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Exploring crowdsourcing information to predict traffic-related impacts

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universidade de aveiro

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Research
Objective

RESEARCH OBJECTIVE

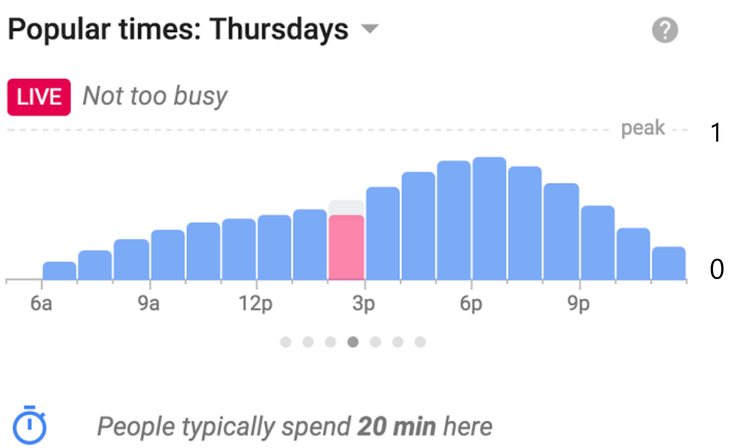
The objective of this study is to explore the potential of using crowdsourcing information as an alternative source data to predict traffic-related impacts.

We examine if there is any correlation between various variables and the information that provided from Google Maps regarding the popular times of specific places or areas.

BACKGROUND

Information included:

- graph per day and hour, showing how busy is a specific location,
- live activity data, updated by real-time information,
- visit duration, showing the average spending time of people.



Example of popular times feature in Google Maps

For the purpose of this study, we assume that the minimum value of the bar is 0 and the maximum is 1 and we divided it in ten equal parts giving them the respective values.

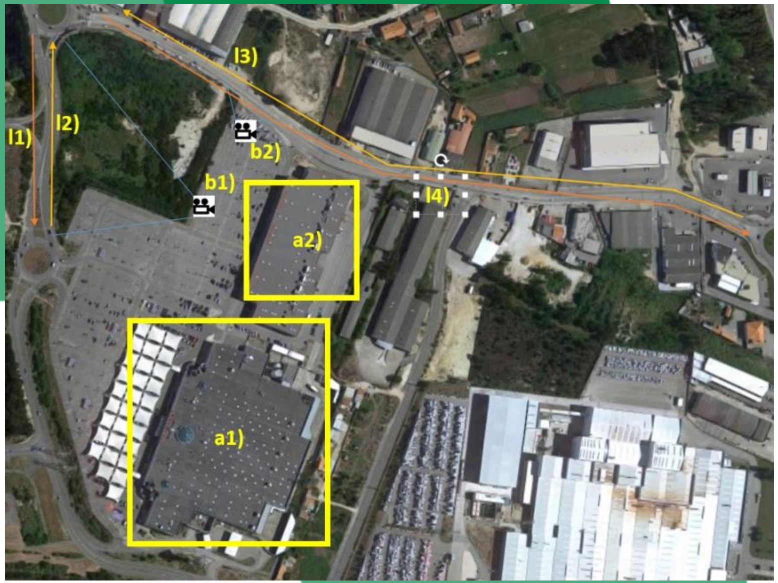
Methodology

DATA COLLECTION

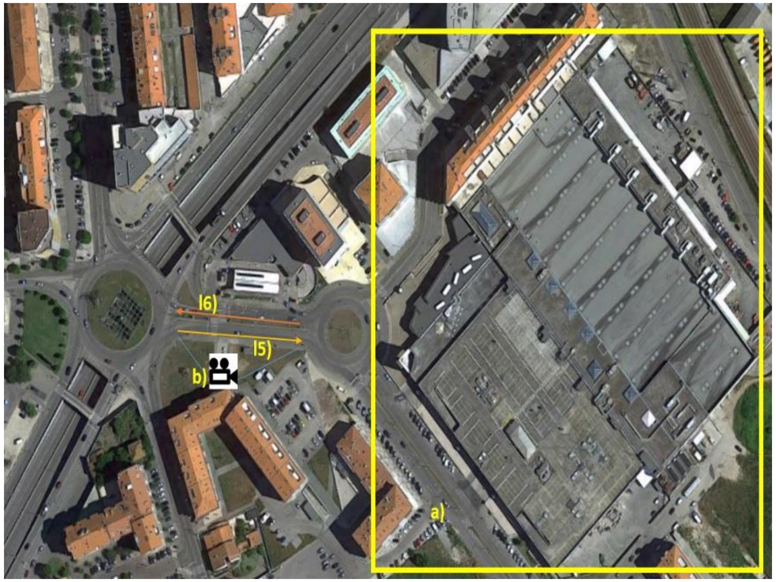
Collected data sets:

- Traffic volumes in 15 minutes intervals for 6 hours (weekday – weekend).
- Traffic dynamics (travel time, speed, and acceleration) with the use of a light-duty vehicle equipped with a GNSS data logger. 10 runs per hour, with different drivers.
- Crowdsourcing information in real time (Popular Times) from Google Maps regarding the activity of our study areas.

CASE STUDIES



Aveiro Shopping Center



Glicínias Plaza Shopping Center

a: shopping areas; b: position of cameras; l: studied links

EMISSION ESTIMATION

Second by second emissions estimated for Carbon Dioxide (CO2); Nitrogen Oxides (NOx); using the concept of Vehicle Specific Power (VSP) and based on the Portuguese vehicle fleet composition.

$$VSP = v[1.1a+9.81(atan(sin(grade)))+0.123]+0.000302v^3$$

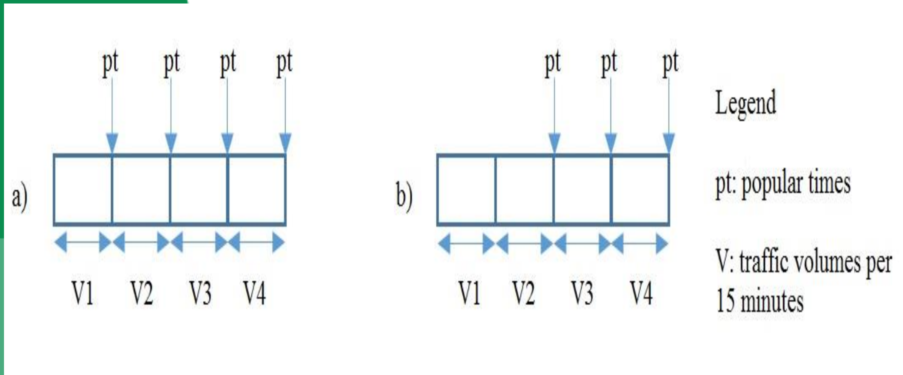
where:

v = vehicle speed (m/s),

a = vehicle acceleration/deceleration rate (m/s^2),

grade = vehicle vertical rise divided by the horizontal run (%).

ANALYSIS

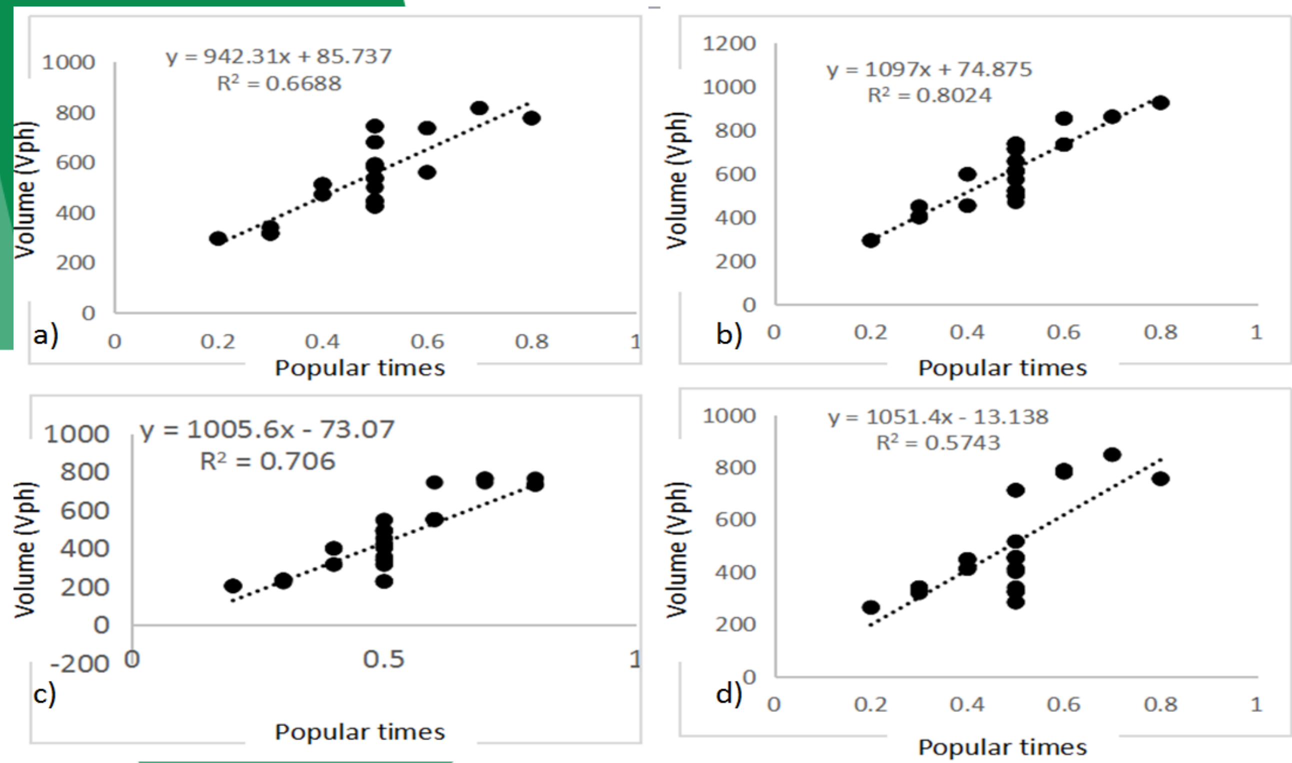


First (a) and second (b) approach for correlation analysis

Analysis

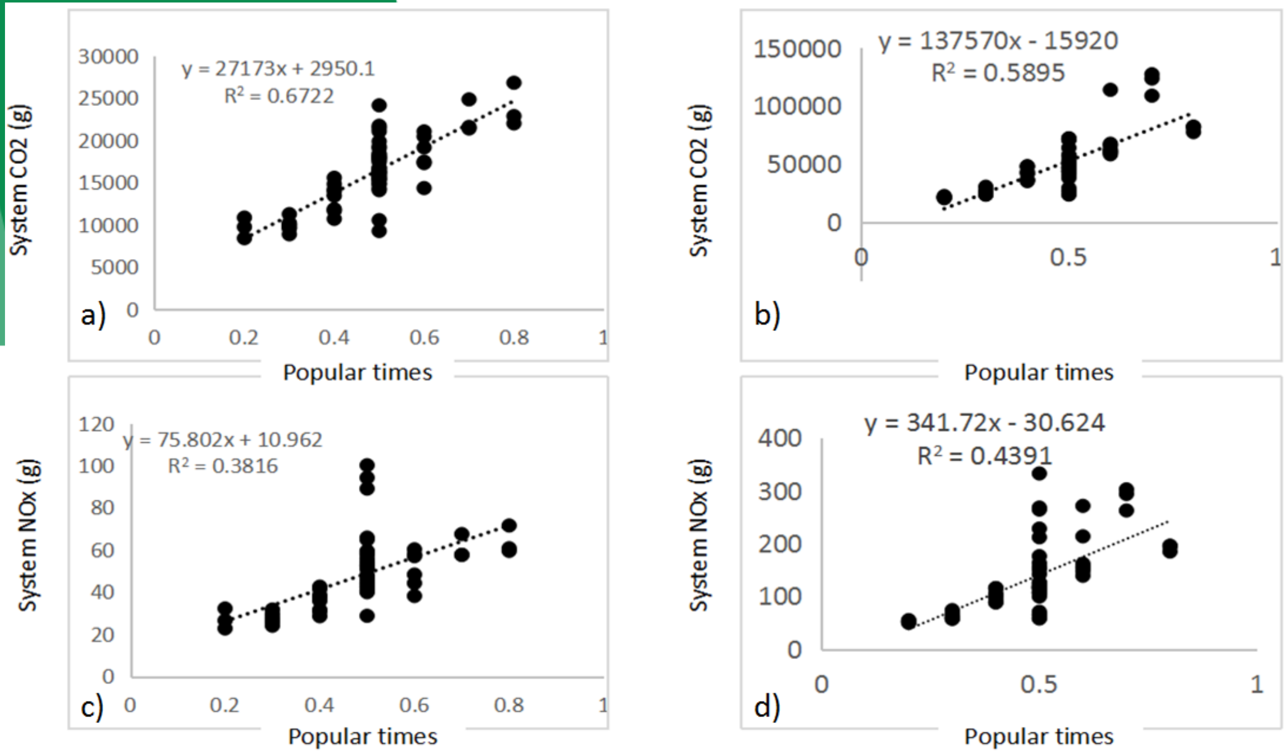
AVEIRO SHOPPING CENTER

TRAFFIC VOLUMES - POPULAR TIMES



Linear Correlations between traffic volumes and popular times
a) Link l1 (p-value=8.74E-16) b) Link l2 (p-value=8.47E-23)
c) Link l3 (p-value=4.69E-17) d) Link l4 (p-value=1.54E-12)

EMISSIONS – POPULAR TIMES

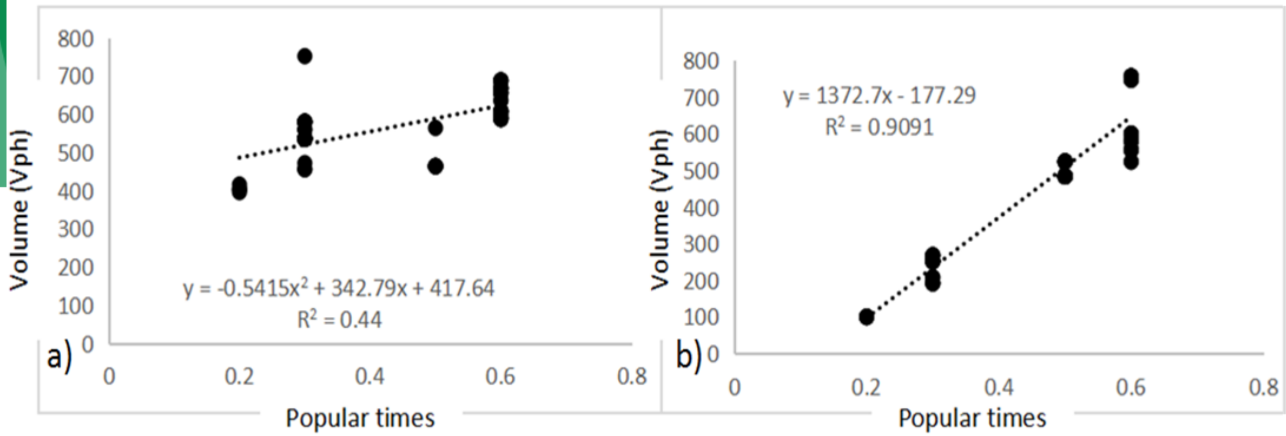


a, c) Linear correlation for CO_2 (p-value = 6.41E-16) and NOx (p-value = 1.14E-07) in link l1
b, d) Linear correlation for CO_2 (p-value = 8.22E-13) and NOx (p-value = 8.06E-09) in link l3

Analysis

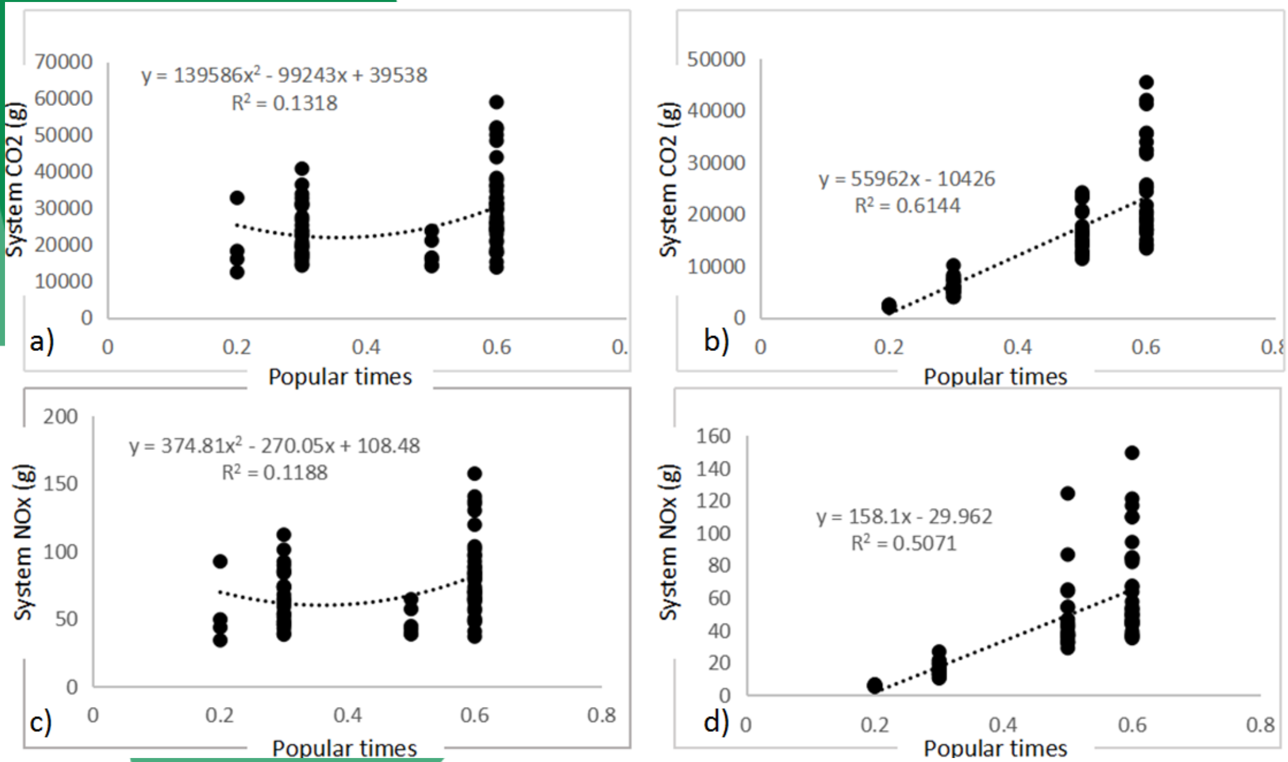
GLICINIA PLAZA SHOPPING CENTER

TRAFFIC VOLUMES - POPULAR TIMES



a) Linear correlation for link l6 between traffic volumes and popular times in weekday (p-value=2.17E-10)
b) Linear correlation for link l6 between traffic volumes and popular times in weekend (p-value=7.78E-42)

EMISSIONS - POPULAR TIMES



a, c) Quadratic correlation for NOx (p-value = 1.27E-02) and CO2 (p-value = 7.63E-03) for weekday in link l6
b, d) Linear correlation for NOx (p-value = 1.87E-13) and CO2 (p-value = 1.34E-17) for weekend in link l6

Conclusions

CONCLUSIONS

The analysis of the statistical fitting of data shows that we can establish clear relationships (most of them linear) between traffic volumes, travel time, emissions, and popular times.

Higher correlations were obtained during weekend when a higher percentage of traffic has as destination the shopping area.

The development of an adaptative learning algorithm is required in order to relate accurately atypical data to distinguish if the drivers use the road to attain other destiny than the place yielding the information.

Further research is going to be conducted in different areas, integrating crowdsourcing data of multiple sites and also including noise analysis.

ACKNOWLEDGEMENTS

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TOYOTA

thank you

for your attention

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