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Propagation of congestion using naturalistic data from a swarm of drones

Auteur : Quentin Besson

Encadrement: Prof. Nikolas Geroliminis 1 / Emmanouil Barmpounakis 1

¹ Urban Transport Systems Laboratory (LUTS) EPFL

Abstract :

This project takes place in the wider context of a first-of-its-kind large-scale open science traffic monitoring experiment nicknamed pNEUMA, that took place in the city of Athens:

"pNEUMA is a large-scale dataset of naturalistic trajectories of half a million vehicles that have been collected by a one-of-a-kind experiment by a swarm of drones in the congested downtown area of Athens, Greece. A unique observatory of traffic congestion, a scale an-order-of-magnitude higher than what was not available until now, that researchers from different disciplines around the globe can use to develop and test their own models." (source: https://open-traffic.epfl.ch/, 30.07.2020)

In this paper, the focus is laid on the impact of taxi servic-related stops on congestion. The problem is tackled by using a step by step task-oriented approach, in order to develop methods that can be used for further research on the dataset.

Keywords: open science, large-scale dataset, traffic monitoric, UAS/UAV, congestion propagation, service-related stops, programmation.

The Dataset :

The total duration of the recordings is 59 h, sizing more than 2 TB. The study area to be analyzed includes:

- i) a total of 1.3 km2 area
- ii) a 10 km road network
- iii) low, medium and high-volume arterials iv) more than 100 intersections (signalized or not)
- v) more than 30 bus stops » [1]

Objectives :

This project the following objectives, of educational and academic nature

- Discover the Python programming language. Indeed, this project is the author's first experience with this language (the "pré-étude" to this project had been conduced using Matlab). This objective serves two purposes :
 - Facilitated future use of the results obtained, since the other participants in the project also use Python;
 - For the author : development of competences with an open source tool widely used in the industry.
- 2. Produce methods (scripts and functions) oriented towards the goal of quantifying the impact of taxi service-related stops on congestion, that can be reused or adapted for their research by the current and future participants of the pNEUMA experiment.
- In the context of the pNEUMA experiment, participate in the development of the new era traffic models.



Study area of the pNEUMA experiment (source: [1])

Flowchart - script 1

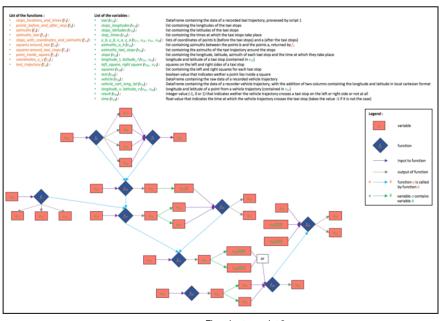
Conclusion:

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A dataset such as the one at hand holds great potential for analysis, but at the same time, it can be difficult to come up with efficient methods to tackle the concrete engineering problems. In the future, experiments such as *pNEUMA* will probably become common practice and it will be the task of transportation engineers, and students in the domain, to develop their data-analysing skills in order to extract the best possible understanding of the networks they study.

Analysis tasks :

- Identify when the taxi stops stopflag definition
- Determine and store the durations of the stop and movement periods
- 3. Identify and correct the "false stops and movements" (stopflag noise)
- Check wether the taxi stops take place on the right lane



Flowchart - script 2

[1] Emmanouil Barmpounakis, Nikolas Geroliminis, 2019, On the new era of urban traffic monitoring with massive drone data: The pNEUMA large-scale field experiment,