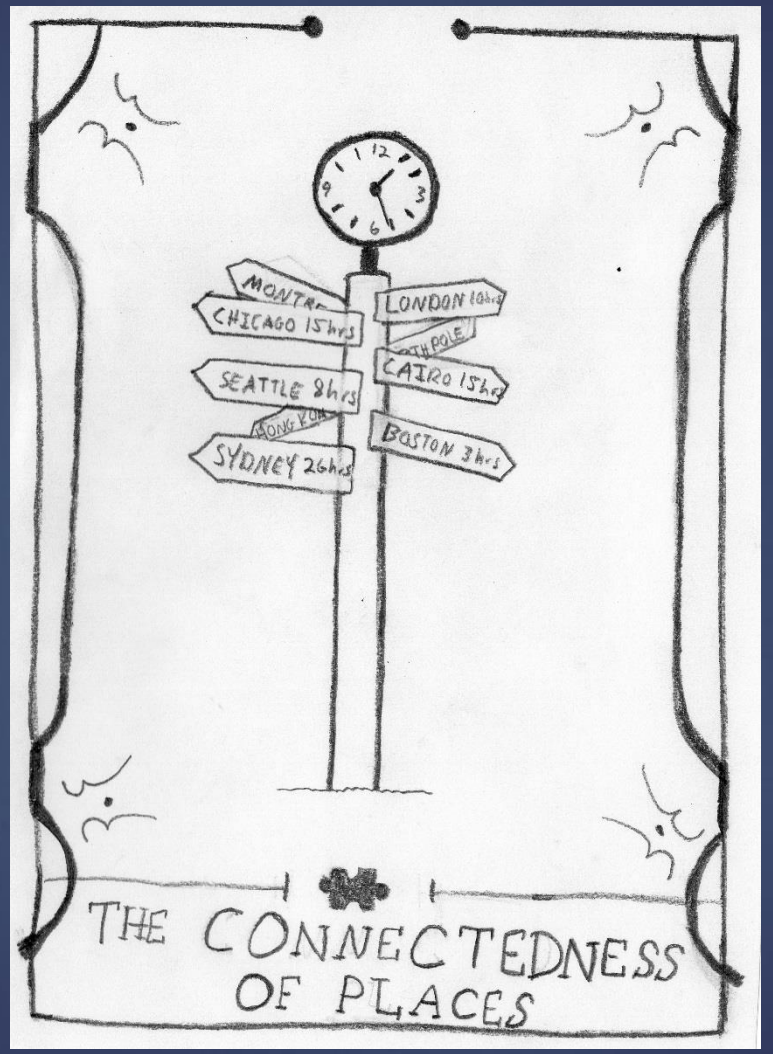
CSYS/MATH 300: PoCS Term Project



AUSTIN THOMAS

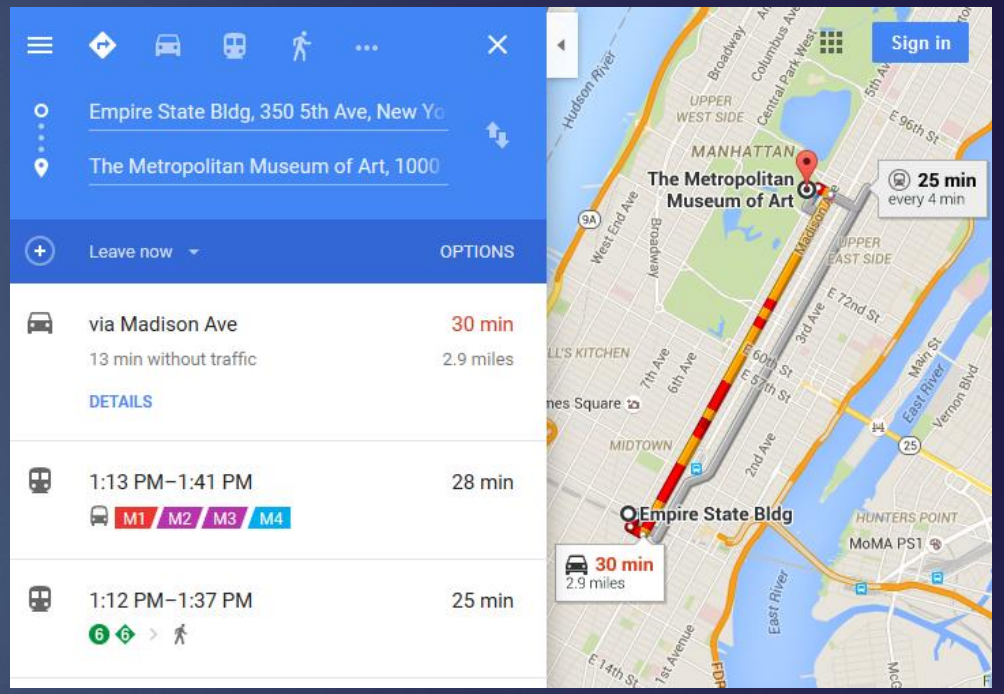
FALL 2015

Project Idea

- Traditional mapping: Point A to point B spans X distance
- Real-word practice: 'Oh yeah, XYZville is half an hour away.'
- Project goal: Describe travel in terms of time → Connectedness!
- Connectedness: ability to reach more places in X amount of time.

Project Plan

- Use Google Maps Distance Matrix data to map travel times between ZIP codes or postcodes
- Repeat for various modes of transport
  - Car, bicycle, on foot, metro, bus, ferry, etc.
- Hopping on a train, plane, ferry, etc. usually allows greater mobility
- Map locations reached vs. time and compare
  - Index of Connectedness?
- Test bed: Vermont (309 ZIP codes) and New York City (211 ZIP codes)



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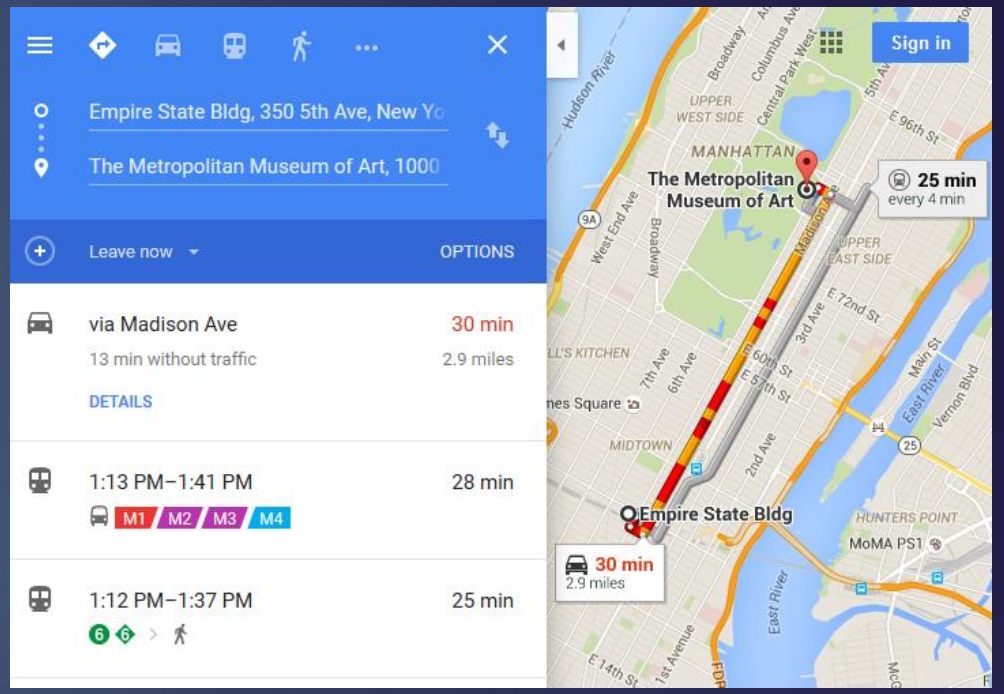
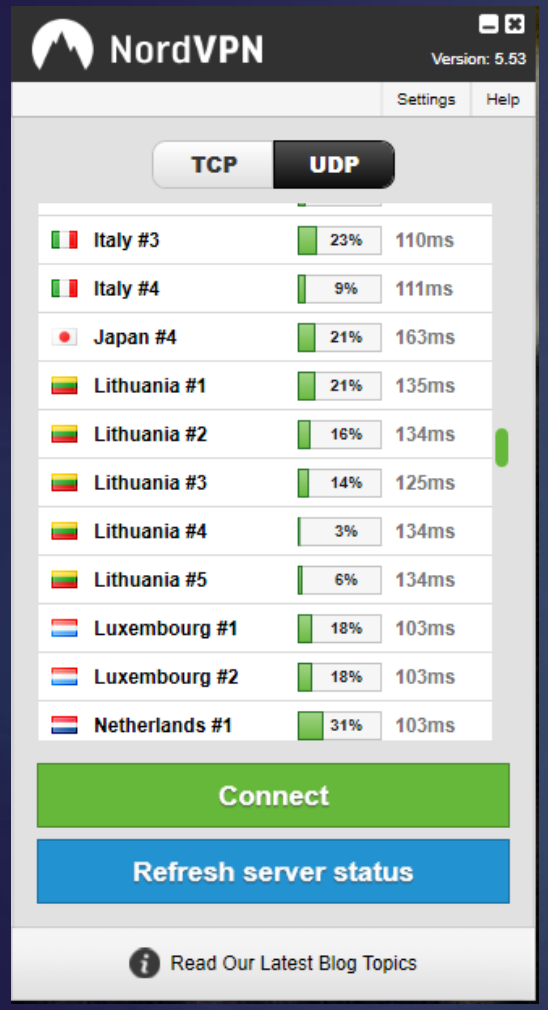
  - 273,565 data points……



Standard Usage Limits

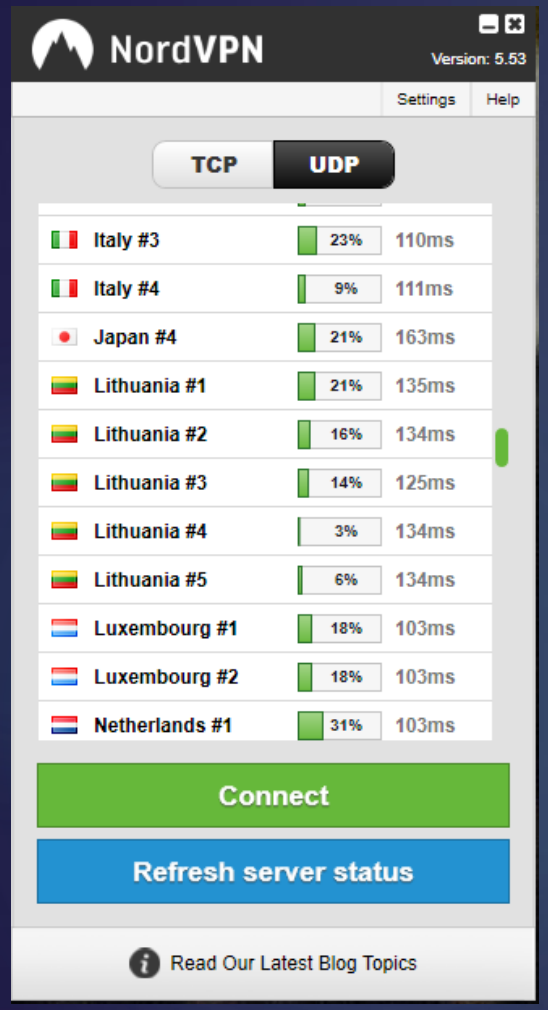
Users of the standard API:	Enable pay-as-you-go billing to unlock higher quotas:
• 2,500 free elements per day • 100 elements per query • 100 elements per 10 seconds	$0.50 USD / 1000 additional elements, up to 100,000 daily. ENABLE BILLING

In practice…….



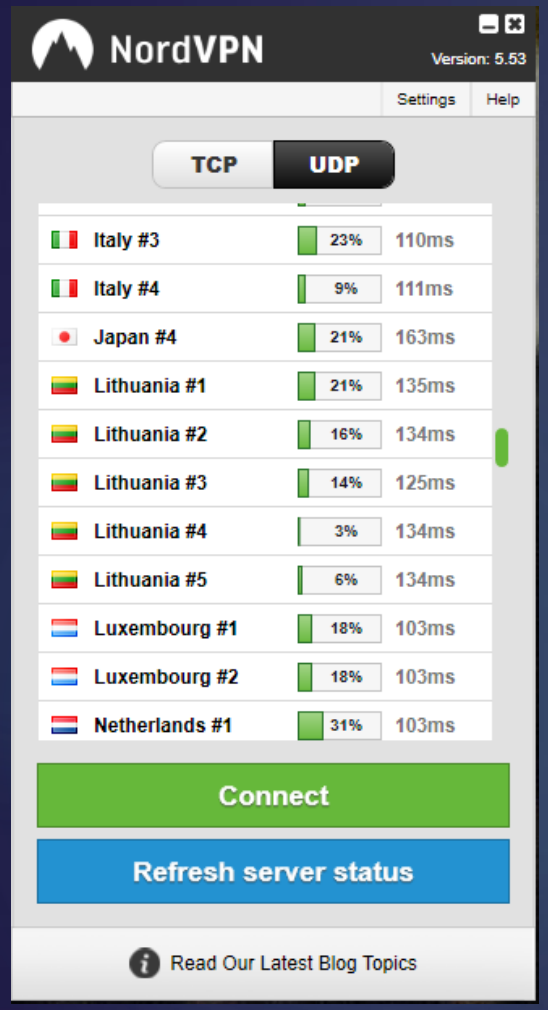
- VPN = virtual private network
- Encrypts internet traffic
- “tunnel” out to a new location

In practice……



\+ https://maps.googleapis.com/maps/api/distancematrix/xml?origins=Vancouver+BC&destinations=San+Francisco&key=AIzaSyDZRUFlFJy9XpBRchXXXXXXXXXXXXXXXXX

In practice……



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https://maps.googleapis.com/maps/api/distancematrix/xml?origins=Vancouver+BC&destinations=San+Francisco&key=AIzaSyDZRUFlFJy9XpBRchXXXXXXXXXXXXXXXXX

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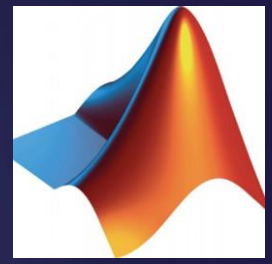
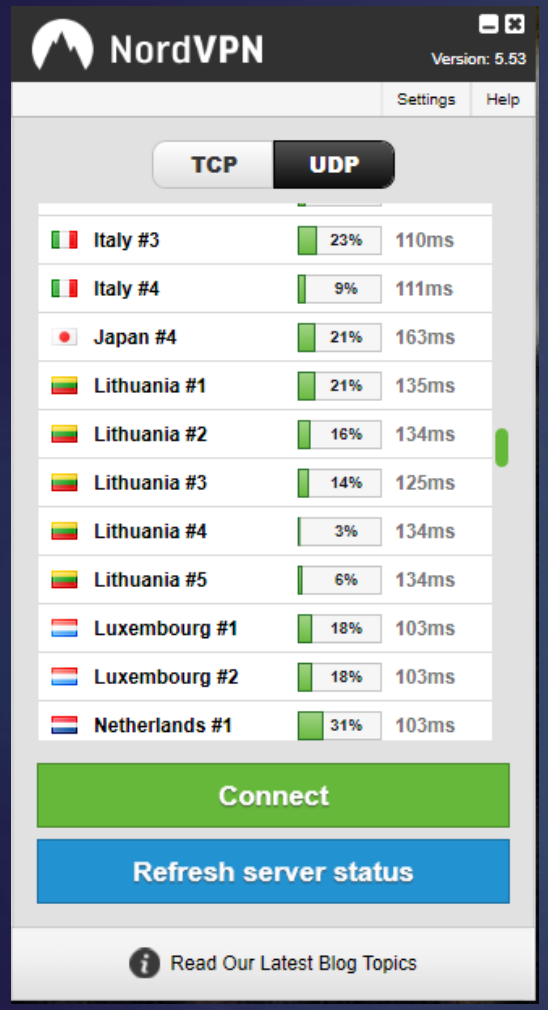


In practice……



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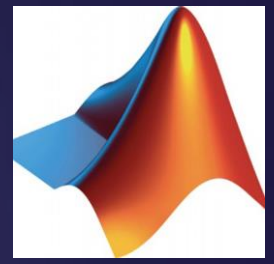
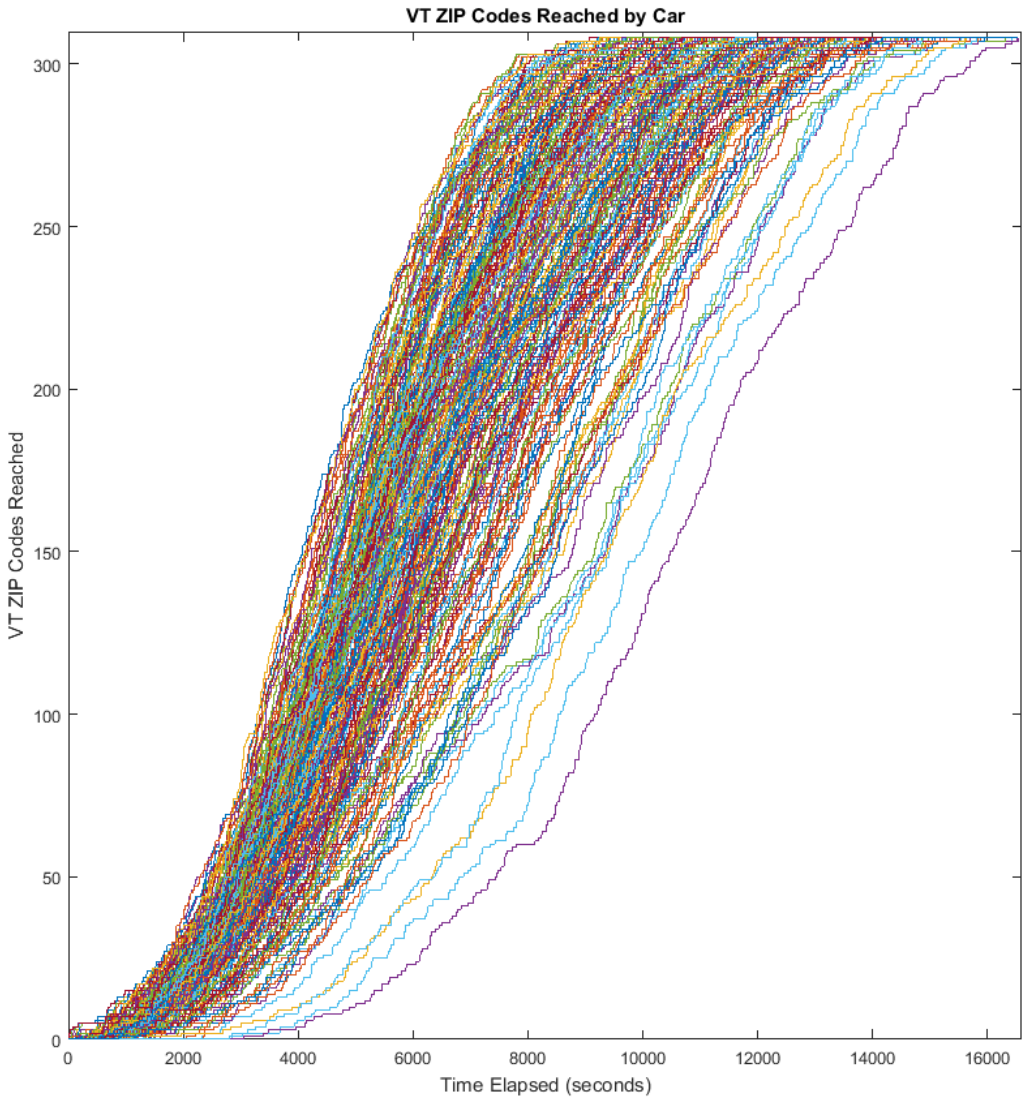
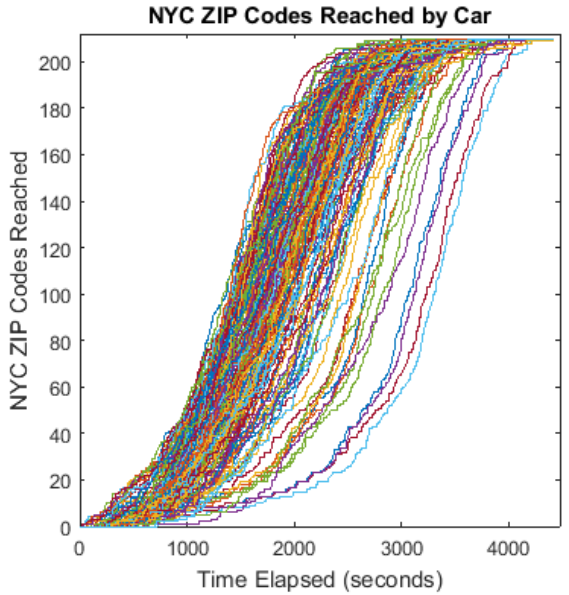


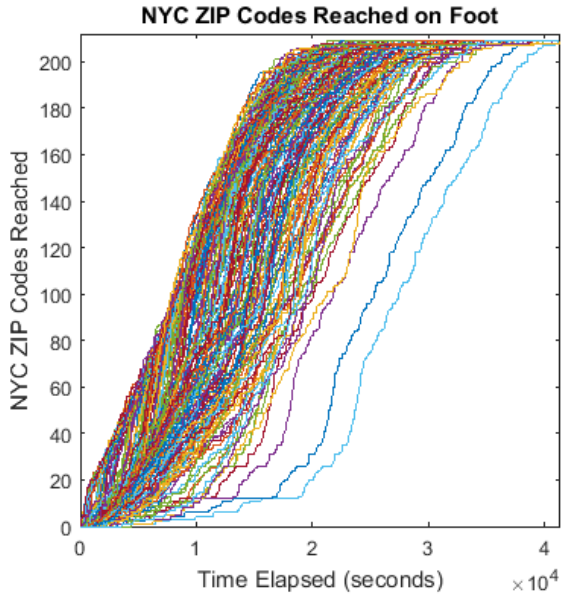
=

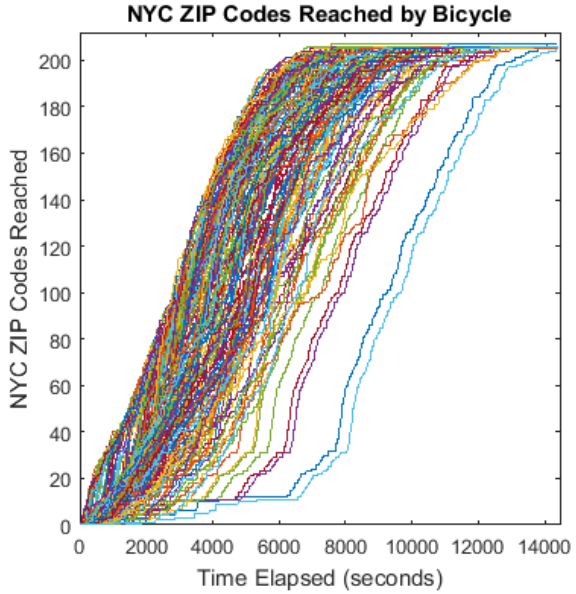

```
– <DistanceMatrixResponse>
    <status>OK</status>
    <origin_address>Vancouver, BC, Canada</origin_address>
    <destination_address>San Francisco, CA, USA</destination_address>
  – <row>
    – <element>
        <status>OK</status>
      – <duration>
          <value>53919</value>
          <text>14 hours 59 mins</text>
        </duration>
      – <distance>
          <value>1528712</value>
          <text>1,529 km</text>
        </distance>
      </element>
    </row>
  </DistanceMatrixResponse>
```

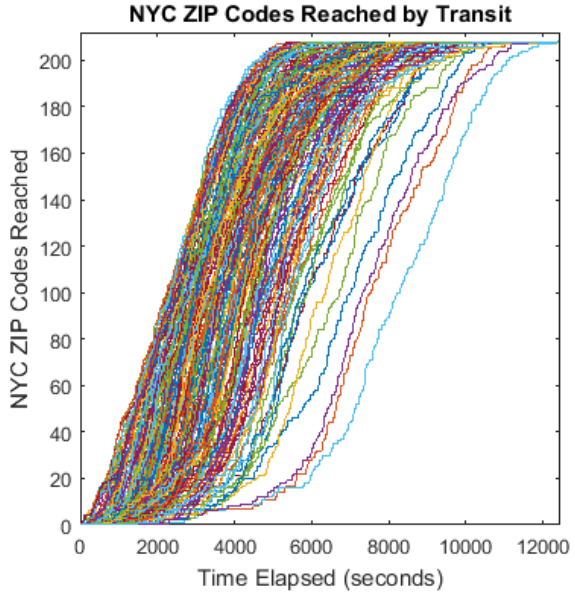
Two weeks later…

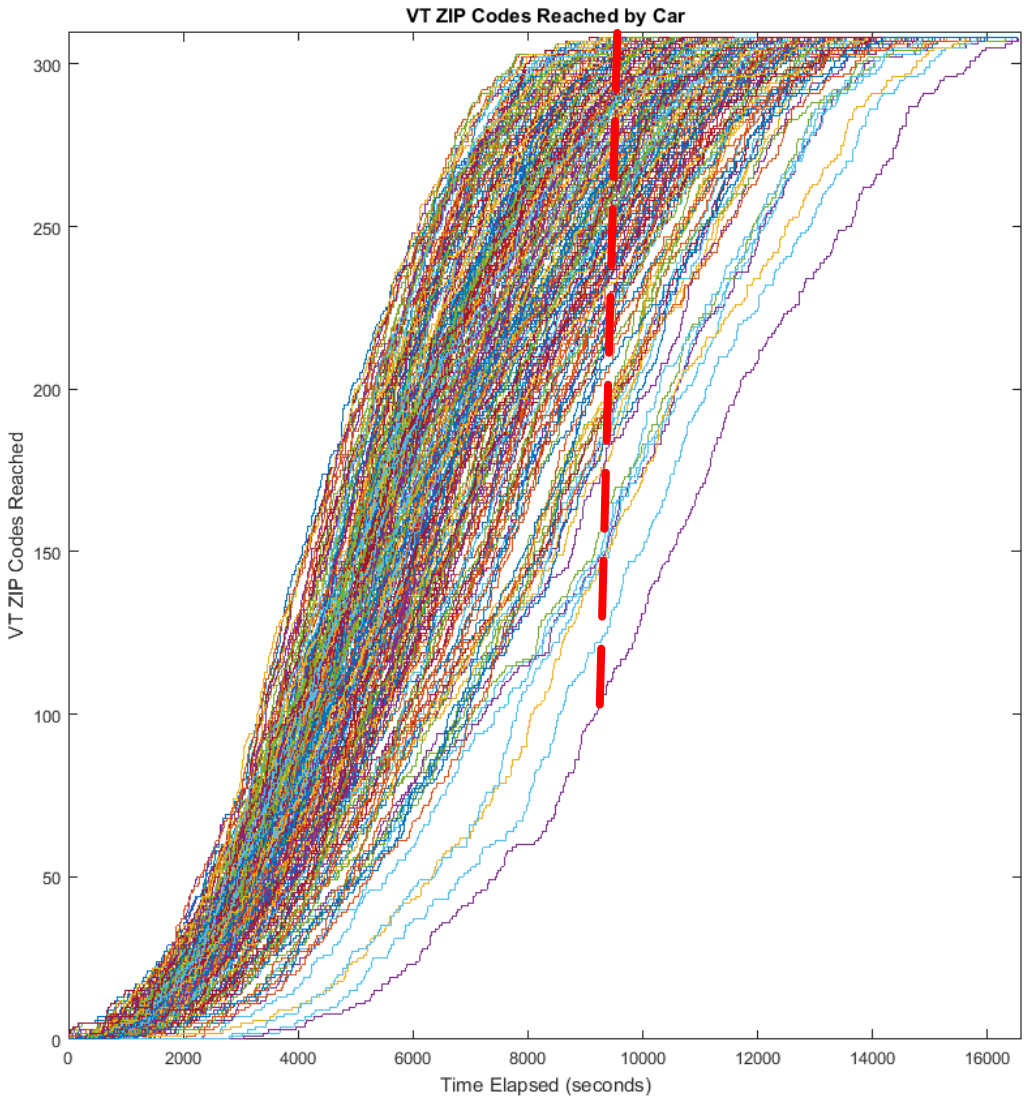

VT ZIP Codes Reached by Car
VT ZIP Codes Reached
Time Elapsed (seconds)
0
50
100
150
200
250
300
0
2000
4000
6000
8000
10000
12000
14000
16000

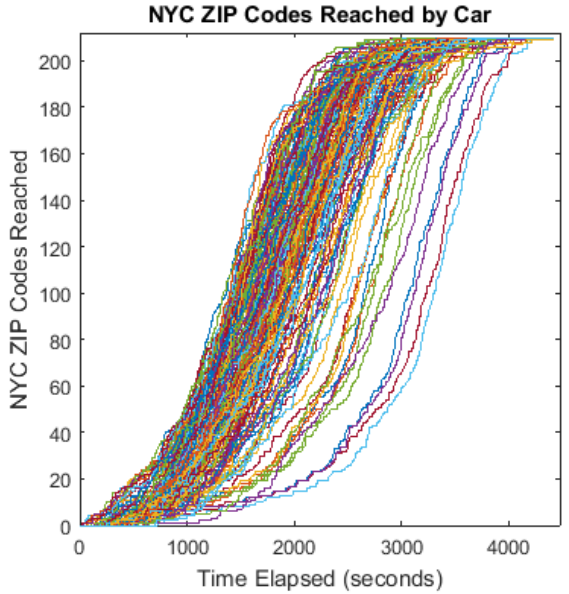

NYC ZIP Codes Reached by Car
NYC ZIP Codes Reached
Time Elapsed (seconds)
0
20
40
60
80
100
120
140
160
180
200
0
1000
2000
3000
4000

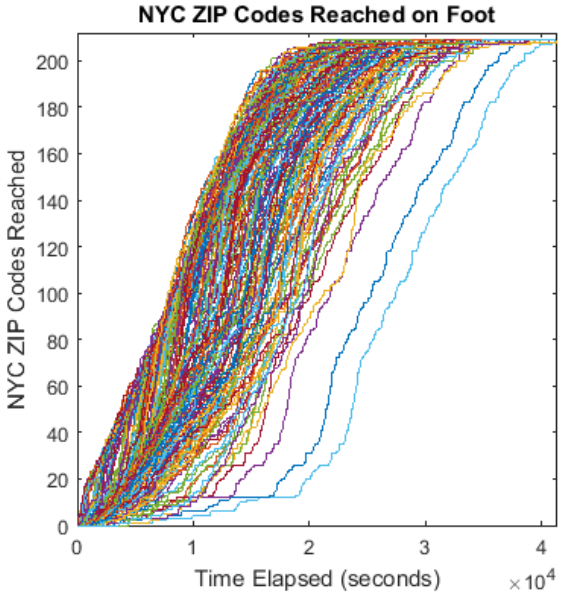

NYC ZIP Codes Reached on Foot
NYC ZIP Codes Reached
Time Elapsed (seconds)
×10^4
0
20
40
60
80
100
120
140
160
180
200
0
1
2
3
4

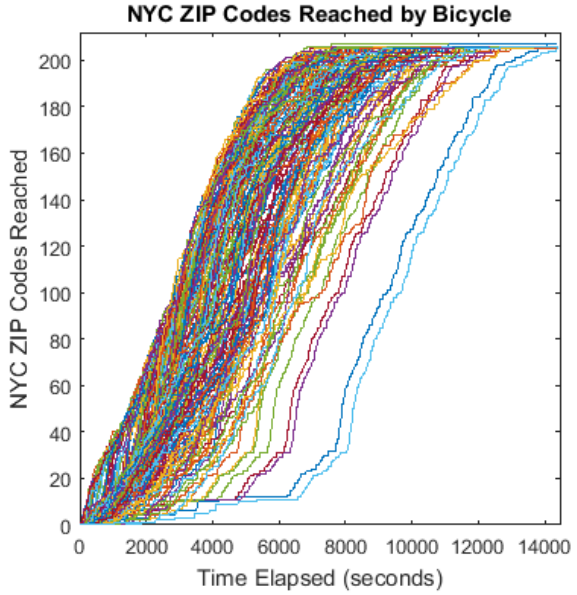

NYC ZIP Codes Reached by Bicycle
NYC ZIP Codes Reached
Time Elapsed (seconds)
0
20
40
60
80
100
120
140
160
180
200
0
2000
4000
6000
8000
10000
12000
14000

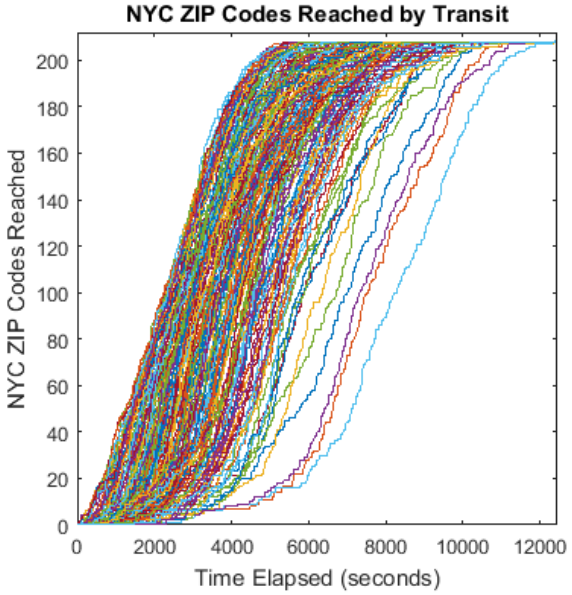

NYC ZIP Codes Reached by Transit
NYC ZIP Codes Reached
Time Elapsed (seconds)
0
20
40
60
80
100
120
140
160
180
200
0
2000
4000
6000
8000
10000
12000











$$C_n = (\frac{1}{t}) \sum_{t=1}^{t_{max}} \frac{x_n - \bar{x}_t}{\sigma_t}$$

Next steps!

- Map index of connectedness!
  - Compare across modes of transport
- More regions?

Questions?
Comments?