

Identifying Pedestrian and Vehicle GPS Traces

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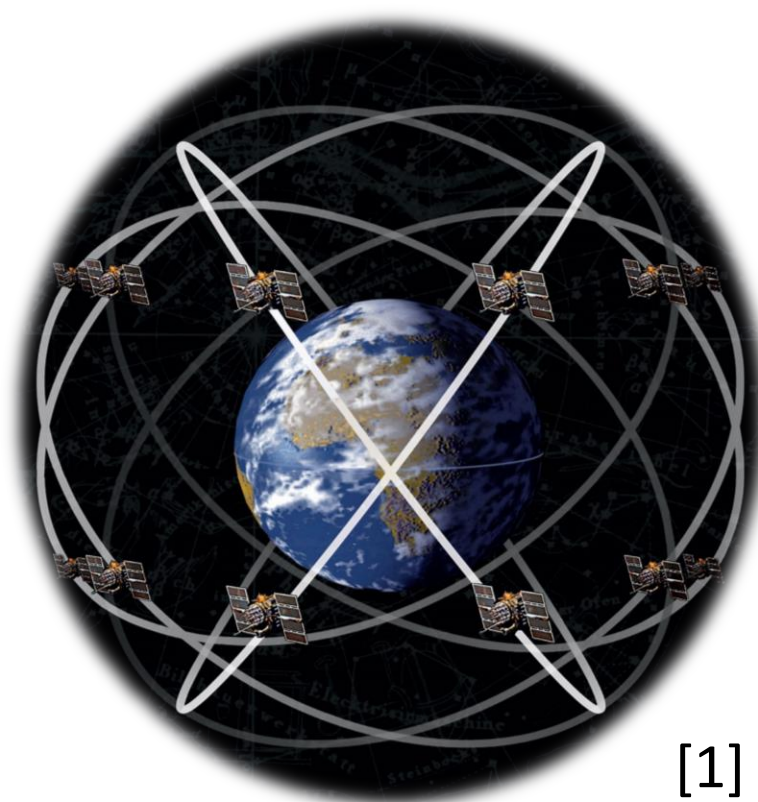


Data Analytics & Society

Background

Global Positioning System (GPS) is a space-based radio navigation system, allowing for worldwide navigation, positioning and timing services. It forms part of the Global Navigation Satellite System.

In recent times, GPS consists of 31 operational satellites, with 24 always in operation by the U.S. Air Force. GPS receivers (e.g. mobile phones and satellite navigators) use four satellites to determine the user's position in a process called three-dimensional trilateration.



[1]

This poster will investigate how to distinguish between pedestrian and vehicle-usage in GPS traces that are classed as having anomalies or showing a mixture of travel modes.

Methods

1. Split the GPS traces into segments using *tulib*; a library built by HERE Technologies, which uses *Monotone Segmentation*
2. Group the segments by speed;
 - Create statistics from known GPS traces that are identified as pedestrian and vehicular, from OpenStreetMaps and HERE Technologies
 - This will become the control
3. Compare the control statistics with trajectories that are classed as containing anomalies, or have a mixture of travel modes.

Results

Table 1. Control statistics from known GPS traces

Statistical Measure	Mean Speed (m/s)		Sum of Elapsed Time (s)	
	Pedestrian	Vehicle	Pedestrian	Vehicle
Median	2.17	23.00	10.00	18.00
Mean	2.83	20.39	34.97	44.46
Maximum	14.87	43.40	561.00	586.00

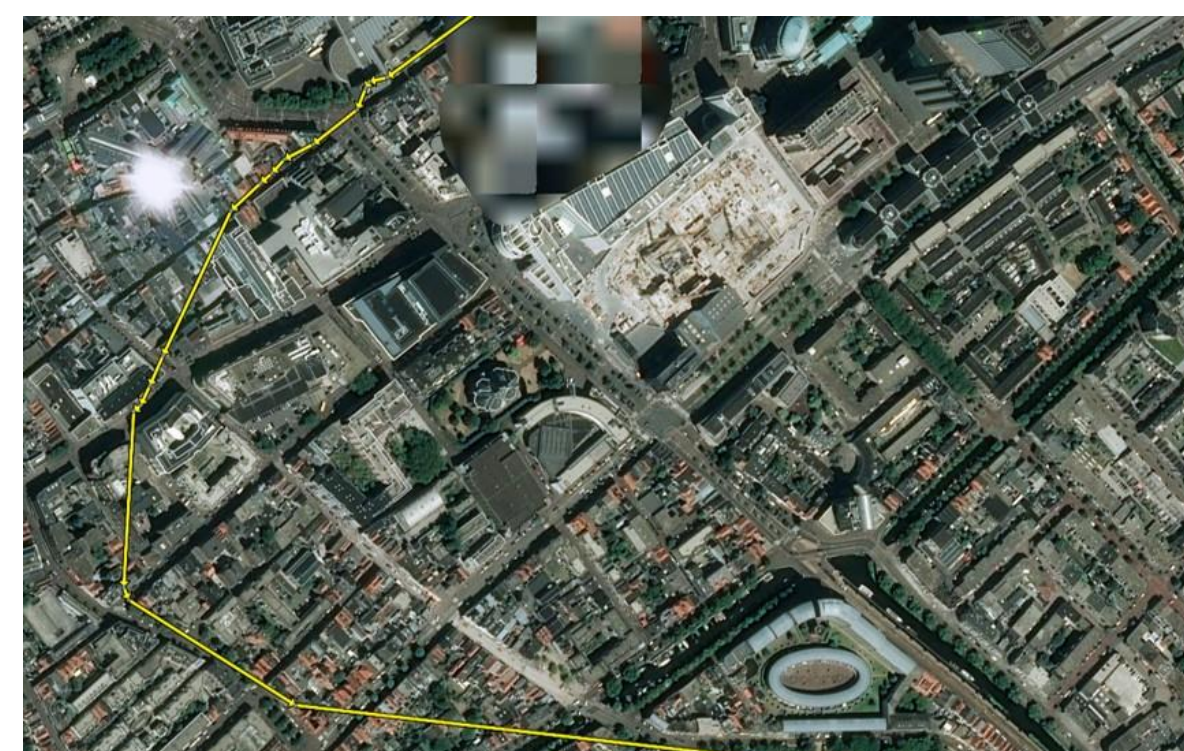
Case Study 1



Segments	Mean Speed (m/s)	Sum of Elapsed Time (s)
0	0.16	308.00
1	0.25	285.00
2	0.07	396.00
3	0.12	187.00
4	0.20	337.00
5	2.79	214.00
6	80.00	41.00
7	90.25	180.00
8	93.33	64.00
9	96.50	24.00
10	86.80	169.00
11	88.14	41.00
12	82.00	6.00
13	95.00	19.00
14	96.00	105.00
15	90.00	66.00

- Lots of clustering at beginning of journey
- Segments 0-6 have very low speeds, and high elapsed times
- Results do not correlate to Table 1
 - GPS lingering at service station?

Case Study 2



Segments	Mean Speed (m/s)
0	0.77
1	2.50
2	3.25
3	16.00
4	7.00
5	2.50
6	4.33
7	2.00

- High speed in Segment 3;
- User travelling by vehicle mid-way through journey?

Conclusion

- ✓ Monotone Segmentation is a good method for splitting trajectories into sections
- ✓ Using statistics from known GPS traces helps with understanding user trajectories which appear to contain anomalies
- ✗ Does not explain all anomalies found in GPS traces

Acknowledgements

I would like to thank HERE Technologies for allowing me access to GPS trajectories for this analysis, and their guidance throughout this project.

References:
[1] Smithsonian National Air and Space Museum (n.d.). *GPS Constellation*. [image]. Available at: <https://airandspace.si.edu/multimedia-gallery/4637hjpg> [Accessed 07 Sept 2019].

