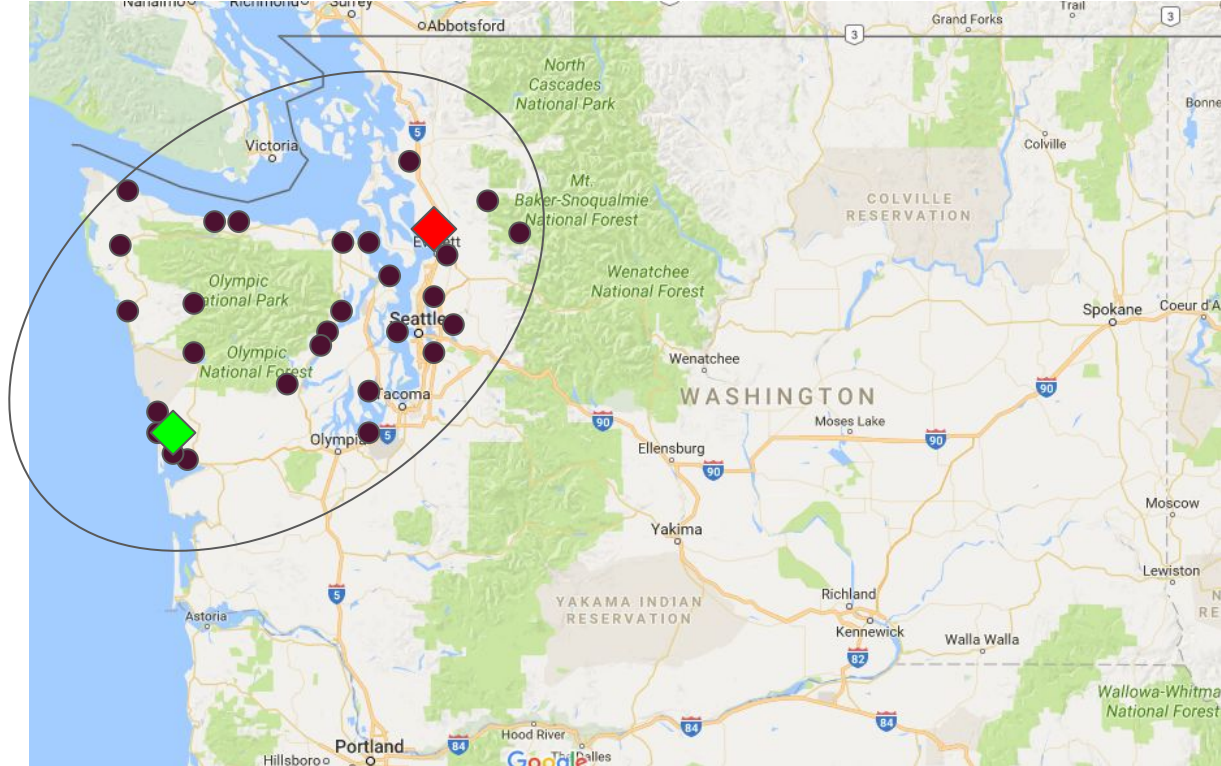


You must enter the end point but never leave it

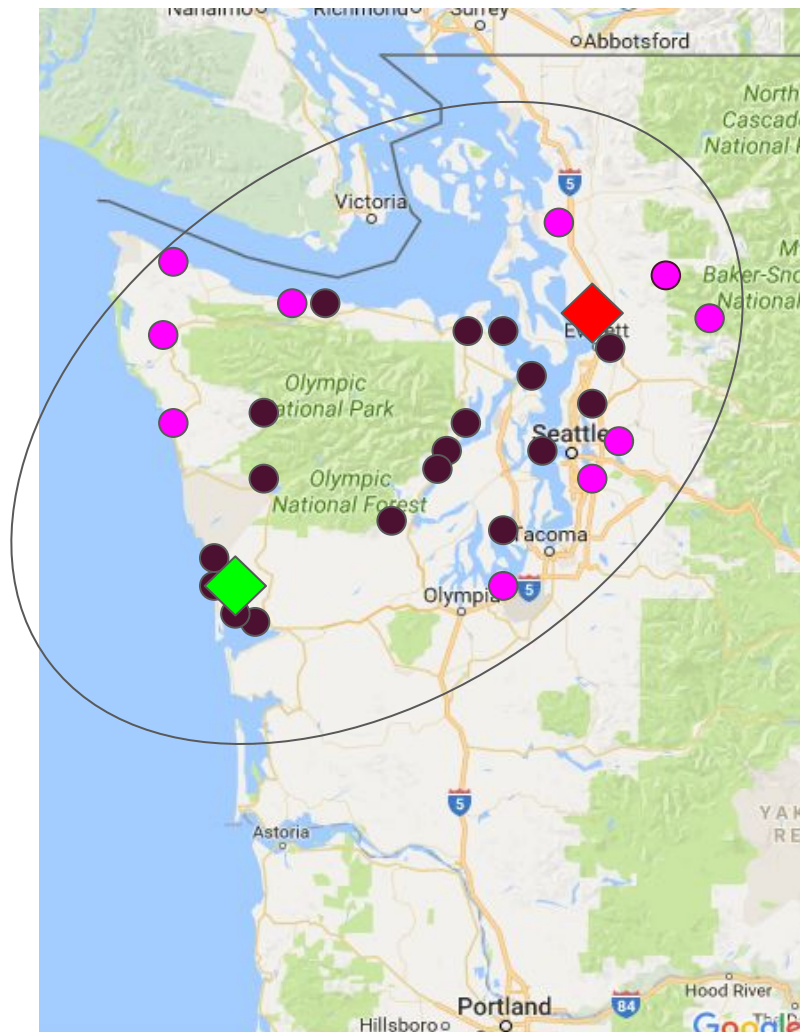
Alternative Heuristic

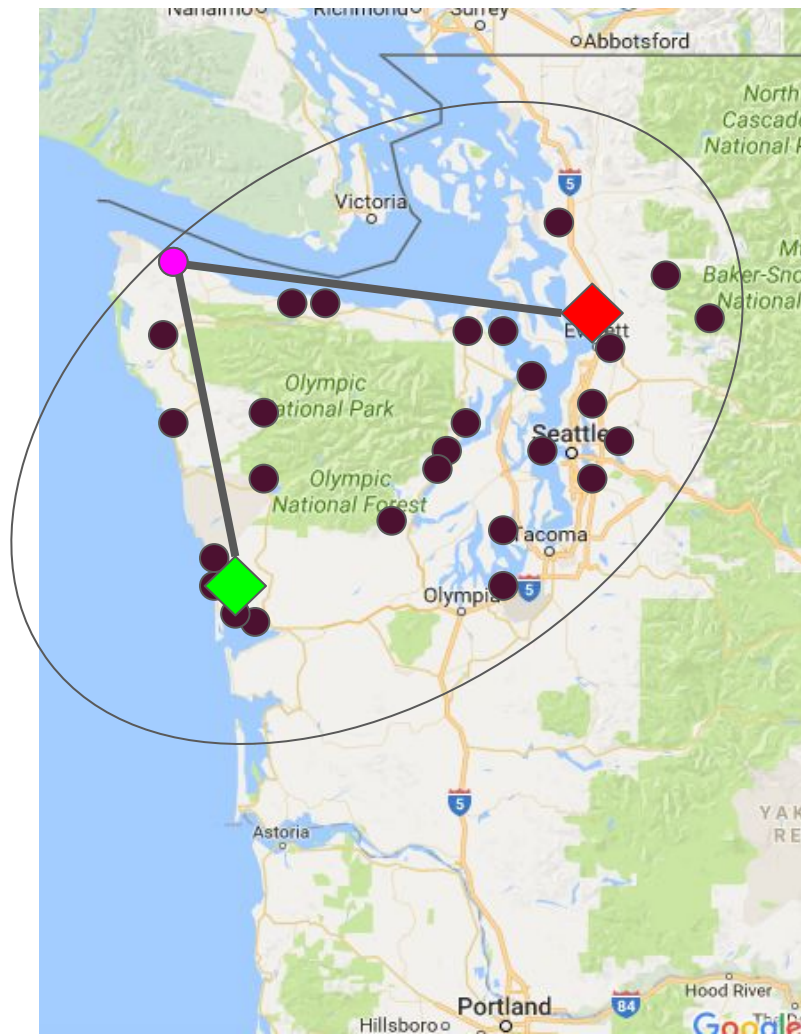
A fast and effective heuristic for the orienteering problem

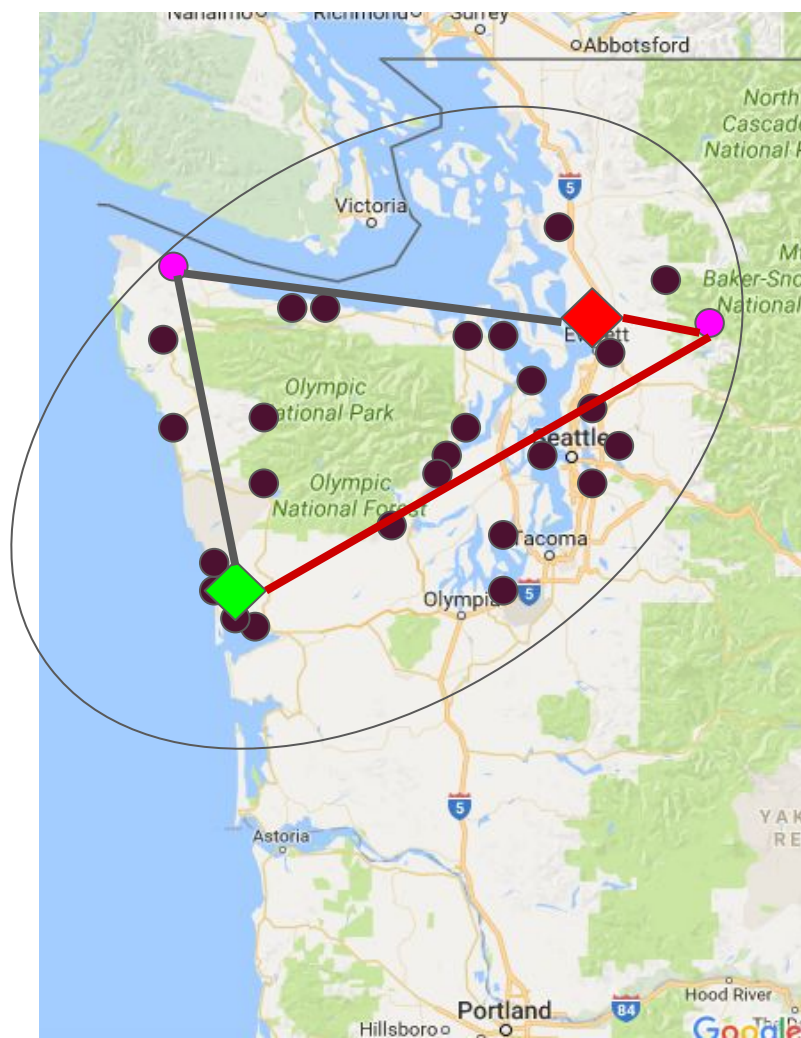
I-Ming Chao ^a, Bruce L. Golden ^{b, .}, Edward A. Wasil ^c



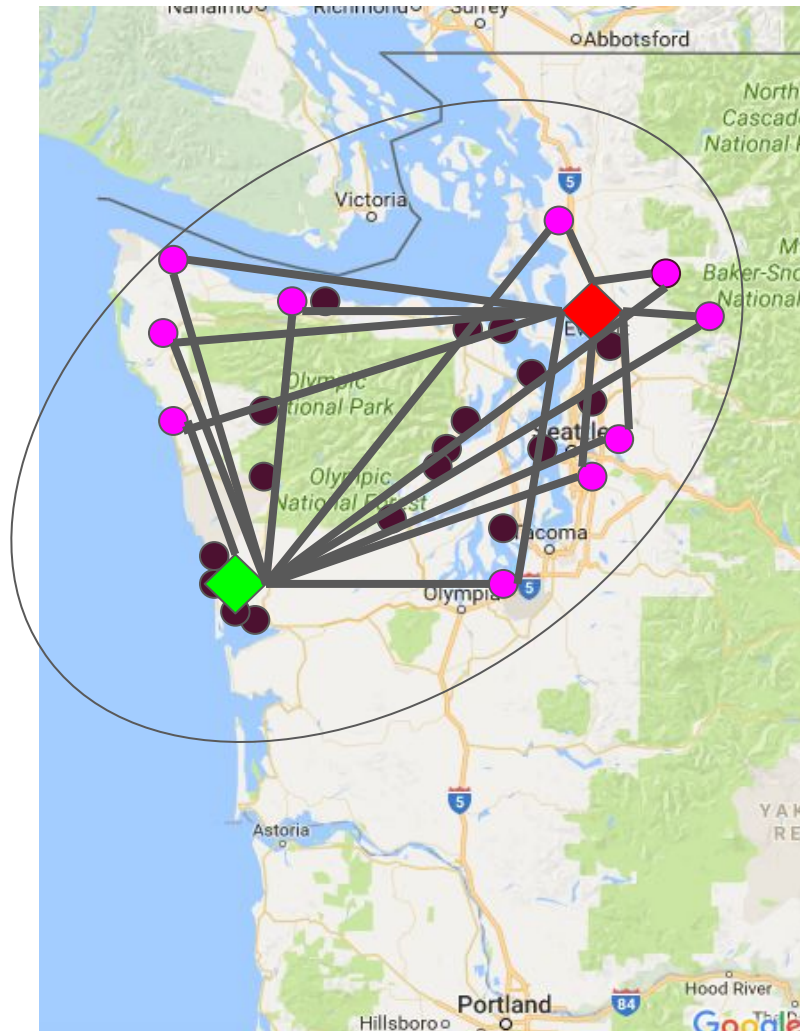
10 points farthest
from the start and
end point

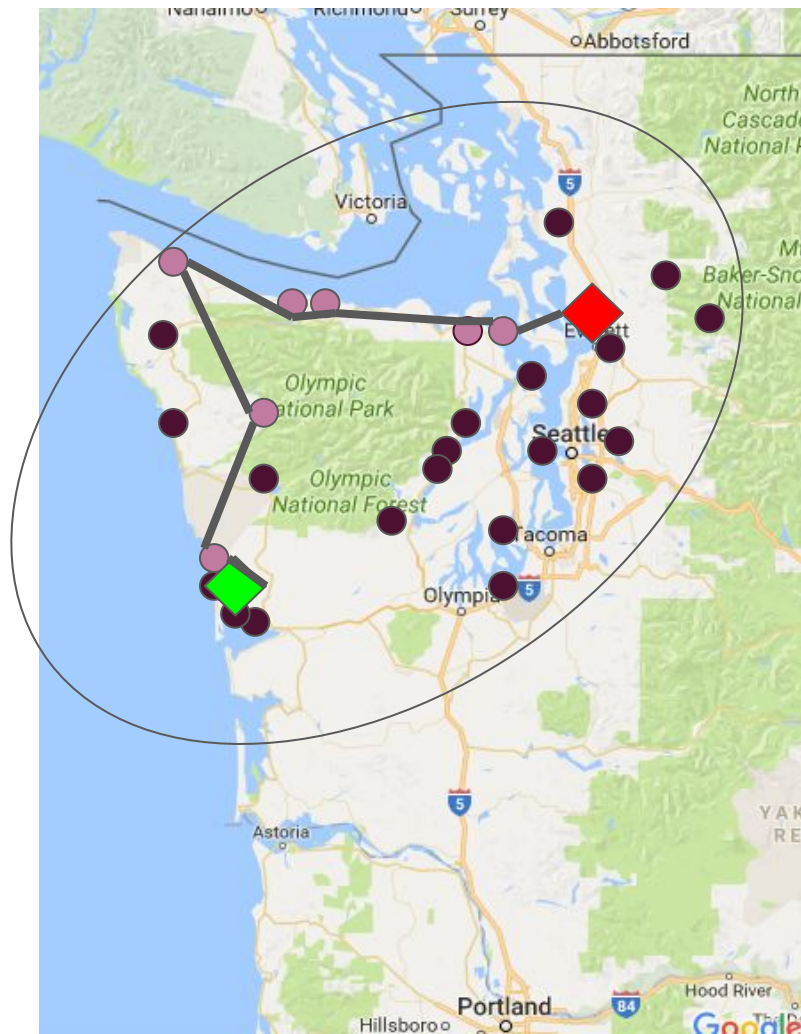


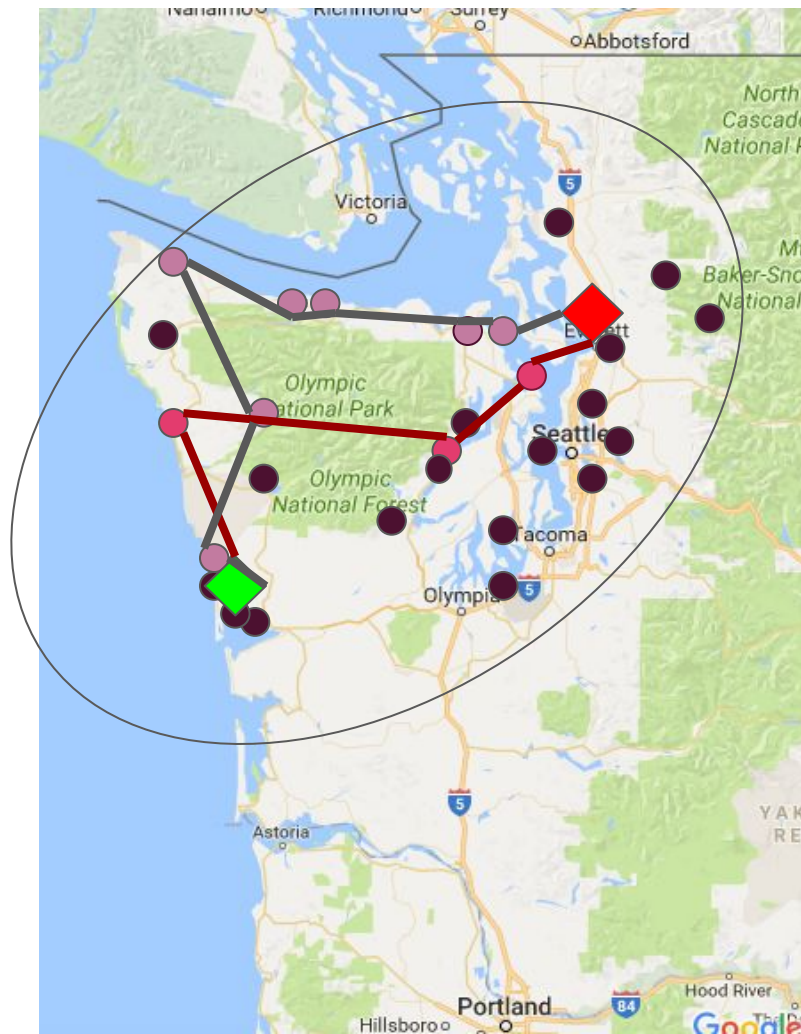




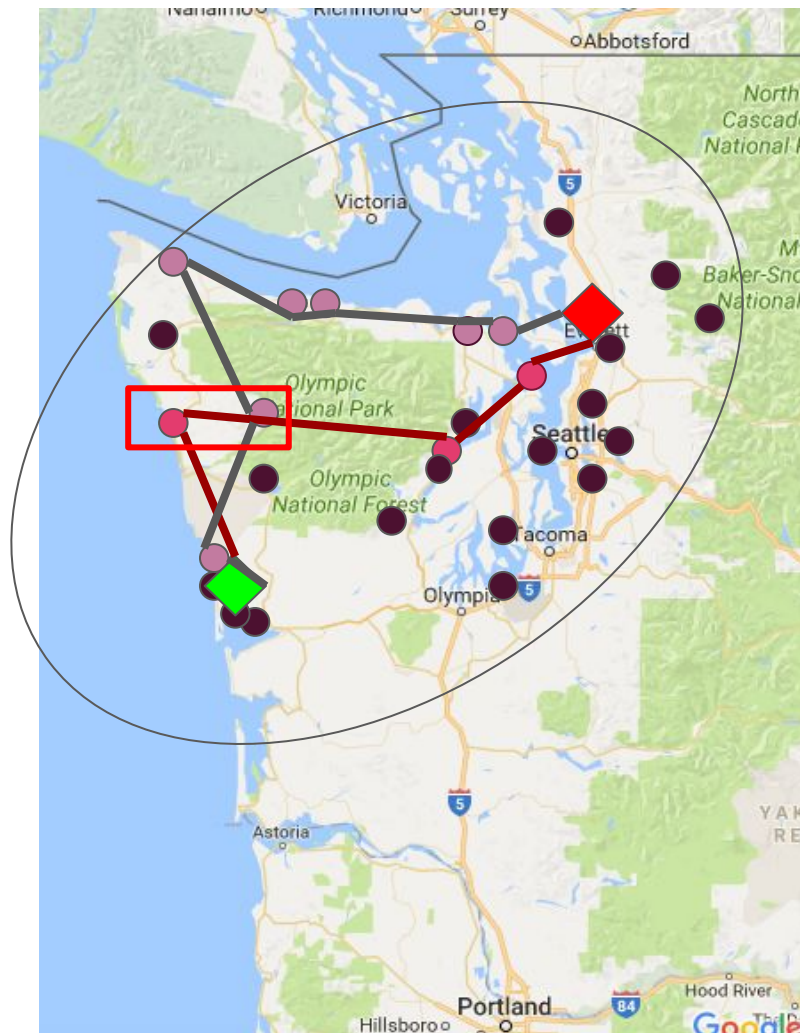
10 paths through the 10
farthest points



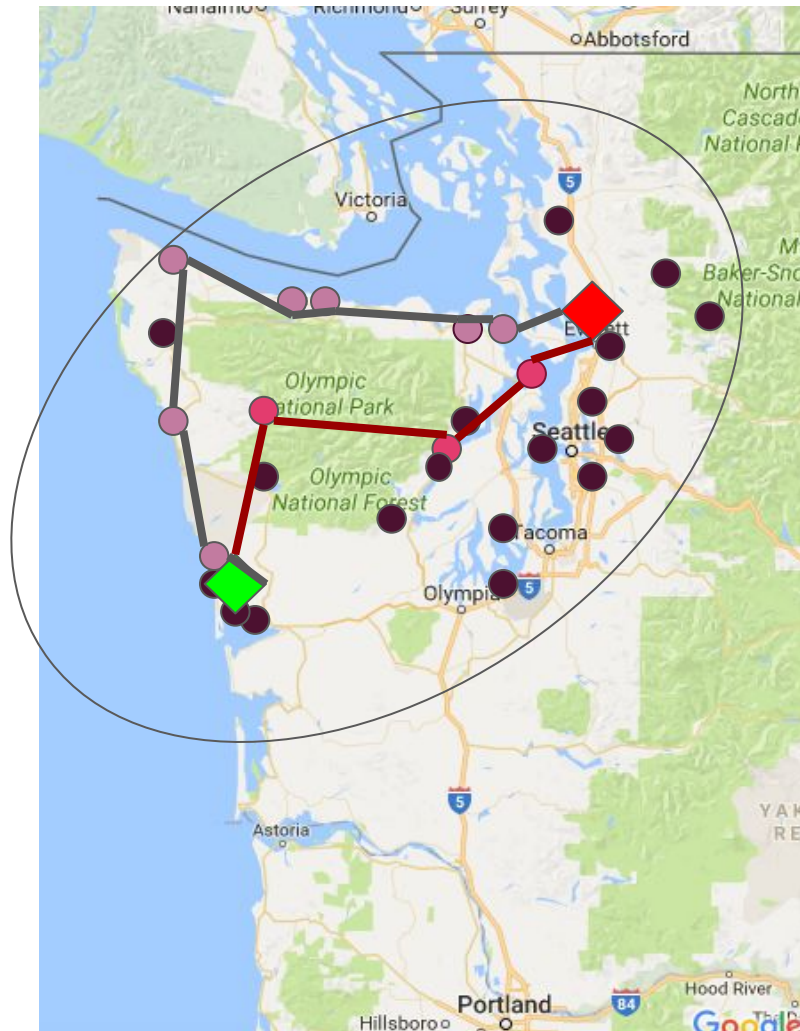




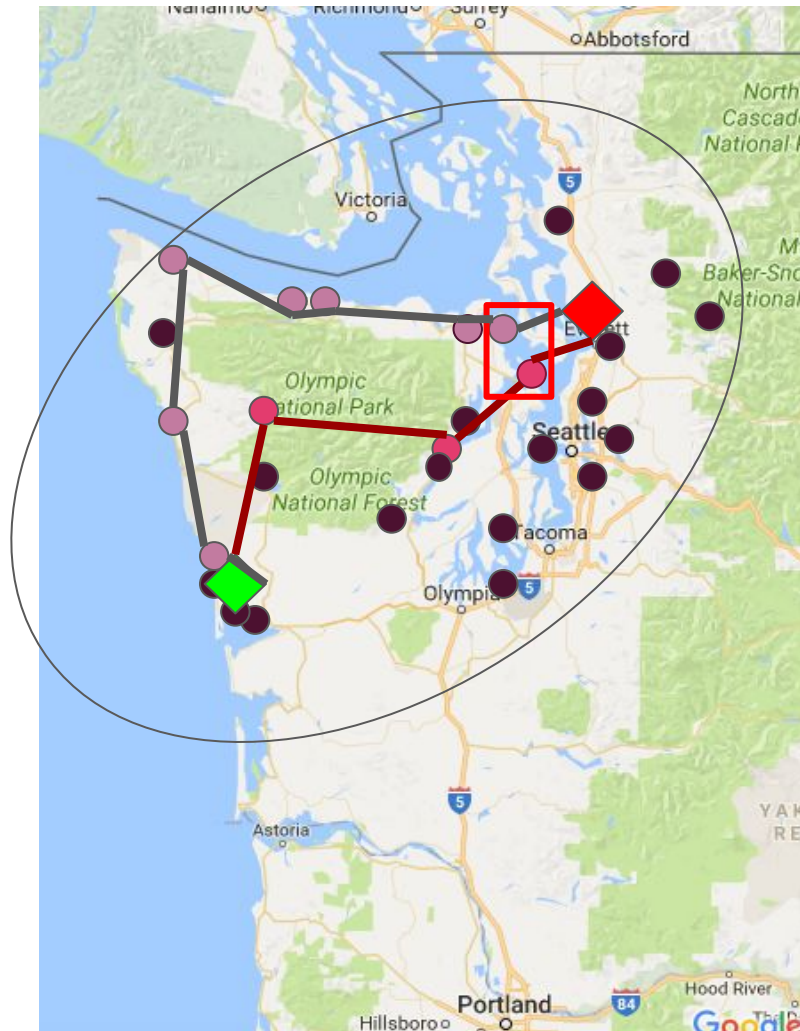
2-Point Exchange



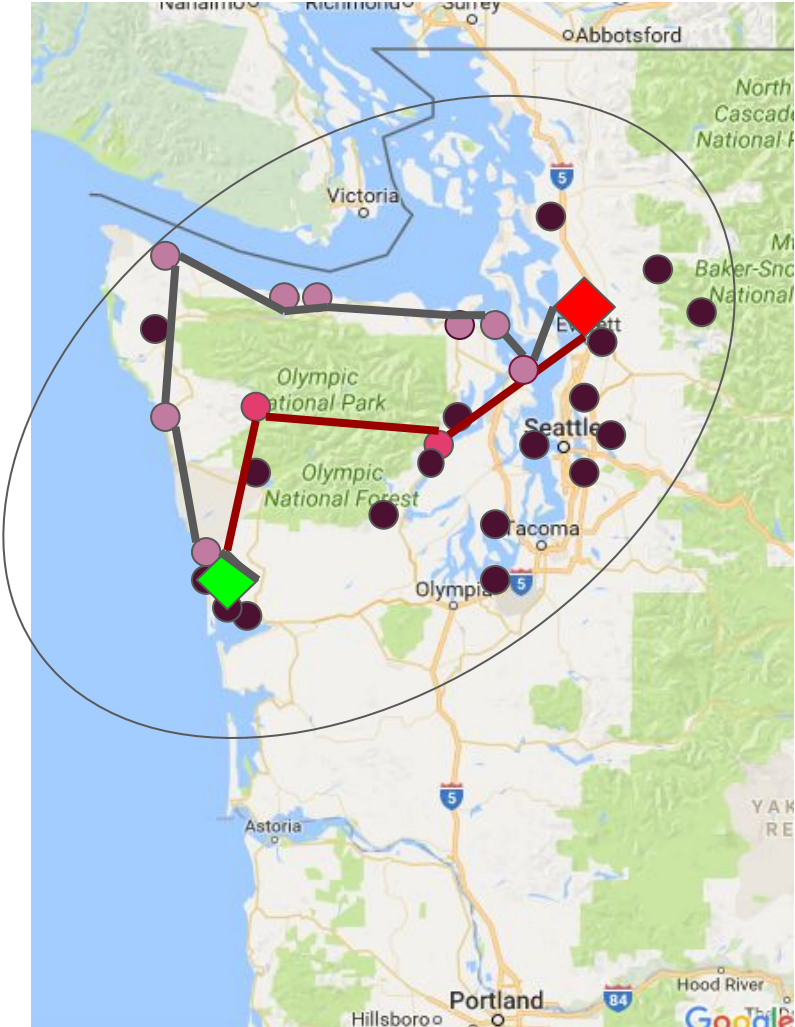
Improved Routes after 2-Point Exchange



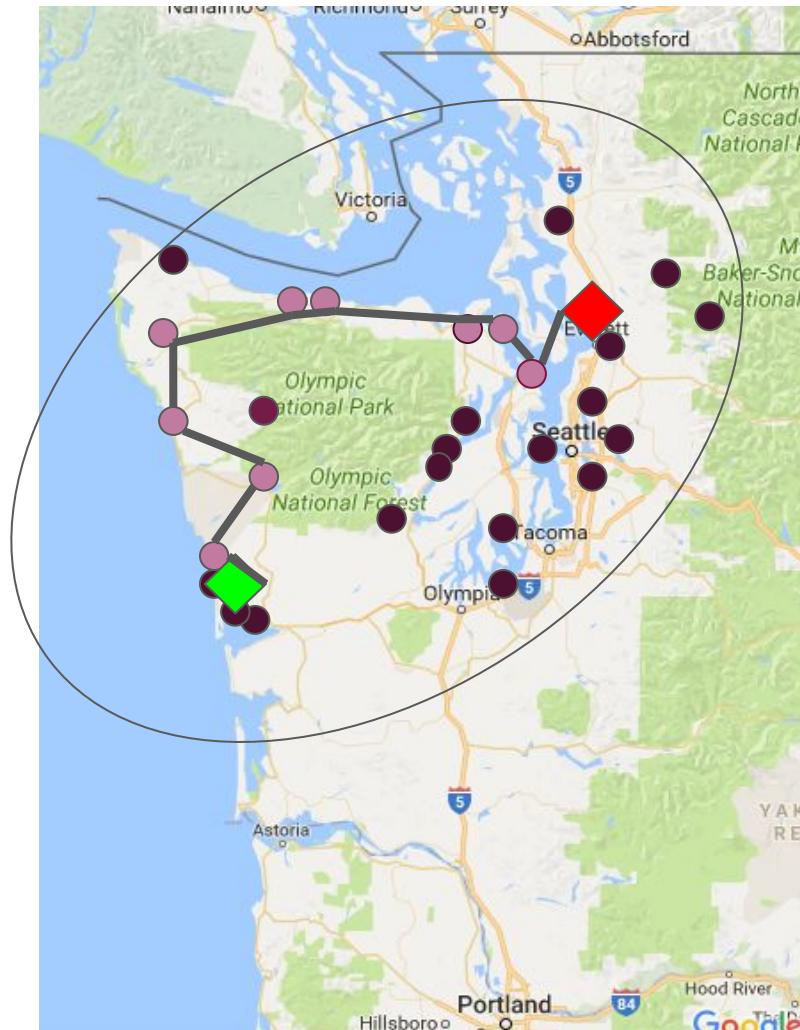
1-Point Movement



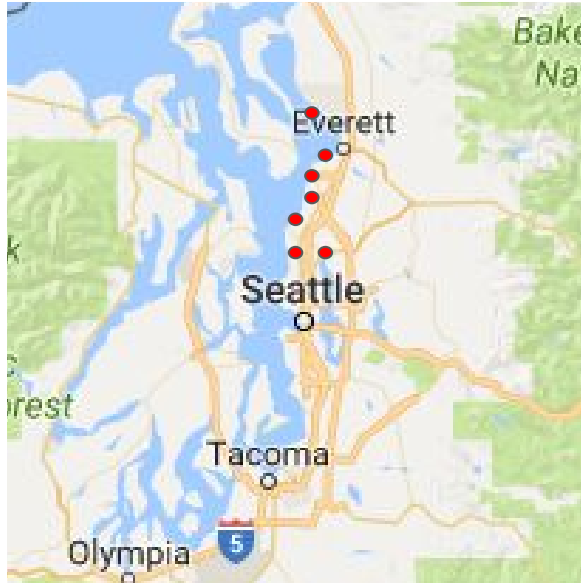
Improved OPT Route after
1-Point Movement



Final OPT Route:
9 Scenic Points



ILP Optimizations



ILP Optimizations



ILP Optimizations



ILP Optimizations

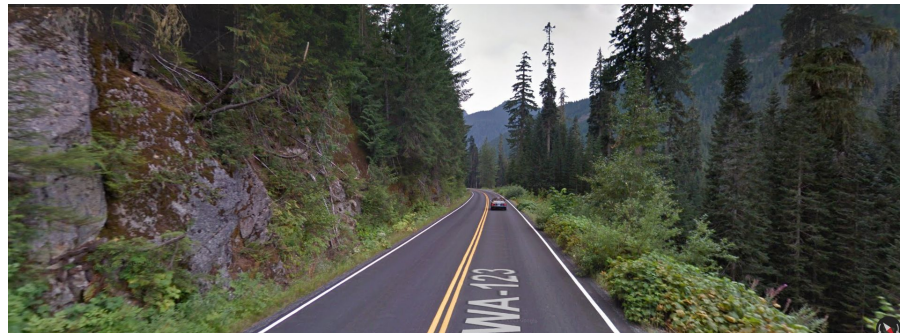


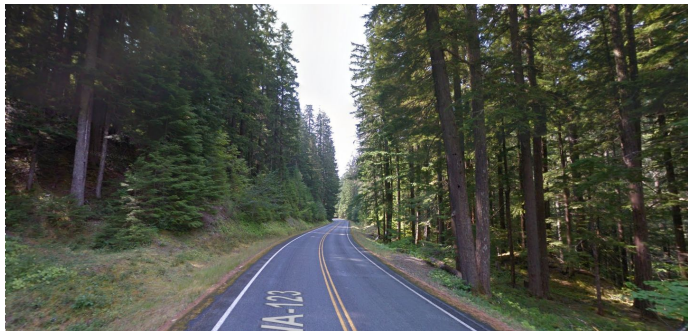
ILP Optimizations



Google

GoScenic





Nature and Woods



Mountains

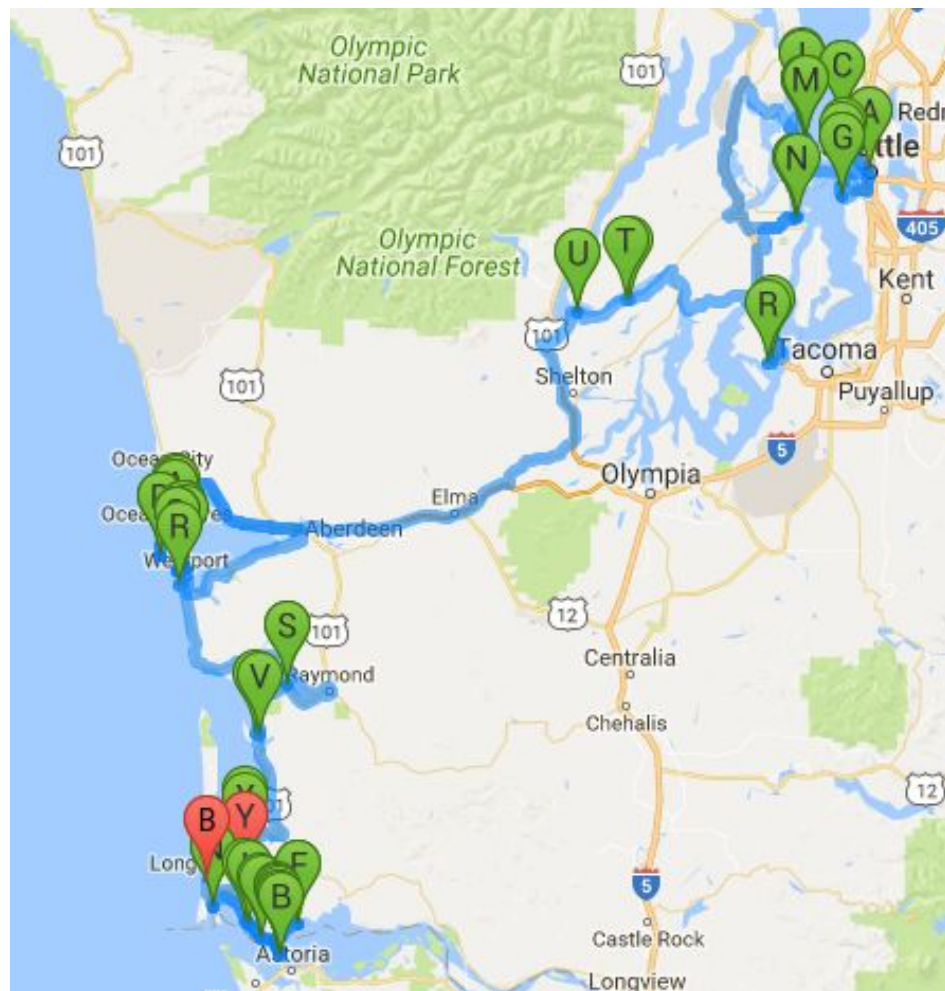


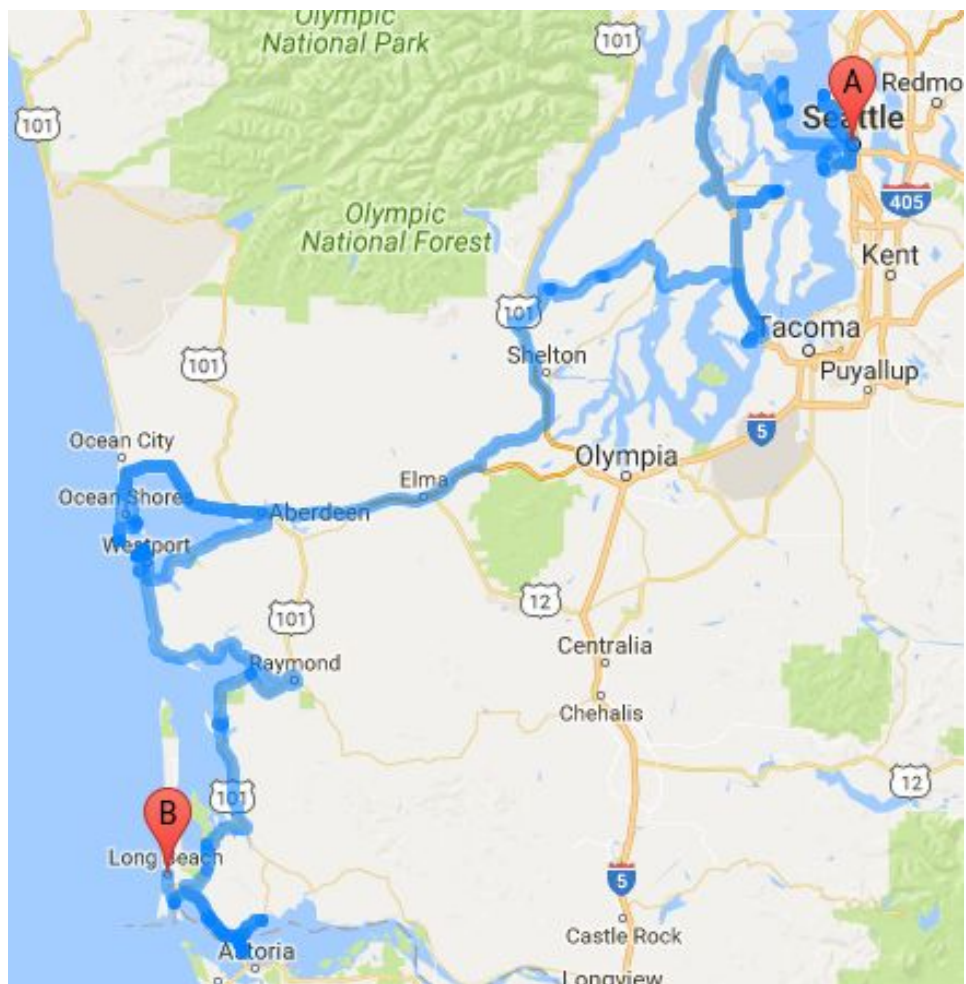
Water

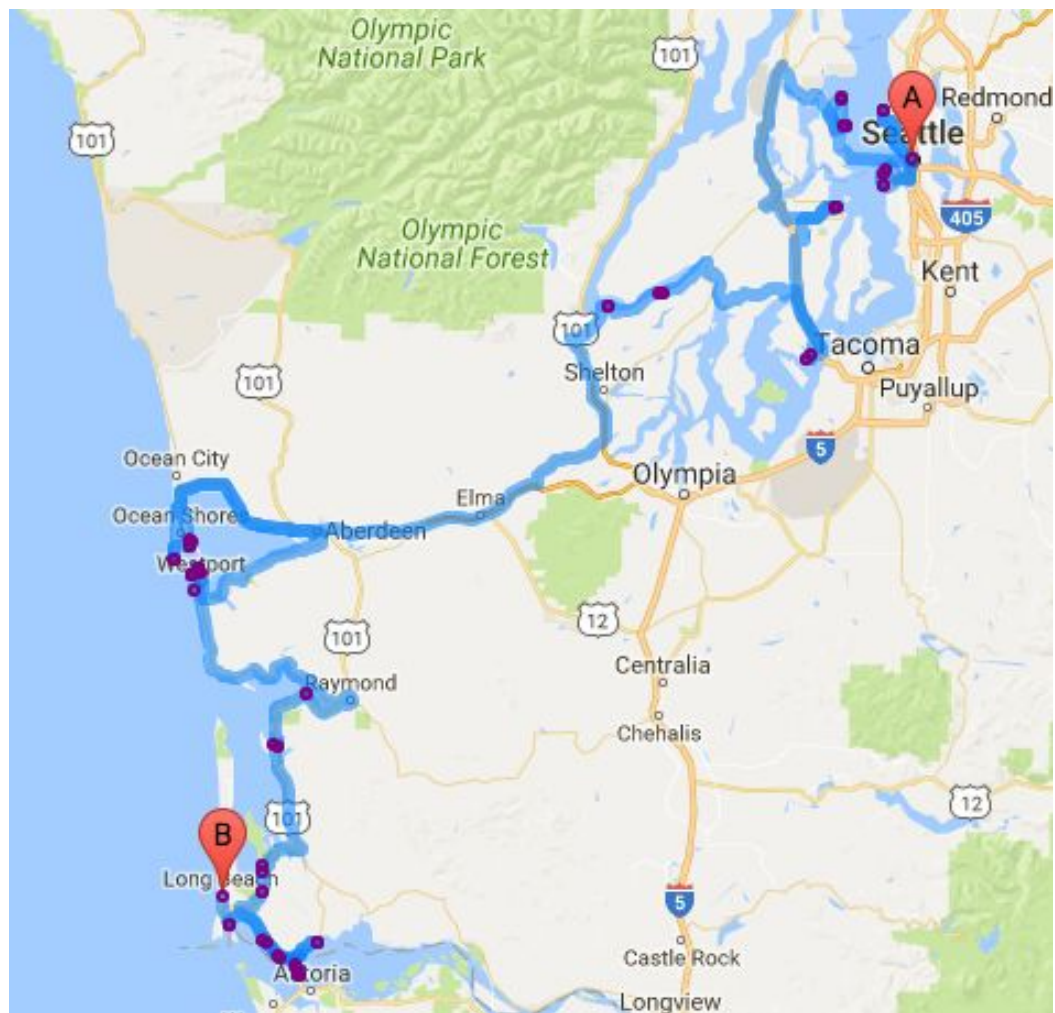
GoScenic “Roadmap”

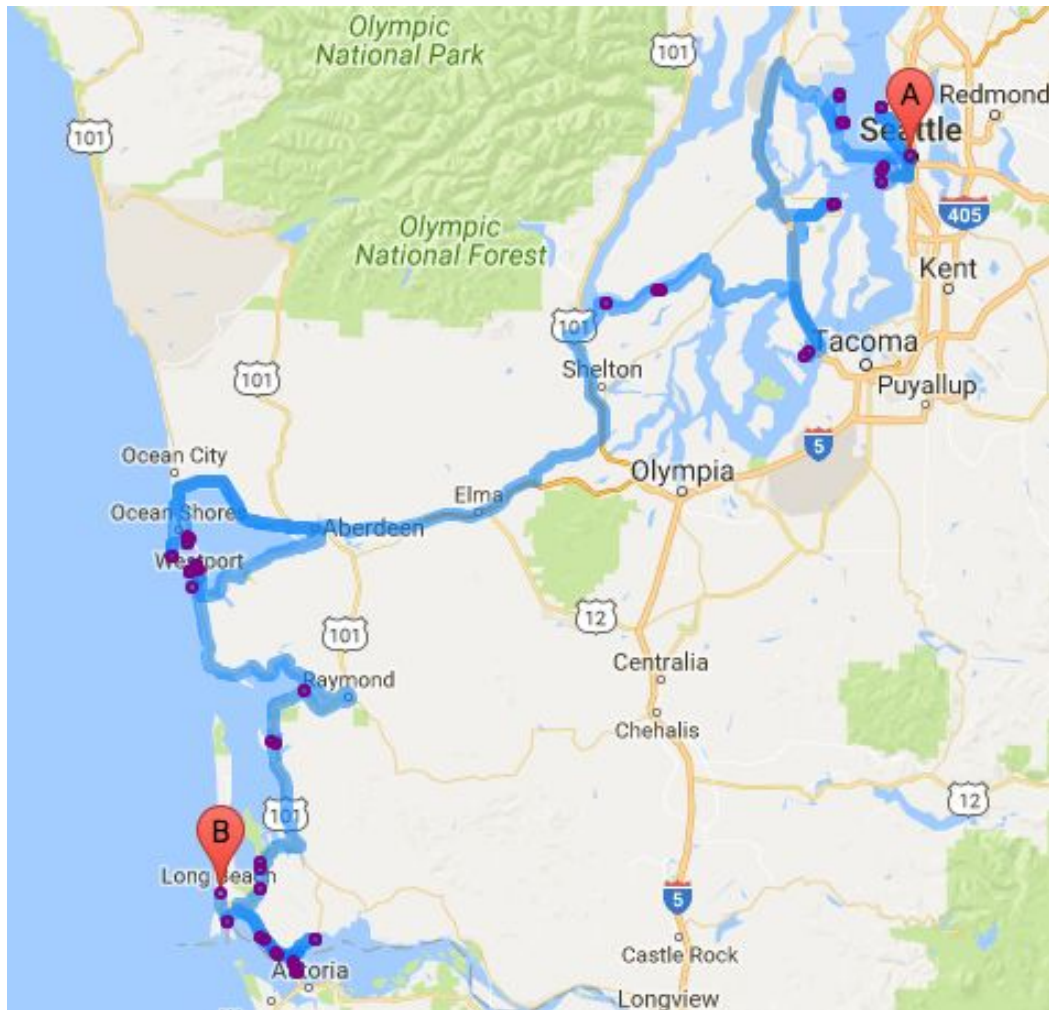
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4. Explore!



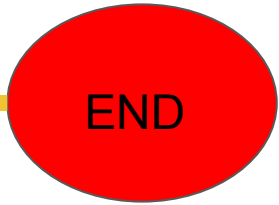
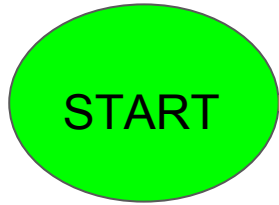


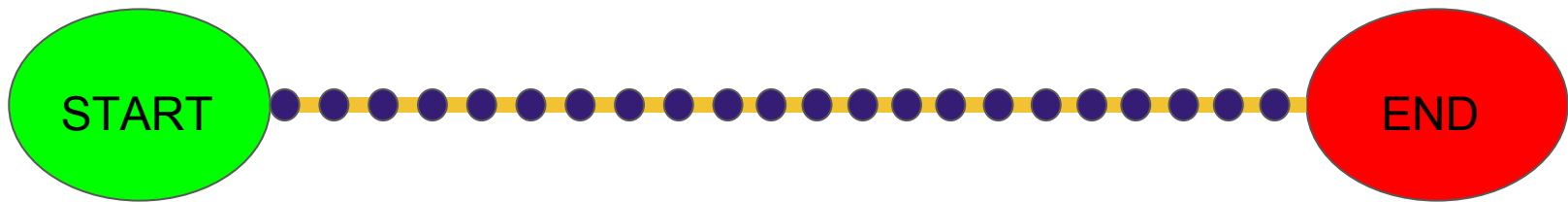


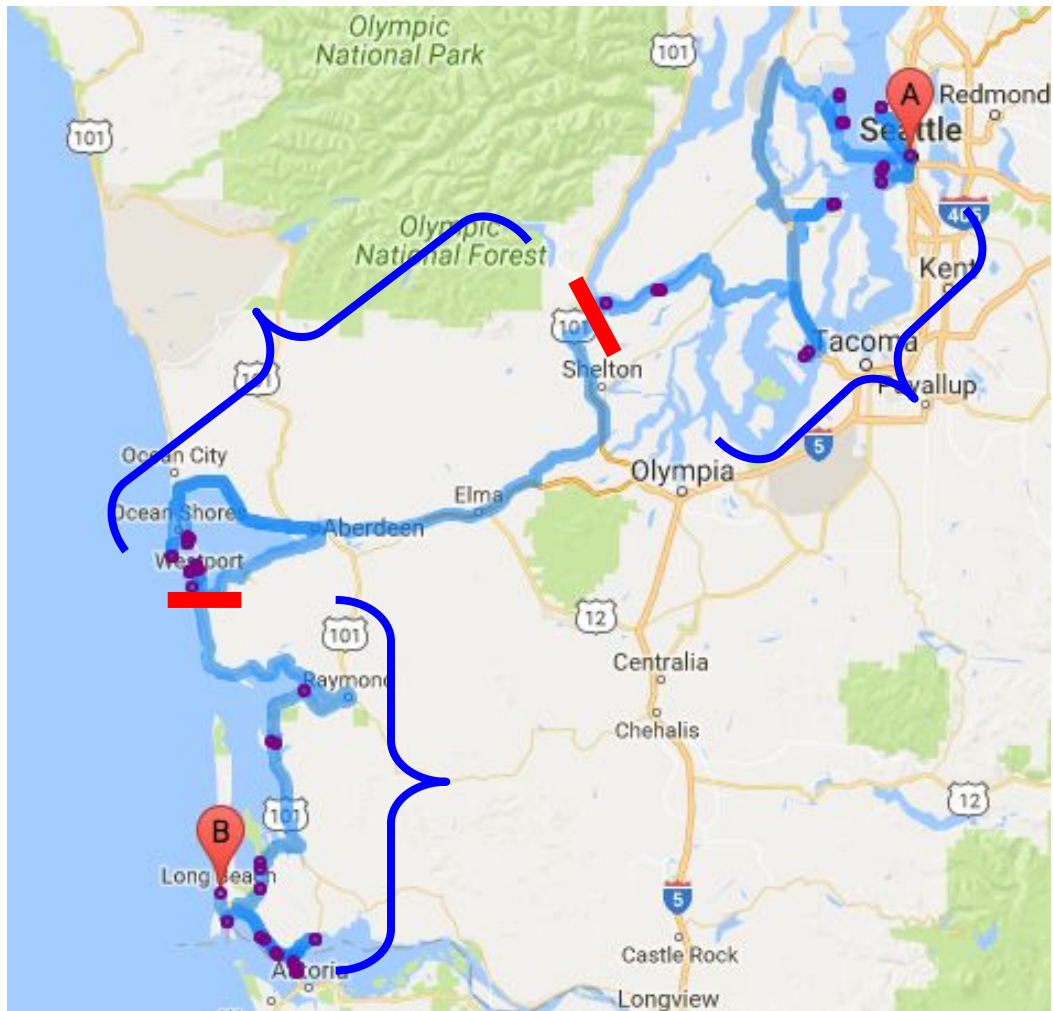




64
Scenic
Points



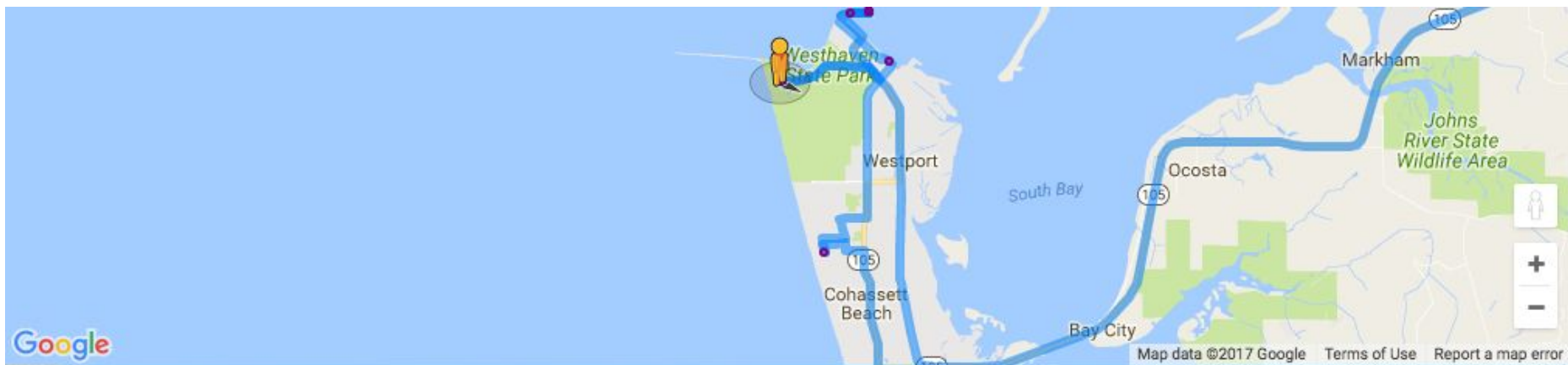




448-498 Madison St, Seattle, WA 98164, USA

8.1 mi. About 28 mins

1. Head **southwest** on **Madison St** toward **4th Ave** 197 ft
- ➡ 2. Turn **right** at the 1st cross street onto **4th Ave** 1.2 mi
- ↩ 3. Turn **left** onto **Denny Way** 0.4 mi
- ↗ 4. Slight **right** onto **Western Ave W** 0.2 mi
5. Continue onto **Elliott Ave W** 1.1 mi
6. Continue onto **15th Ave W** 1.4 mi
- ↩ 7. Keep **left** to stay on **15th Ave W** 0.6 mi
- ↗ 8. Slight **right** toward **15th Ave NW** (signs for **Ballard**) 453 ft
9. Continue onto **15th Ave NW** 269 ft
- ↩ 10. Turn **left** onto **NW Leary Way** 0.6 mi
- ↩ 11. Turn **left** onto **NW Market St** 0.5 mi
- ↩ 12. Slight **left** onto **NW 54th St** 0.4 mi



GoScenic “Roadmap”

1. Classify the scenic area.
2. Build the best route between our scenic points.
3. Output route to user.
4. Explore!



GoScenic: a Demo!

The image shows a web application interface for 'GoScenic' set against a scenic mountain background. The title 'GoScenic' is in a large, dark blue serif font, with the tagline 'Enjoy the Ride!' in a smaller, italicized serif font below it. There are two white input fields for 'Start Location' and 'End Location'. Below these is a time display showing '0' in a box, followed by 'Hours', '0' in a box, and 'Minutes'. To the right of the time display is a dropdown menu labeled 'Select Scenery' with a downward arrow. At the bottom center is a white button with the text 'Get My Route' in a dark blue font.

GoScenic

Enjoy the Ride!

Start Location

End Location

Hours Minutes

Select Scenery ⌵

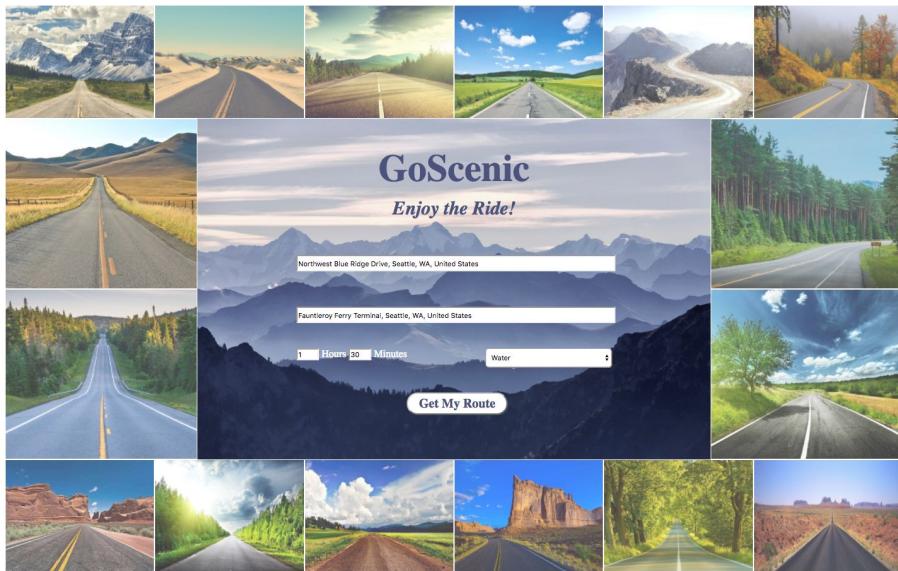
Get My Route



Thank you!



Questions?



The GoScenic map interface displays a map of Seattle, WA, with a blue route highlighted. The route starts at point A (Northwest Blue Ridge Drive) and ends at point B (Fauntleroy Ferry Terminal). The map shows various landmarks and roads in the area. Below the map, there is a list of scenic points along the route, each with a description and a distance. A street view image at the bottom shows a scenic view of a road along the water.

GoScenic
We found 10 scenic points on your route!
The total length of your trip is 1 hours, 16 minutes, and 27 seconds.

2032 NW Blue Ridge Dr, Seattle, WA 98177, USA

1.1 mi. About 5 mins

1. Head west on NW Blue Ridge Dr toward Richwood Ave NW 0.4 mi
2. Continue onto Triton Dr NW 0.2 mi
3. Continue onto 28th Ave NW 335 ft
4. Turn right onto NW Golden Dr 0.1 mi
5. Turn left onto 31st Ave NW 0.1 mi
6. Turn right onto NW 95th St 233 ft
7. NW 95th St turns slightly left and becomes Whitney Pl NW 289 ft
8. Continue onto View Ave NW 0.1 mi

9200-9216 View Ave NW, Seattle, WA 98117, USA

1.1 mi. About 6 mins

1. Head southwest on View Ave NW toward Cyrus Ave NW 0.2 mi
2. Turn right onto Golden Gardens Dr NW 0.5 mi