Safety in Mobility

Contents

INTRODUCTION

There are some concerning problems in mobility in the cities. One of them is the possibility of accidents which may occur due to several reasons, such as:

-possible anomalies in the roads

-some crossings

-weather conditions

Traffic accidents

Main accident perpetrator

Main accident perpetrator in accidents causing personal injury, by type of traffic participation.

Main accident perpetrator	Unit	2015	2016	2017	2018
Total	Number	305,659	308,145	302,656	308,721
Including: Drivers of ...					
- Bicycles	Number	35,825	37,671	37,427	42,552
- Motorcycles with insurance sign	Number	7,682	7,248	6,991	7,495
- Motorcycles with official sign	Number	15,779	15,437	15,442	16,600
- Passenger cars	Number	209,950	211,460	206,413	206,041
- Buses and coaches	Number	2,452	2,483	2,623	2,628
- Goods road motor vehicles	Number	19,260	19,22	18,988	18,594
Pedestrians	Number	8,807	8,900	8,858	8,678

As at 06 May 2019

Moreover, there is also another concerning problem, especially for cars, which is traffic congestion [1] and is not only a time wasting problem but more seriously a key factor that could lead drivers to accidents.So, every possible data and ML/AI procedure should be used in order to take necessary and more precautionary measures, that would help us decrease traffic congestion and thus accidents related to them. For instance, traffic predictor could be taken into consideration in solving this problem.

Another thing to be taken into consideration:

Rider’s behaviours. Why? Because keeping track of their behaviour would lead to safer driving thus reducing the possibility of accidents.

The things that affect rider’s behaviour:

- not driving properly (drunk, drugs)
- aggressive braking
- sharp turns
- potholes

With keeping track of the behaviour of the drivers we can give them useful feedback for them for to improve their driving.

Also, tracking the rider’s behavior can also be applied for the drivers of the company: the company can give feedback to their drivers -> less accidents -> products reaching the market safer -> less loss for the company

Taking safety measures will be more and more important ,

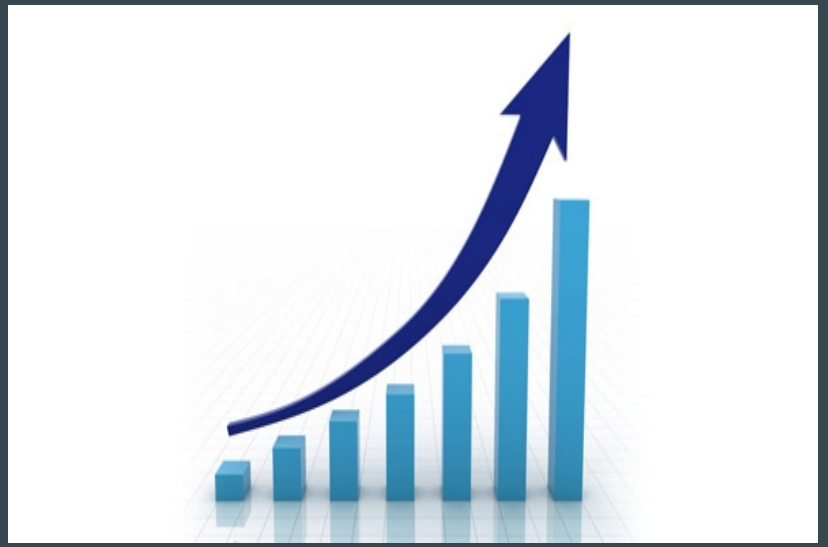
as FORD Mobility would like to increase the number of these kind of vehicles (as well as other companies in this business)

and considering the expected growth (expected to bring 20 % annual growth through 2030[2]) of this market.

Safer vehicles -> more people willing to drive these FORD vehicles ->

-FORD becomes more and more popular among people (indirect advertisement)

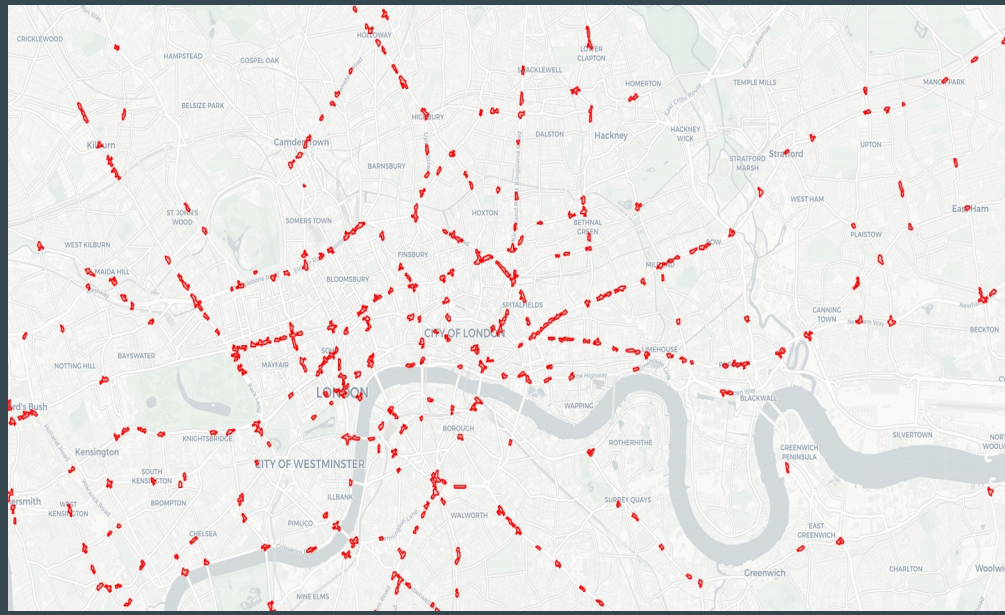
-When more and more people use Ford Mobility services, it would be profitable directly for the company



Solutions For Safety in Mobility

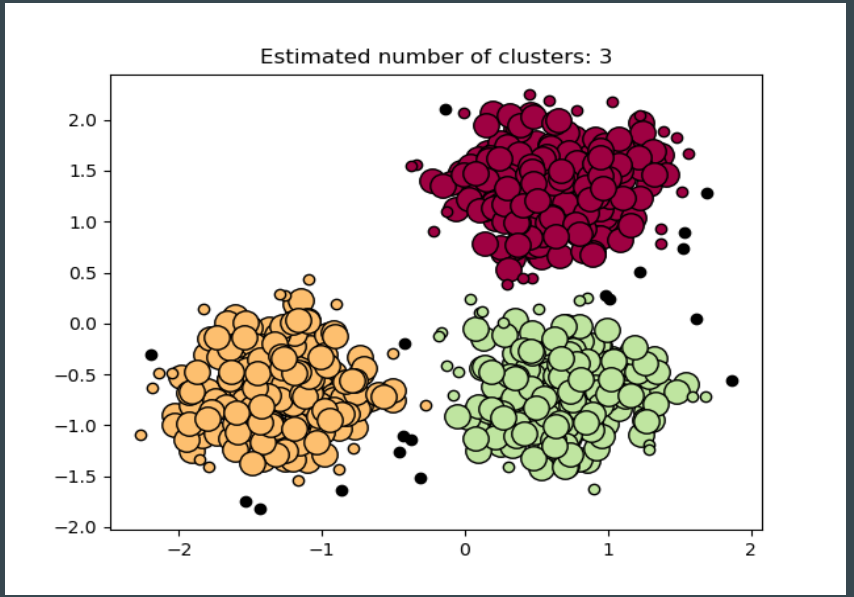
Accident Hotspots

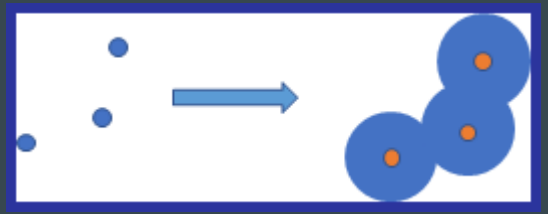
- Road Safety Data published by UK government includes incident's geographical coordinates.[3]
- Data from 2009 to 2016. Huge amount of data, cannot directly dump into a map.
- Density based clustering algorithm
- Higher density areas into geofence.
- Geofence into a geographical database.
- Create a GeoDataFrame and plot.
- Plot the final data into an interactive map as can be seen in the image.



Approach : Clustering

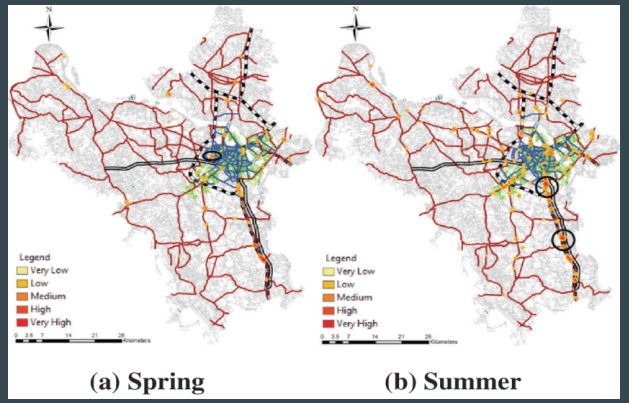
- We can use Density based Clustering Algorithm(DBSCAN) for this purpose.
- Groups together set of points which are closed together based on distance.
- Requires two parameters :
  - eps : specifies closeness of data points.
  - minPoints : min. no. of points for a region.
- Noise points are marked in black and we can neglect them.
- Coalescing Bubbles : Draw a circle around a point and merge it together into a polygon.
- Polygon/geofence represented on a map can be used as a purpose of driving assistant.





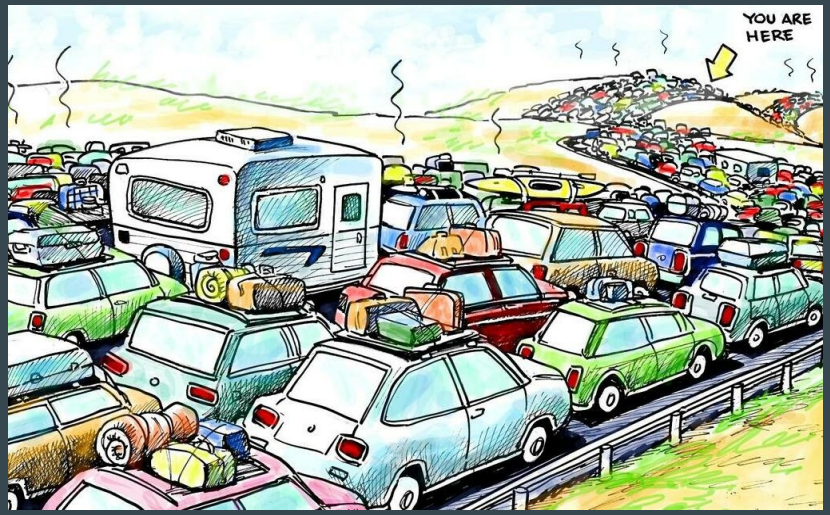
Accident Hotspots

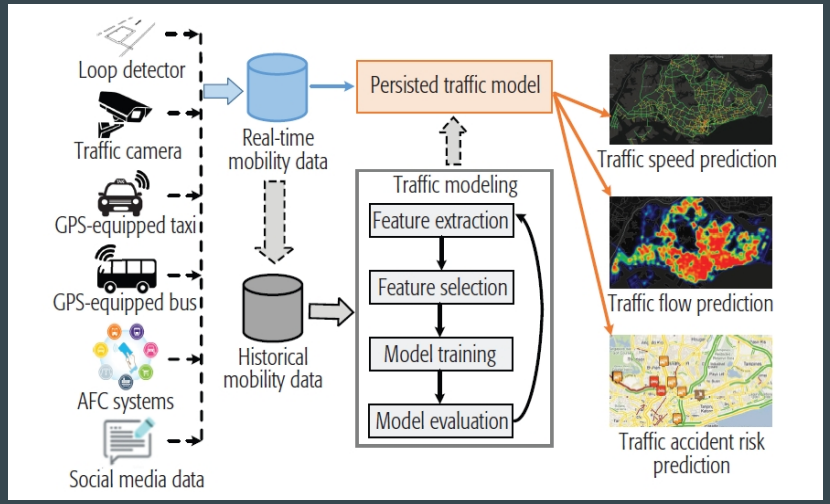
- A feature that would notify you about entering a road accident hotspot, much like when it warns you off about approaching speed cameras or like low emission zone in London.
- Here in the map KDE(kernel density estimation) based clustering was used.[4]
- Red circles are accident hotspots that the user can see on their app.
- Depending on season and time of day the user can get information about possible hotspot or accident lane in his area.



Traffic Predictor

- Research on accurately modelling Traffic speed, traffic flow and accident risks.[5]
- Mobility data collection
  - Loop detectors
  - Traffic camera
  - GPS data
  - AFC - Automated fair collection
  - Social media data
- Real time and Historical mobility data
- Simulations and Deep learning models can be helpful to complement data based analysis.

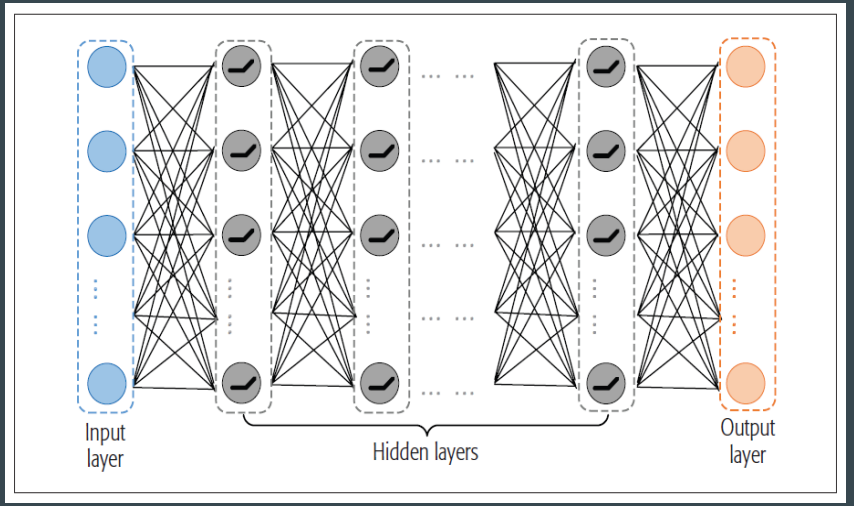


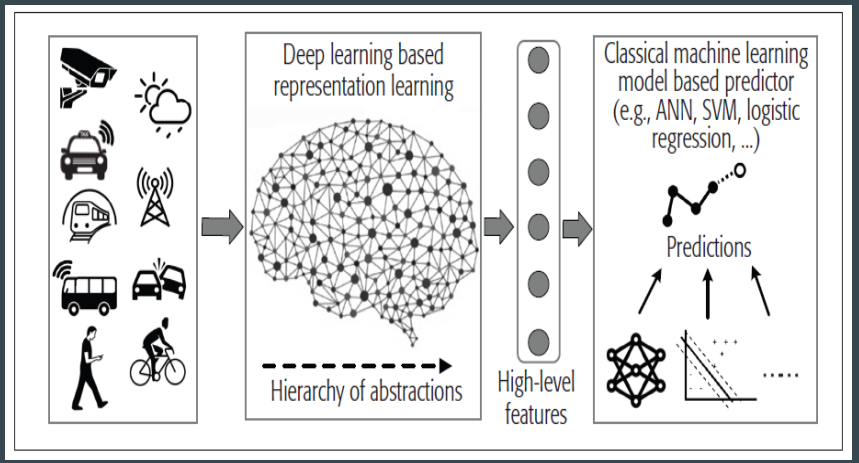


Traffic Predictor

- Advanced traffic modelling using ML
  - Extract some desired values from raw data
  - Features correlated with target traffic condition.
  - Spatial and temporal factors considered.
  - construction a traffic model for machine learning using only most informative data.
  - Heavily dependent on man crafted features.

- Deep learning for traffic prediction
  - input , hidden, output layers
  - each layer builds up on its previous layer with added data.
  - performance continues to increase with more and more data contrary to ML.





Rider’s Behaviour Analysis

- Analysing riders behaviour can help classify rider as Aggressive and non-Aggressive.
- Data from sensors and on-board camera can be used.
- Data may consists of Rider’s speed, brake force, accelerator force .
- GPS data from smartphones can be used[6]
- Machine Learning and Deep Learning algorithms can be used.
- Machine Learning : ANN , SVM
  - ANN : Artificial Neural Network
  - SVM : Support vector machine
- Impacts safety, fuel and energy consumption.

CONCLUSION

- Road Accidents and Traffic are the major problems in cities both for 2 wheeler and 4 wheeler vehicles.
- Accident Hotspots, Traffic prediction and Riders Behaviour are some of the key solutions using Machine learning.
- With Ford sensor data which might already be available, it might be possible to execute many of these solutions.
- These solutions and features can be integrated with an App.
- Safer vehicle would imply more people willing to drive Ford vehicles.

Thank You

References

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Extra slides

Model	Application scenarios	Referred works
CNN	2-dimensional data (e.g., images, videos)	Speed prediction [7, 8]; flow prediction [5]
RNN	Sequential data (e.g., speech, language)	Speed prediction [8, 9]
LSTM	Long sequential data (e.g., speech, language)	Speed prediction [10]; flow prediction [11]
SAE (SdAE)	Representation learning	Flow prediction [2]; accident risk prediction [12]
RBM DBN	Representation learning	Speed prediction [9, 13, 14]

Predicting Accidents

- With the data on Weather, Road curvature, intersections, width of road, number of lanes we can predict roadways which are highly risky.
- Data may be available in public domain or can be requested from transport authorities of a city.
- It is possible to predict highly risky roadways depending on seasons and time during peak hours.