Investigating the impact of COVID-19 pandemic on driver behaviour through telematics data

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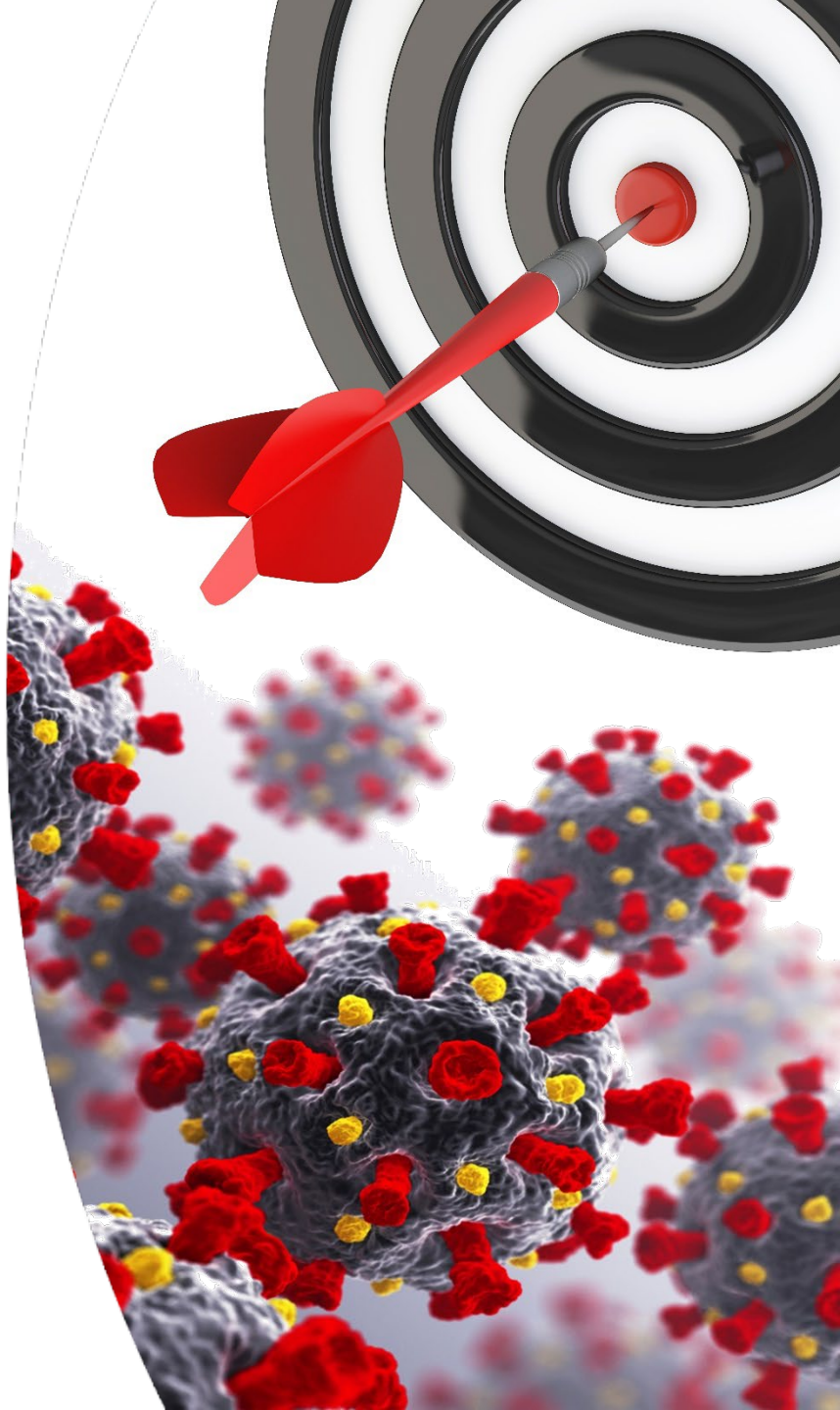
Introduction

- The pandemic of COVID-19 has been affecting human activity, since December 2019.
- Governments around the world implemented lockdowns in order to decrease human mobility and prevent the pandemic spread.
- Many studies found that driving behavior was significantly affected.
- The literature findings revealed that the observed values of driving behavior indicators (i.e., average speed, speeding, harsh braking and harsh accelerations per 100 km) were higher during the first lockdown.

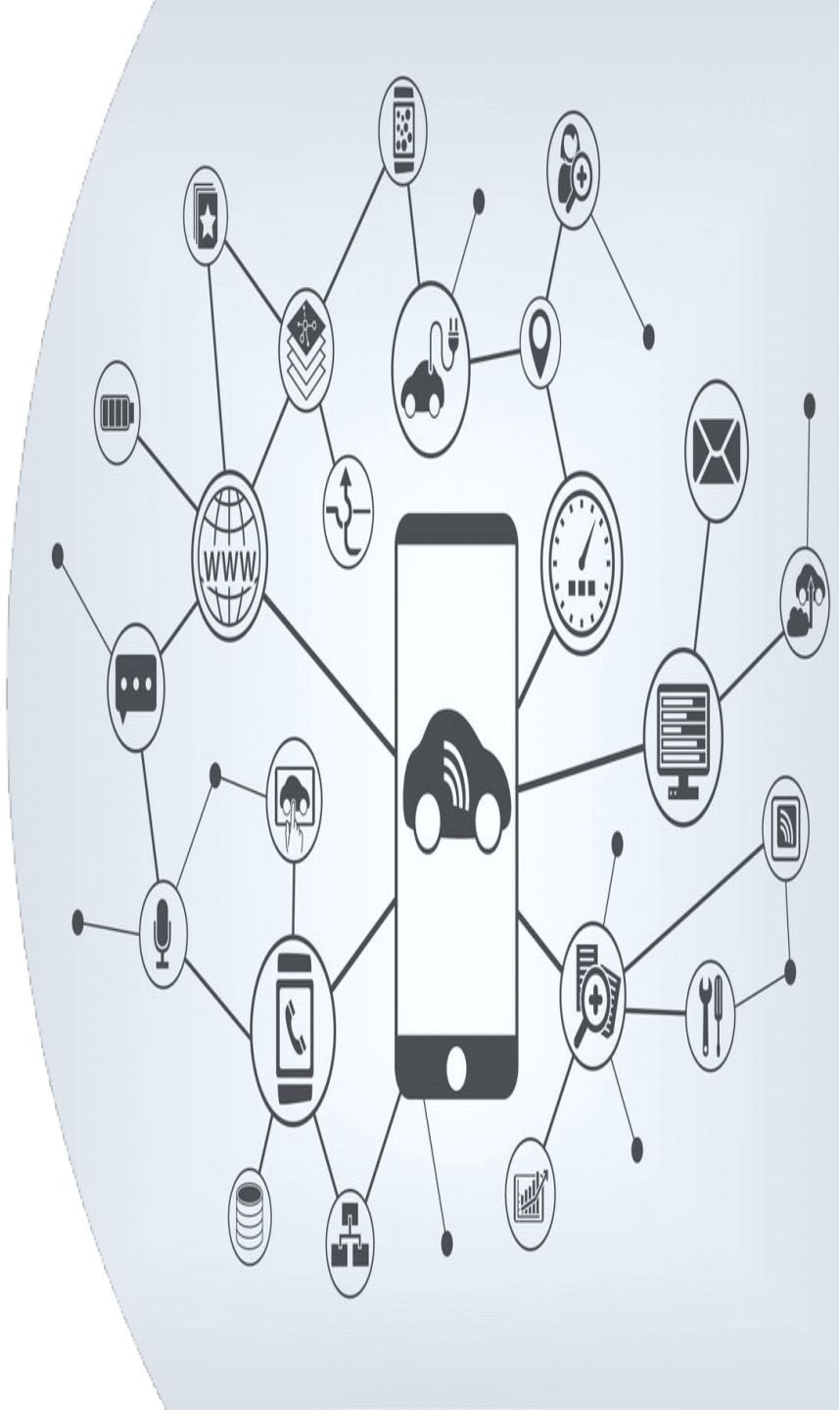
Objective

- Identification of the most important factors that influenced driving behavior in the year 2020.
- Naturalistic driving data along with other 3 open-access databases was analyzed for this purpose.
- The indicators studied were harsh acceleration and harsh braking events before, during, and after the imposition of lockdown measures in Greece.



Naturalistic Driving Data

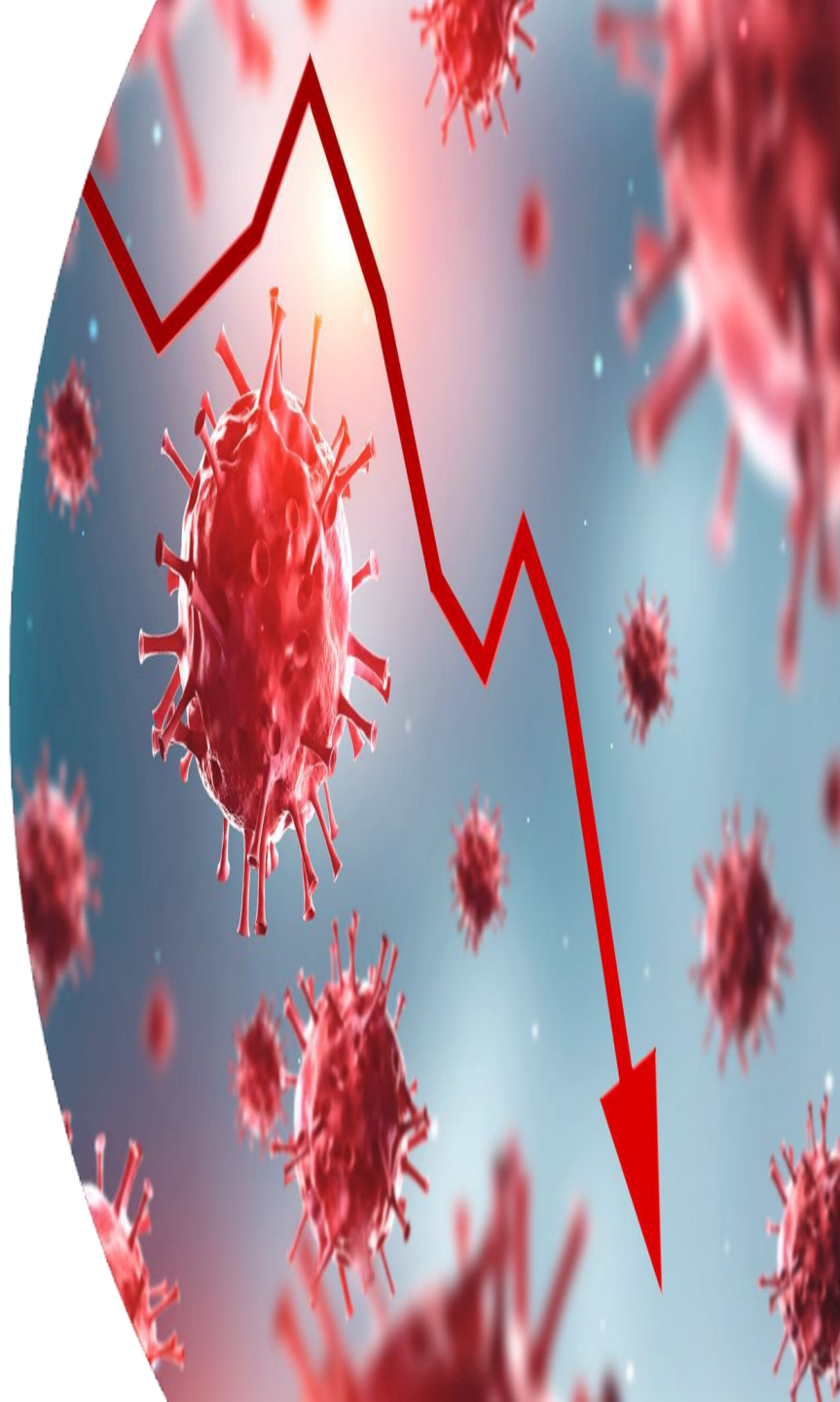
- OSeven Telematics (oseven.io) provided a dataset with naturalistic driving trips from its database in order to associate driving behavior with COVID-19 parameters and restrictions.
- The database covered 305,638 trips around Greece for the entire year 2020.
- OSeven uses its specially developed smartphone application to obtain data from smartphone sensors (i.e., GPS, accelerometer, and gyroscope data).
- Data were sent to the OSeven backend infrastructure through Wi-Fi or cellular network which were evaluated using filtering, signal processing, ML algorithms and safety/eco scoring models.



Data Overview

Four databases were used for the analysis:

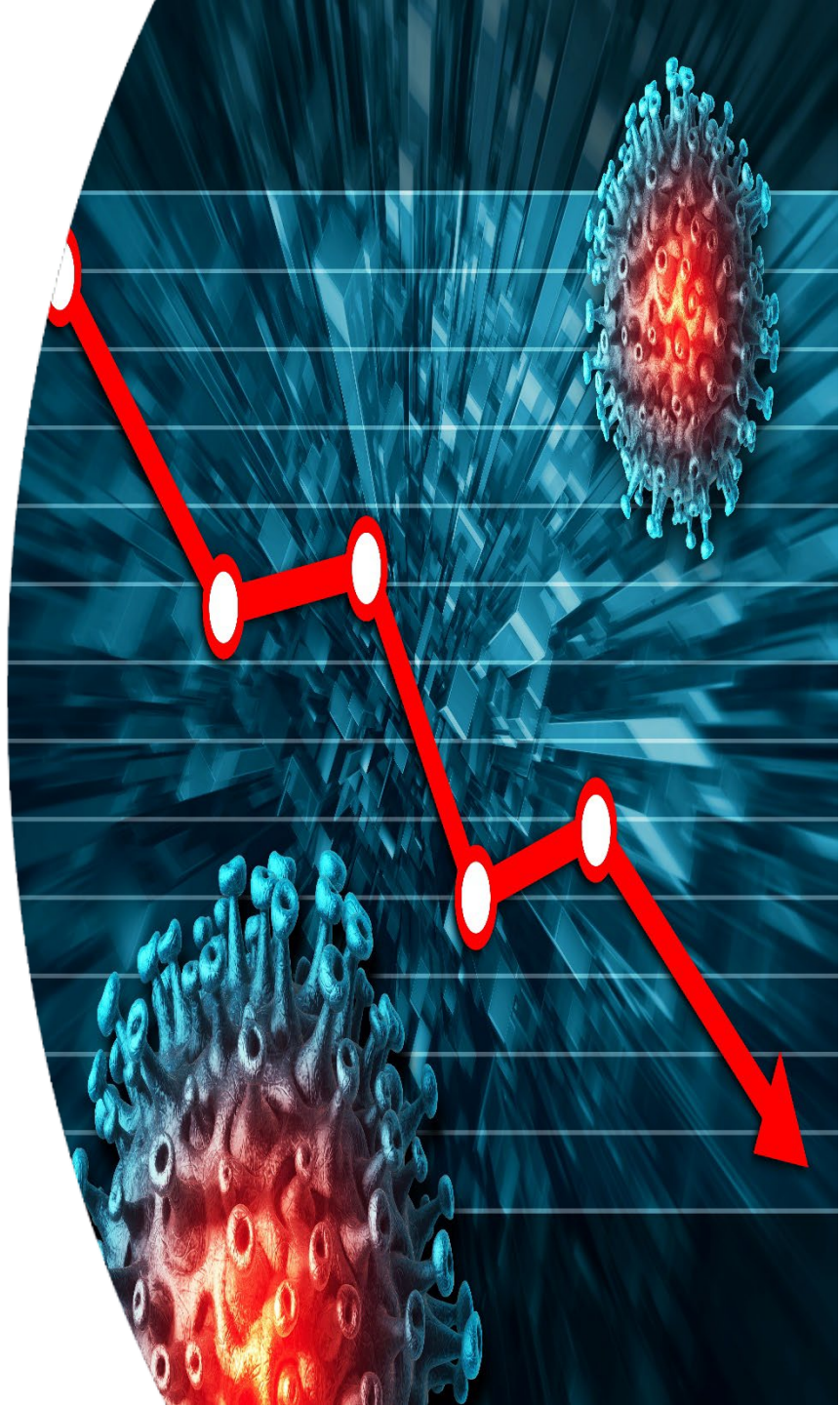
- From the OSeven dataset, five variables (i.e., harsh accelerations (HA) /100km, harsh brakings (HB) /100km, mobile use/ driving time, driving during risky hours, distance) were exploited.
- Database of Our World in Data, 2020 was exploited to capture the daily evolution of COVID-19 metrics i.e., new cases, new fatalities, and the COVID-19 reproduction rate of the pandemic.
- The response measures of the Greek government were quantified with an index titled "Stringency Index". This index was obtained and calculated by Oxford University. The stringency index ranges between 0 and 100 (i.e., 100 = strictest response).
- Mobility Trends Reports from Apple were used to incorporate into the analysis the driving patterns on Greek roads.



Analysis Method

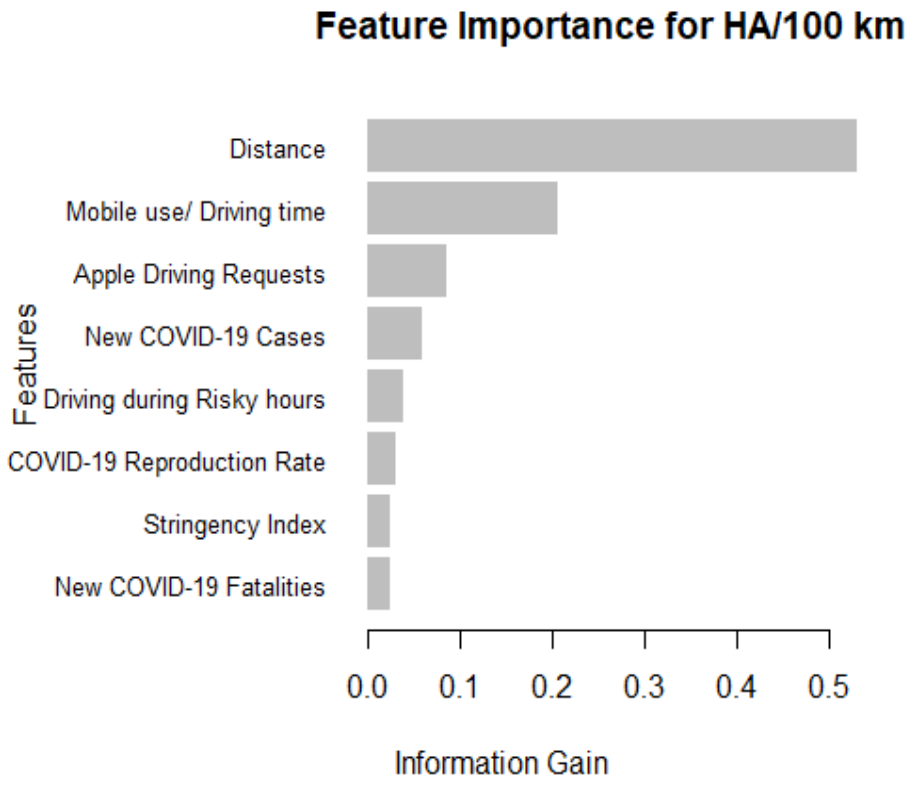
- The Extreme Gradient Boosting (XGBoost) algorithms were chosen in order to evaluate the feature importance of the variables i.e., mobility, COVID-19 metrics and restrictions on the naturalistic driving behavior indicators.

- The naturalistic driving behavior indicators were the frequency of:
  - Harsh brakings per distance (100km)
  - Harsh accelerations per distance (100km)



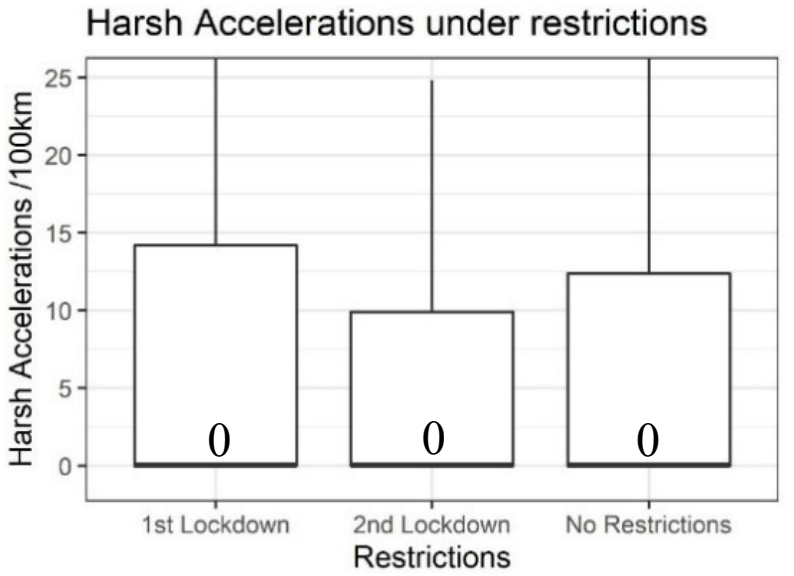
Harsh Acceleration Events (1/2)

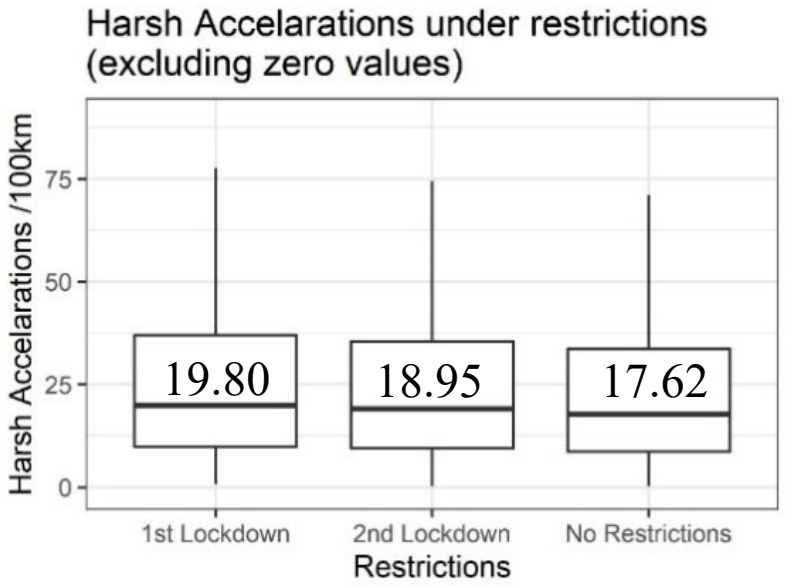
- The three variables with the highest impact on the HA/100km model were:
  - Distance
  - Mobile Use/ Driving Time
  - Driving Requests
- The new COVID-19 cases in Greece seem to precede compared to other COVID-19-related variables.
- Other COVID-19-related variables that influenced the harsh accelerations in Greece were COVID-19 Reproduction Rate, Stringency Index, and New COVID-19 Fatalities.



Harsh Acceleration Events (2/2)

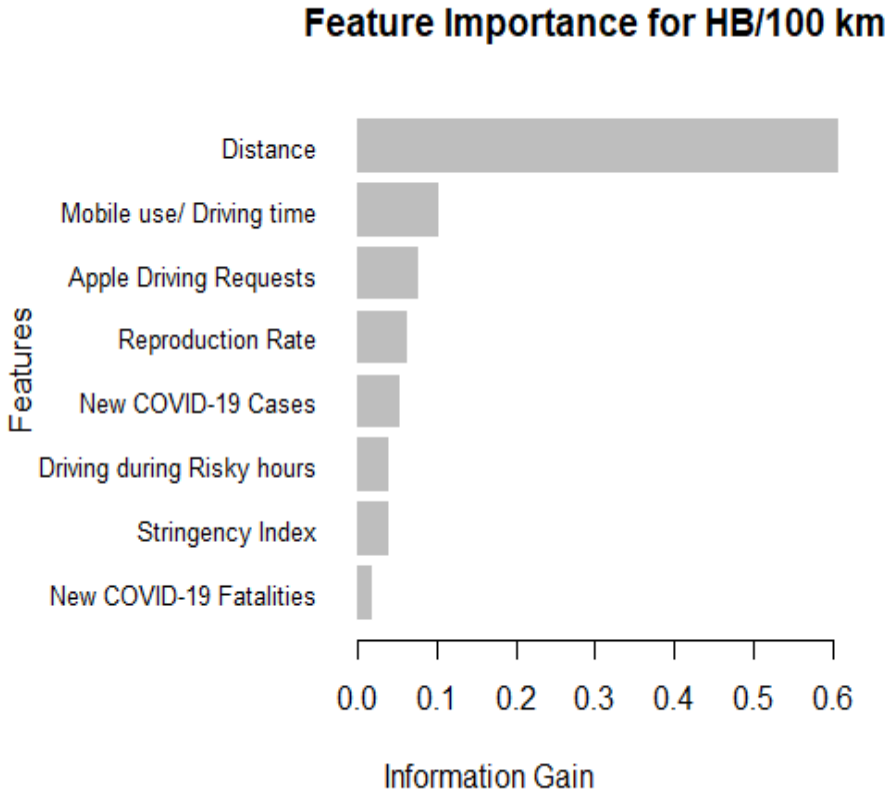
- As can be seen in the upper boxplot, the median values for each condition equal zero.
- Hence, the lower boxplot was created with trips with harsh events occurrence.
- The highest median was observed at the 1st lockdown, then at the 2nd, and then without restrictions.





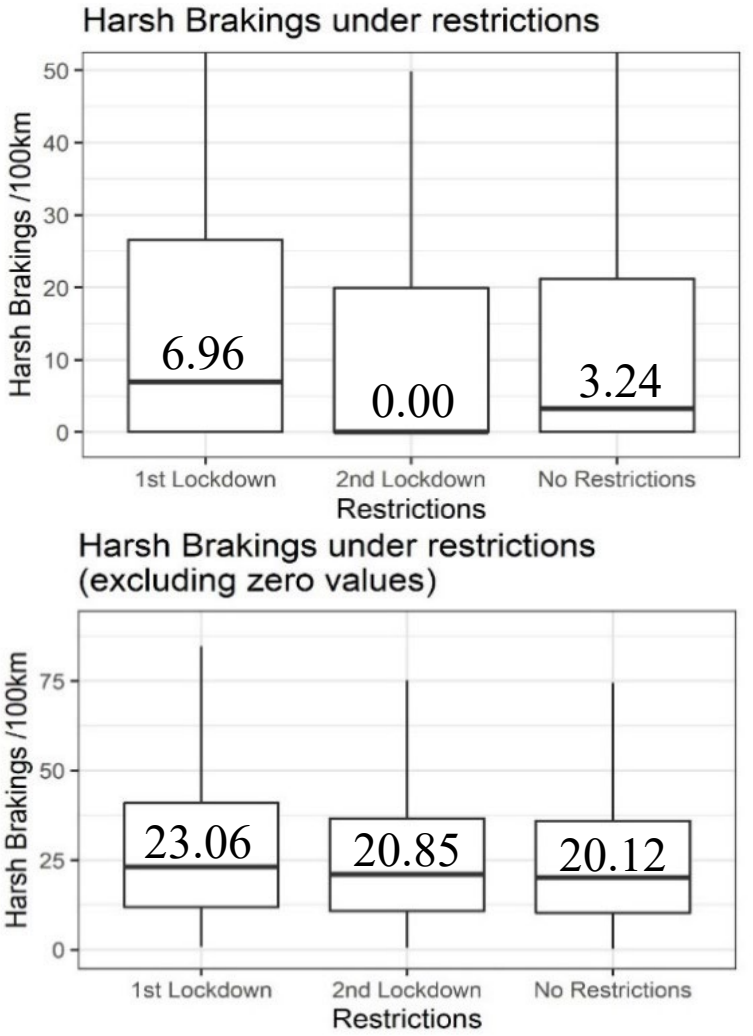
Harsh Braking Events (1/2)

- Similar to HAs, the three variables that impacted HB/100km the most were:
  - Distance
  - Mobile Use/ Driving Time
  - Driving Requests
- Different from HAs, COVID-19 Reproduction Rate was found to influence the most HB.
- Other COVID-19-related variables that influenced the harsh brakings in Greece were New Cases, Stringency Index, and New Fatalities.



Harsh Braking Events (2/2)

- As can be seen in the upper boxplot, the highest median was observed during the 1st lockdown.
- Then, the conditions without restrictions follow and it is noteworthy that the median for the 2nd lockdown equals zero.
- Similar to the HA model, for trips with HB occurrence, the highest median was observed at the 1st lockdown, then at the 2nd, and then without restrictions.



Conclusions

- The three variables that influenced HA and HB events the most were distance, mobile use/ driving time, and Apple driving requests.
- COVID-19-related variables that influenced the HA and HB events in Greece were Reproduction Rate, Stringency Index, and New Fatalities and Cases.
- Traffic volume during the 1st lockdown was lower. With fewer vehicles ahead, the drivers could accelerate more easily and maintain higher speeds and it was more probable for the drivers to be involved in a harsh braking event.

Scientific and Social Impact

- The COVID-19 pandemic has shown how quickly global mobility and safety conditions can change.
- Road crashes can be considered as a pandemic, and should also be treated as such.
- On a positive note, as cities put in place new cycling infrastructure, cycling use numbers increased.
- After the pandemic era, we need to build a safer and more equal system for all road users – giving back separated space for healthier and sustainable active travelling.
- Telematics data can provide detailed naturalistic insights into driving behaviour for large-scale samples, especially for a societal crisis that needs instantaneous measures to mitigate the increased road safety risk.

Future Challenges

- A more in-depth understanding of how the pandemic has affected road safety and driver behavior is still to be determined.
- The impetus that COVID-19 is placing on installations of temporary or permanent infrastructure to facilitate more pedestrians and cyclists, is a positive result of this crisis and should be further explored.
- The COVID-19 crisis can be the trigger also for new and tactful measures from the Authorities for safer roads for all, and everywhere in the world.

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