KU LEUVEN Allianz

TELEMATICS
Feature Extraction & Predictive Modelling

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Content

What

1. What are Telematics Features?
2. Describing Allianz Telematics Data

Why

3. Why are Telematics Features Useful in General?

How

4. Telematics Analytics
   ➔ Quantitative Data Analysis

1. What are Telematics Features

- Insurance company monitors your driving habits
- Several possible technologies:

Black-Box

Phone App

Plug-In Device

- Huge amount of collectable data:
  A. Policyholder: Age, Sex, Individual/Professional, etc
  B. Driving Behaviour: Speed, Acceleration, Cornering, etc.
  C. External Data (Restaurants, Sport Clubs, etc.)

2. Describing Allianz Telematics Data

Allianz Bonus Drive Application

Captures Both:

1. Pay-As-You-Drive:

   = How much you drive

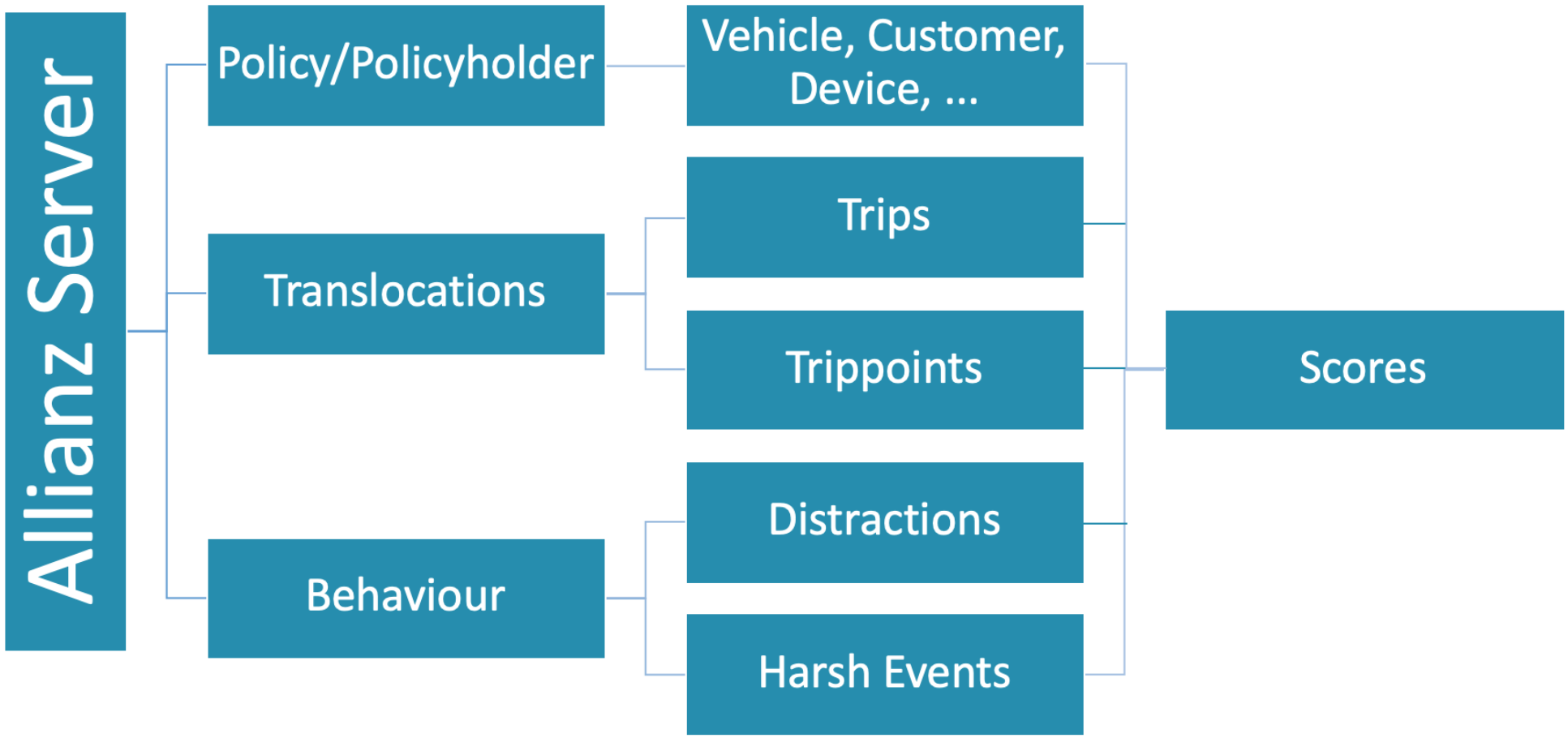
2. Pay-How-You-Drive:

   = When you drive

   = Where you drive

   = How you drive

2. Describing Allianz Telematics Data



3. Why are Telematics Features Useful?

Individual Tailored Price

Fair Price ~ Driving Behaviour

Improving Driving Skills + Possibility Cheaper Insurance for Young Drivers

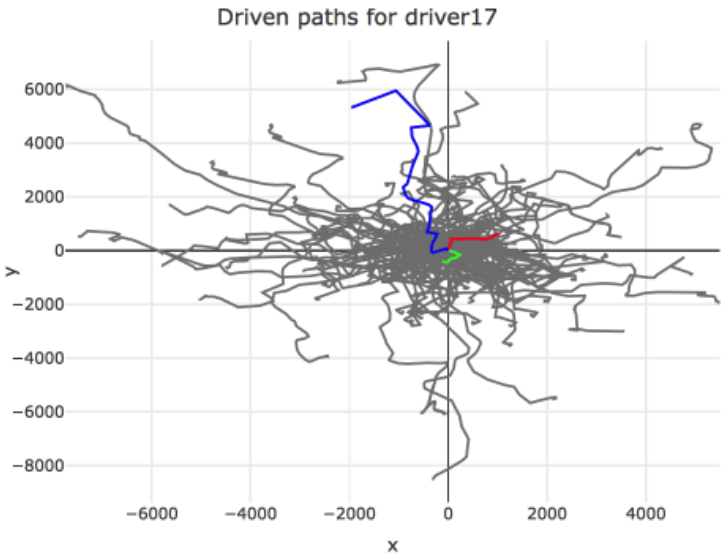
More Insights in Customer Behaviour + Increasing Predictive Power

“A great business at a fair price is superior to a fair business at a great price.”

Charlie Munger

4. Telematics Analytics: Descriptive Analysis

- Visually:



Difficult to Assess a Drivers Risk

- Table:

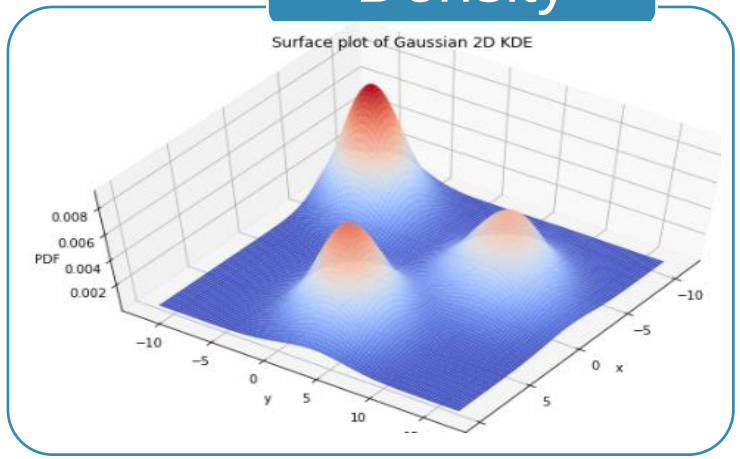
Variable	Driver 1	Driver 2	Driver 39	Driver 2719
Total Distance (km)	842.09	1619.56	1294.98	2267.68
Average Distance Per Trip (km)	4.21	8.10	6.47	11.34
Total Time (h)	32.4	40.21	40.72	38.13
Average Time Per Trip (min)	9.73	12.06	12.22	11.44
Average Speed Per Trip (km/h)	25.81	39.98	31.78	59.39
Average Acceleration Per Trip (m/s^2)	-0.005	-0.007	-0.01	-0.006

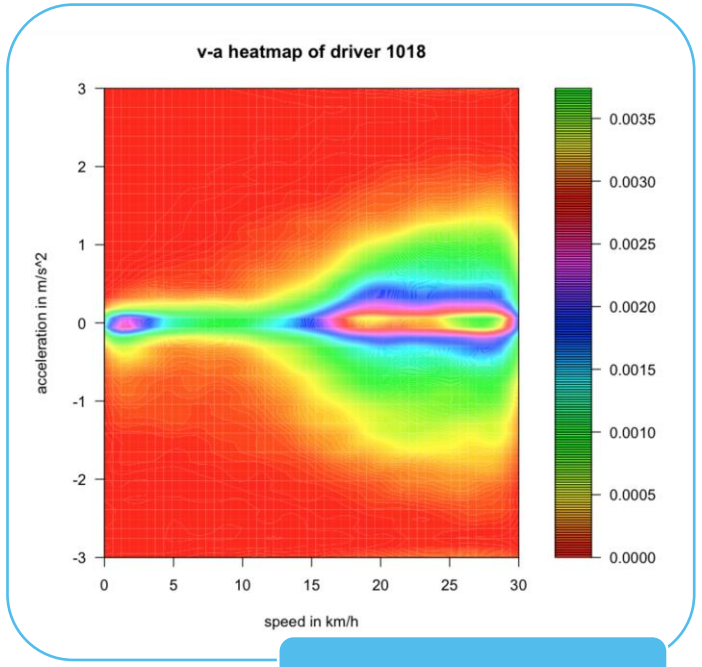
4. Telematics Analytics: Constructing Heatmaps

Bucket	Explanation
$[0]$	car stands still
$(0, 5]$	acceleration phase
$(5, 20]$	low speeds
$(20, 50]$	urban area speeds
$(50, 80]$	rural area speeds
$(80, 130]$	highway speeds

Speed Buckets

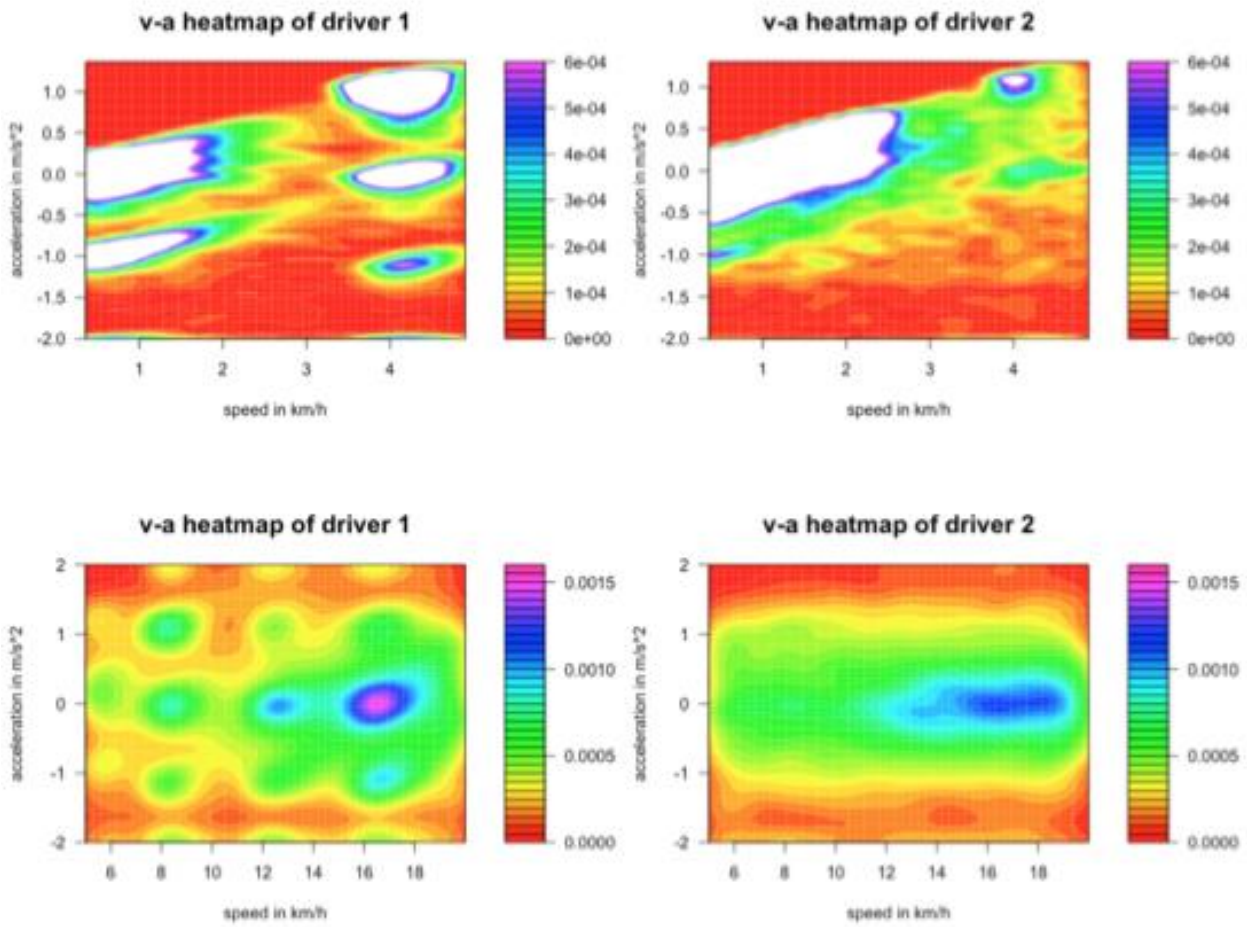
2D-Kernel Density





Heatmap

4. Telematics Analytics: Comparing Heatmaps



Ultimate Goal:

Use These Heatmap Features in the Insurance Pricing Process

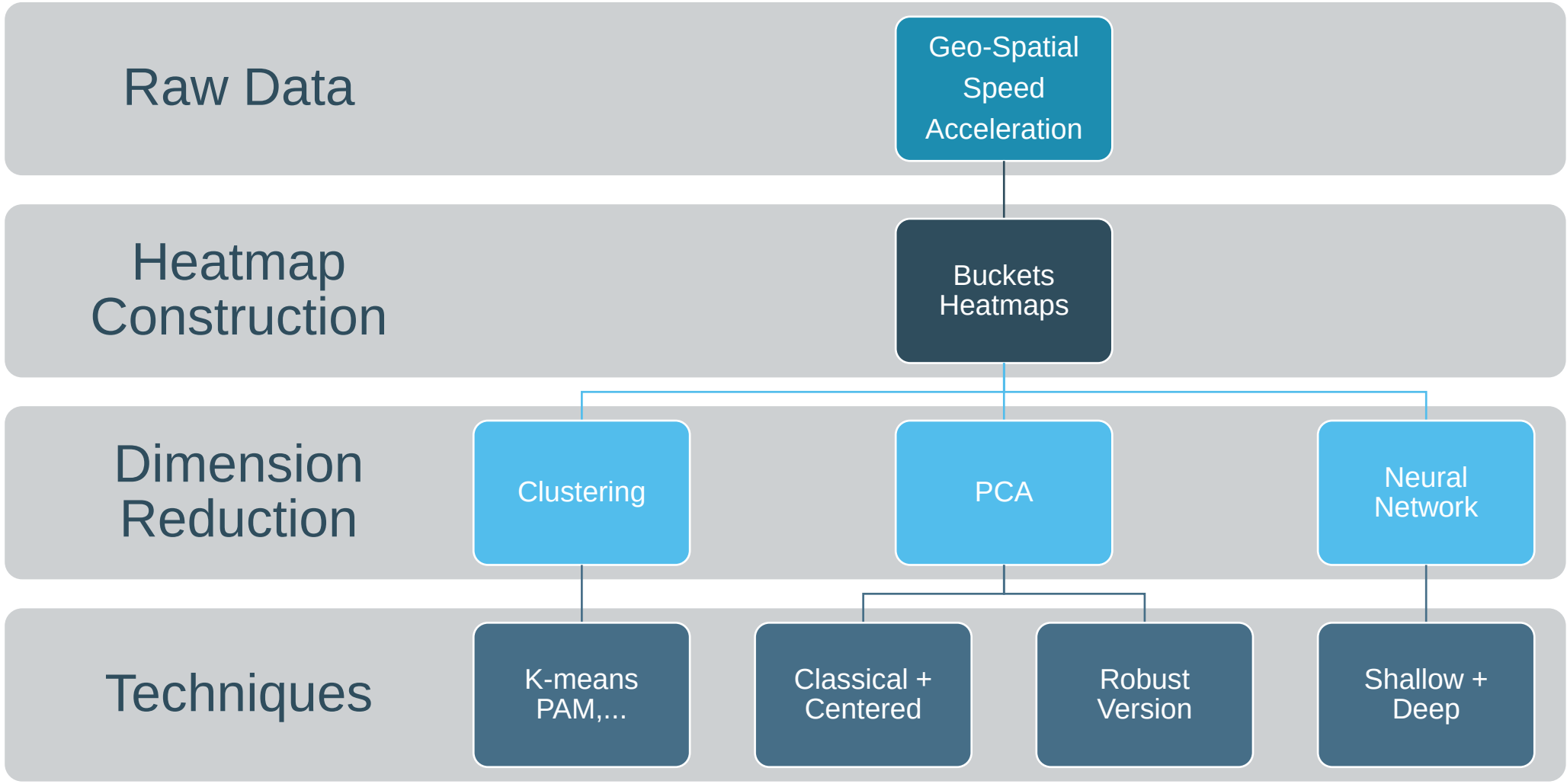
Problem:

Too Many Features Created

Solution:

Heatmap Dimension Reduction

4. Telematics Analytics: Dimension Reduction



The R Code Alive: Shiny Application

Short screen recording of each step discussed above:

1. Descriptive Analysis
2. Heatmap Construction
3. Dimension Reduction
4. Performance Dimension Reduction

PART 1

- Descriptive Analysis
- Heatmaps
- K-Means
- Random-Forest
- PCA
- Neural-Network
- Comparing
- Comparing-Analytical

Click to Close Application

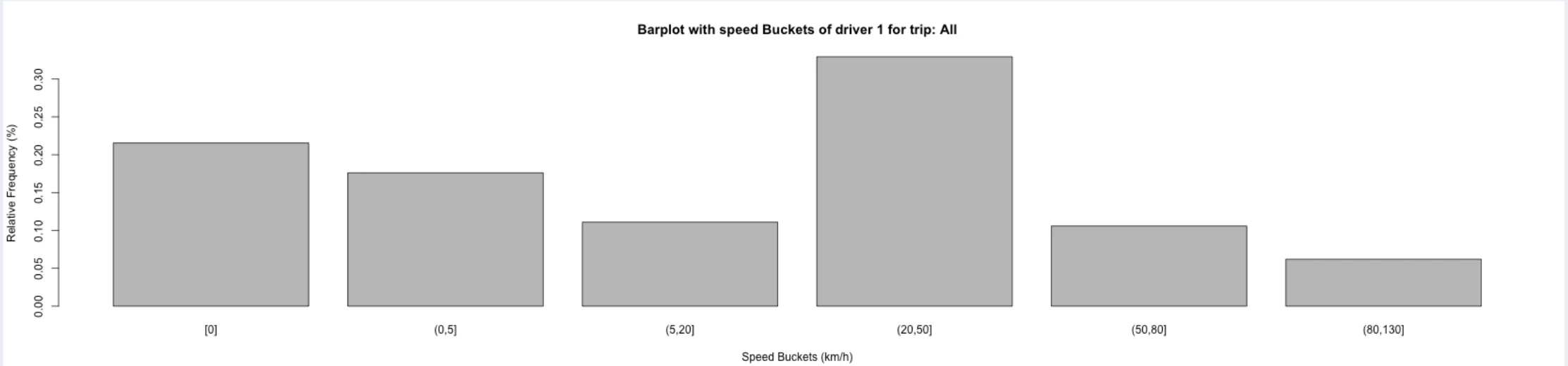
Overview for each driver

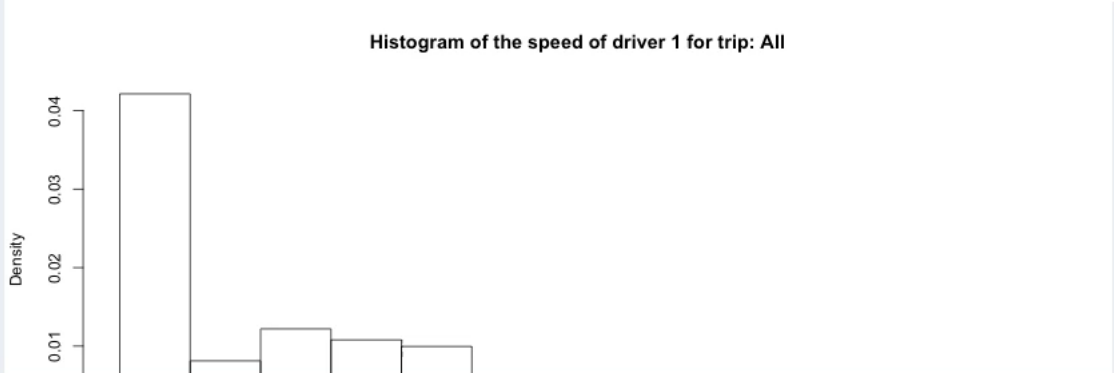
Choose a driver:

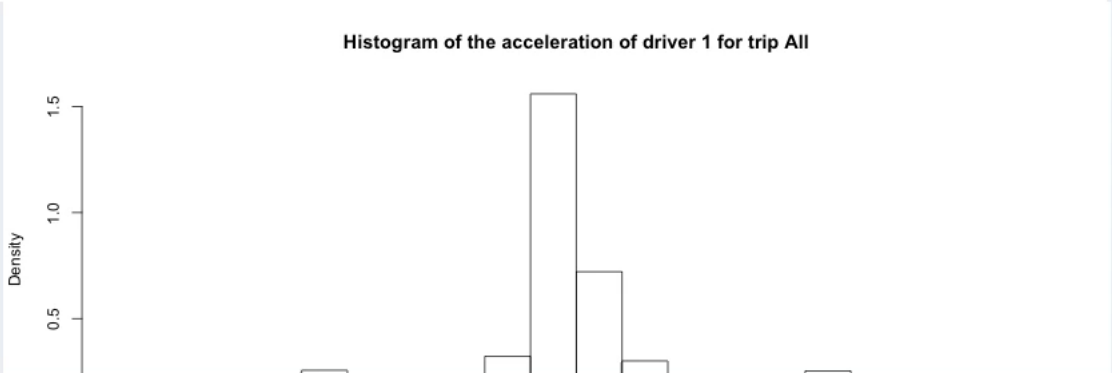
1

```
   Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
   0.00    0.36   19.73   25.81   41.55  130.00
```

```
      Min.   1st Qu.    Median      Mean   3rd Qu.      Max.
-2.000000 -0.238465  0.000000 -0.005568  0.245861  2.000000
```







PART 1

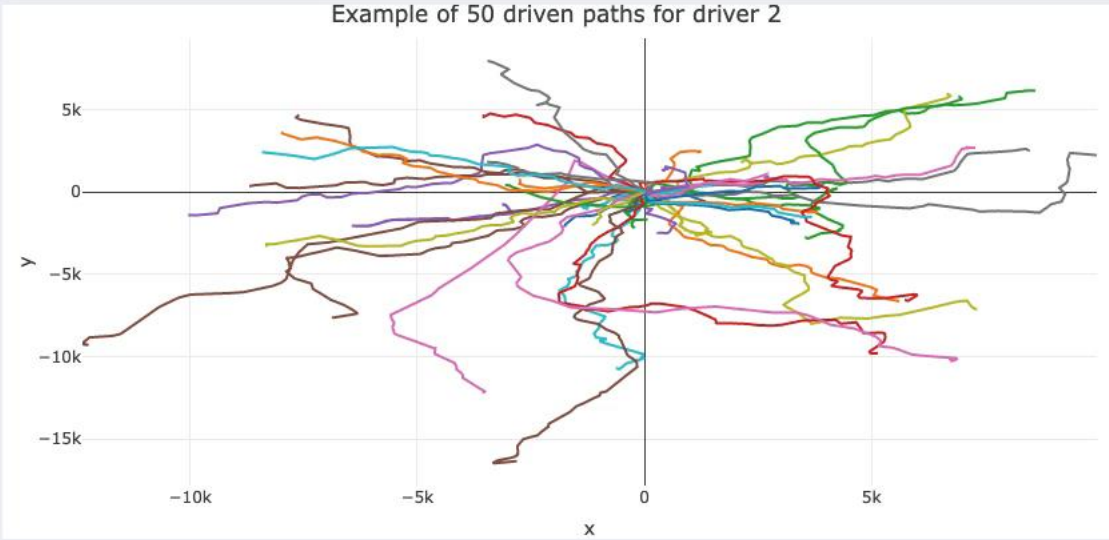
- Descriptive Analysis
- Heatmaps
- K-Means
- Random-Forest
- PCA
- Neural-Network
- Comparing
- Comparing-Analytical

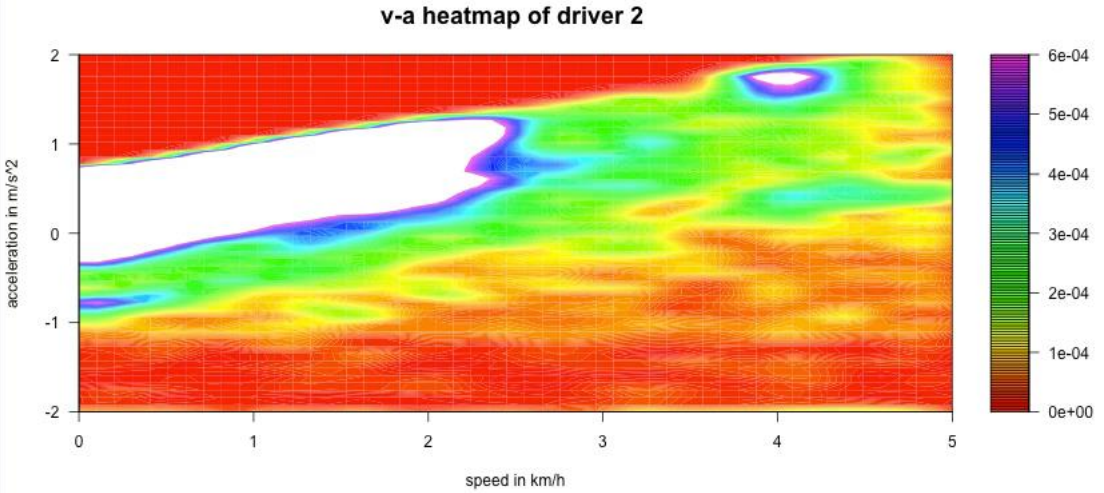
Click to Close Application

Heatmaps

Choose a driver: 2

Choose a speed bucket: (0,5]





Heatmaps
K-Means
Random-Forest
PCA
Neural-Network
Comparing
Comparing-Analytical
Click to Close Application

Heatmap Approximation PCA vs. NN

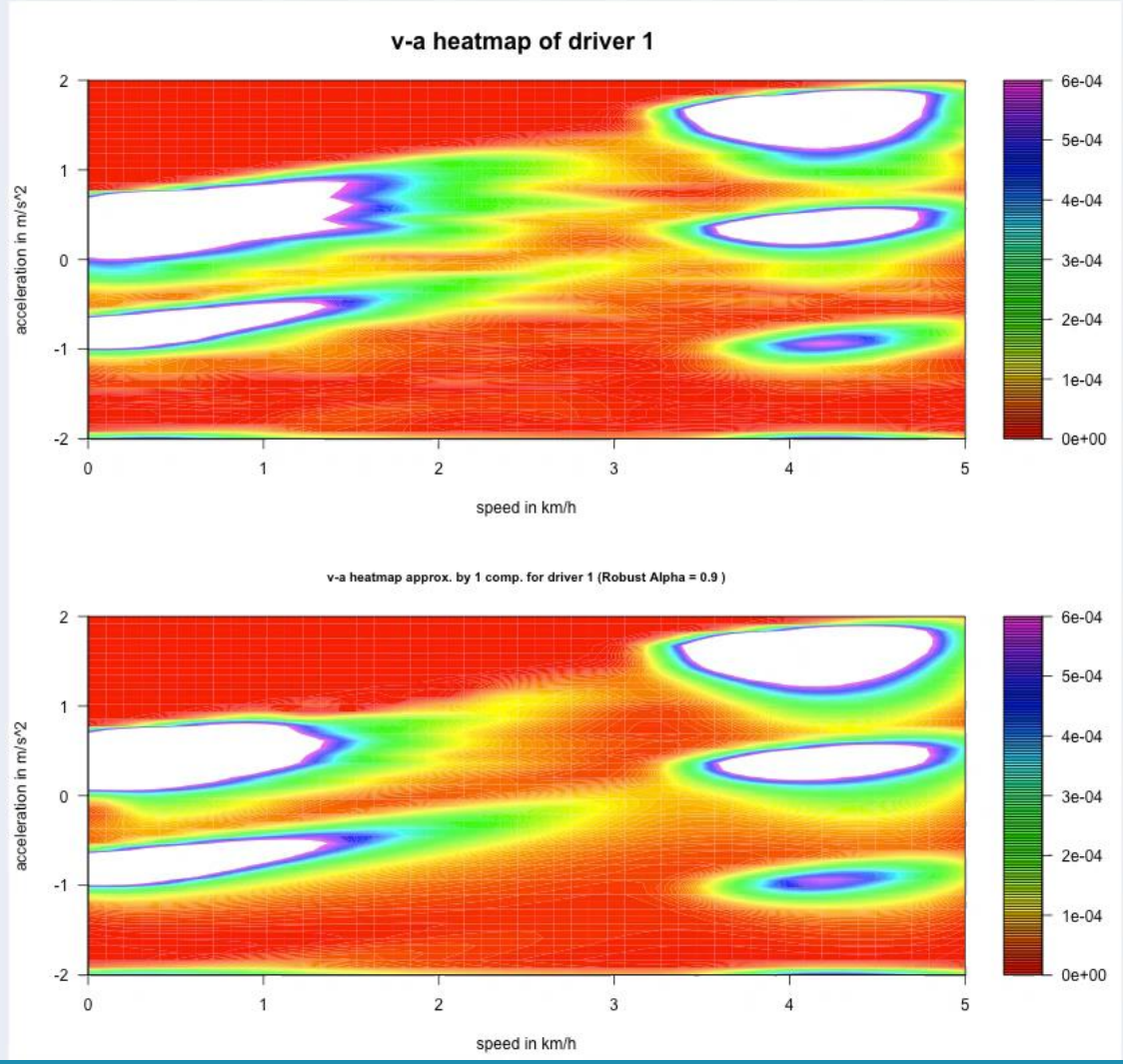
Choose a driver: 1

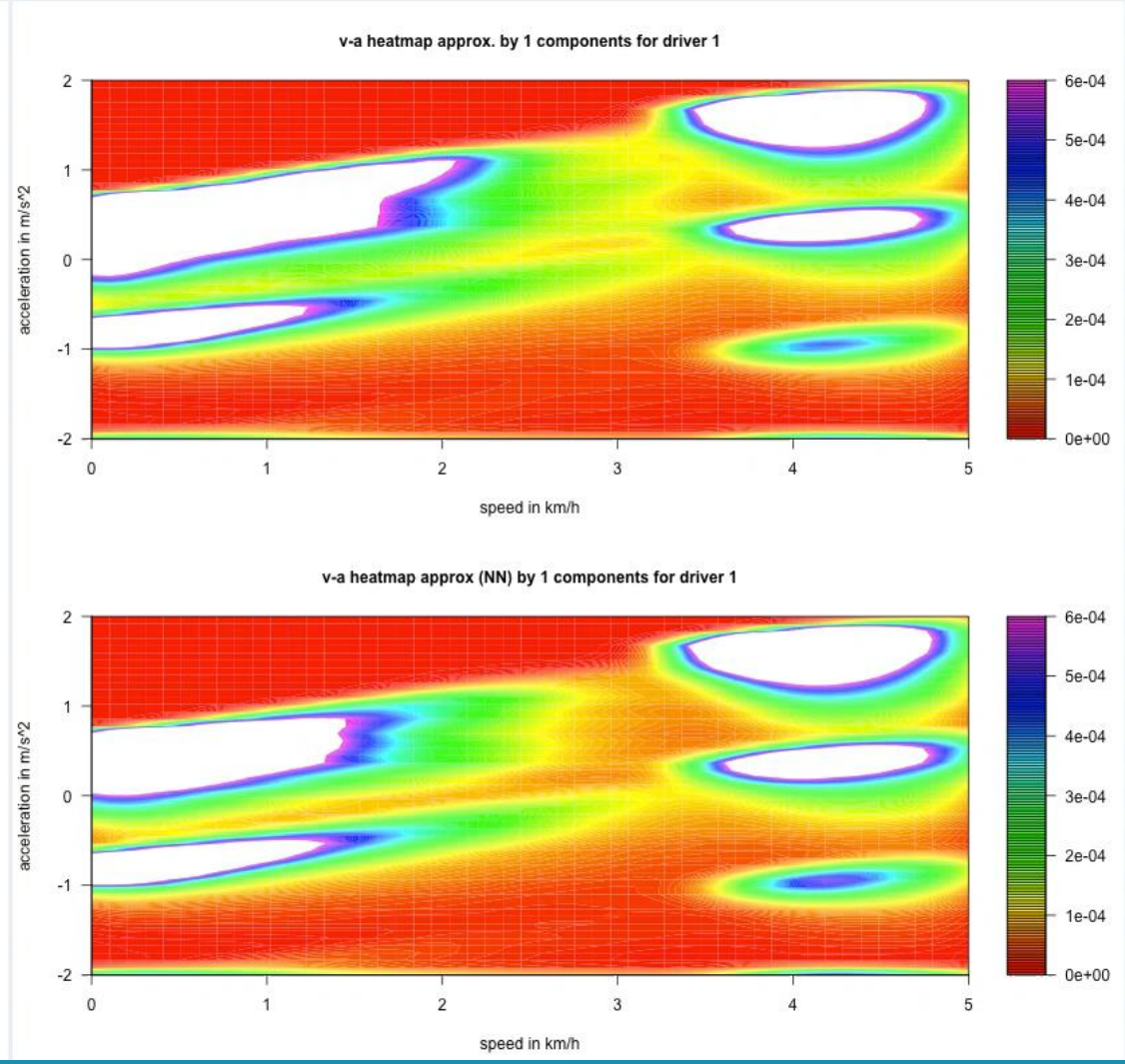
Choose a speed bucket: (0,5]

Choose number of components: 1 (1 2 3 4 5 6 7 8 9 10)

Choose hidden structure NN: (10,q,10)

Choose robustness parameter:
- 0.5
- 0.7
- 0.9

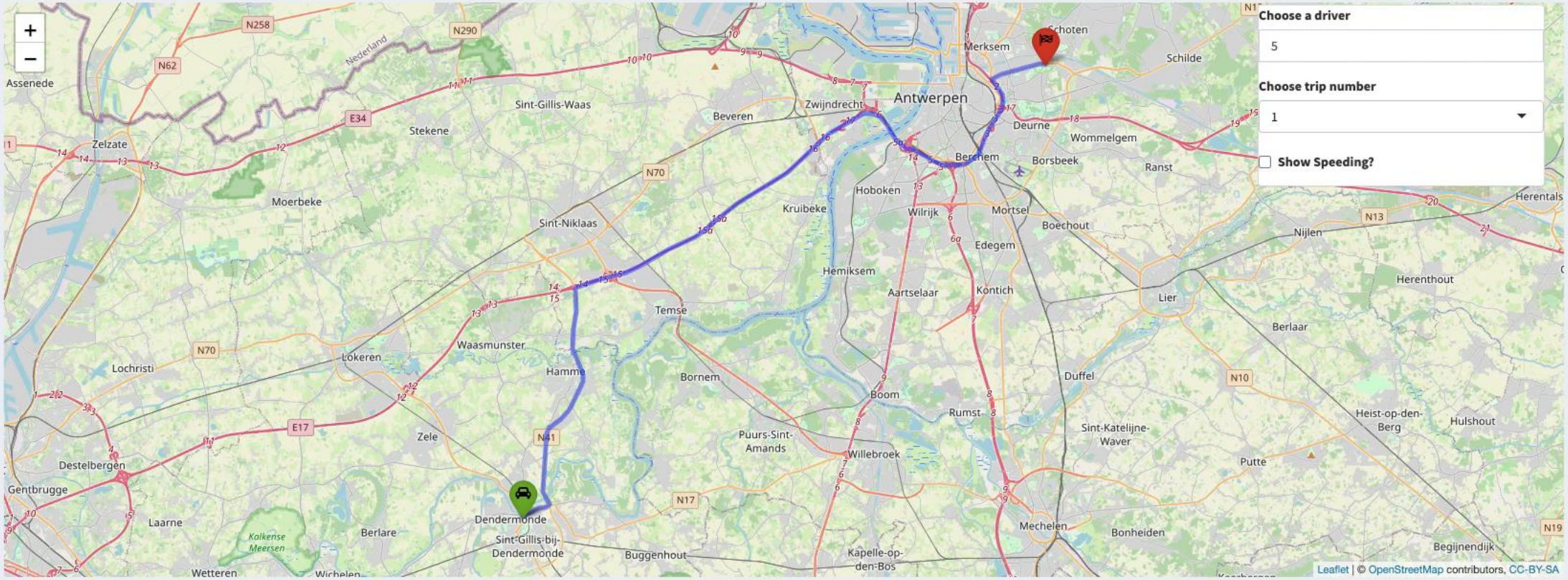




- Geo Map
- Heatmap
- S & A Plots
- Overview Trip
- Overview Driver
- Dim Reduction Heatmap

Click to Close Application

Map of the Trips



4. Telematics Analytics: Prediction of Accidents

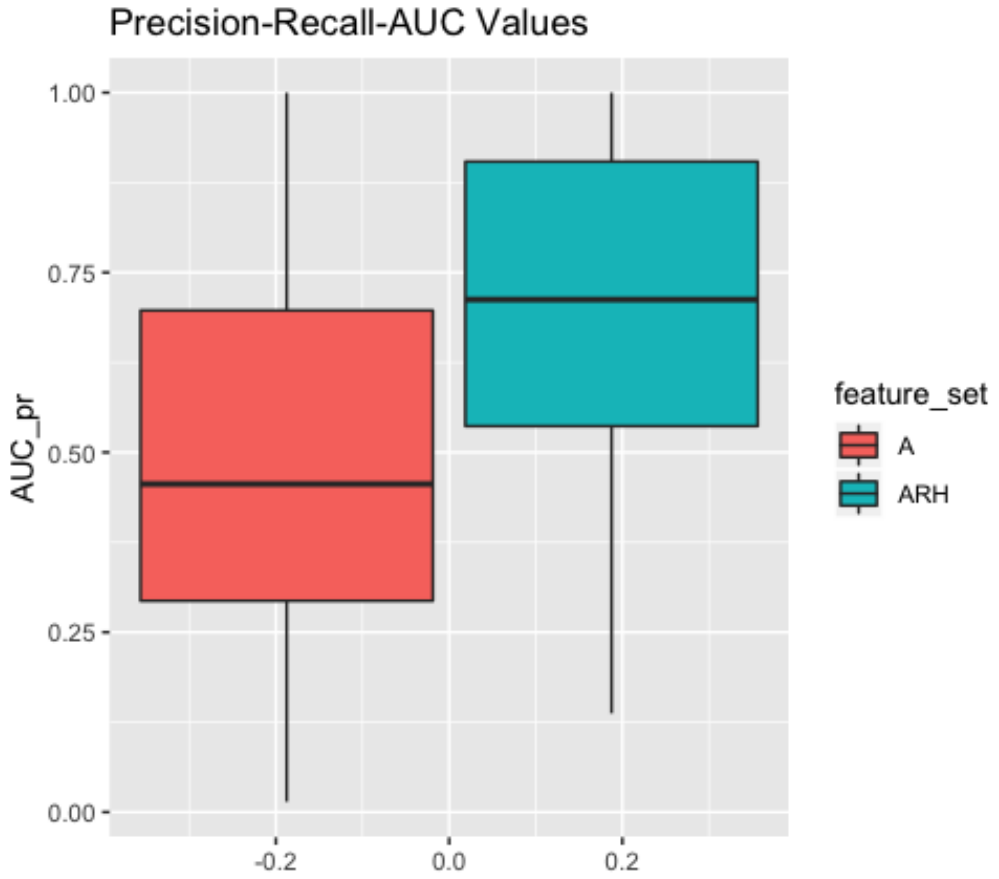
Prediction of Accidents

- Used Classifiers:
  Logistic Regression, Naïve Bayes, CART,
  Random Forest, Boosted Trees, …

- Performance Measure:
  10x10 Cross Validation of
  Precision-Recall AUC values

- Implemented all analyses myself in R

+ Application To Visualize Power of Telematics



Summary and Conclusion

Belgium Market

Future Potential and Growth Possible

➔ More and more Data Analytics

Sector & LoB

Financial Sector in general needs to adapt to the fast & changing “Tech-Environments”!

➔ MTPL in Insurance

Telematics

Fair Pricing ~ Driving Behaviour

➔ PAYD + PHYD

Key Advantage Insured

Increases Predictive Power

➔ Also Extensions and Other Analytics

Key Advantage Insurer

Thanks for Your Attention