Does Weather has an significant impact on the number of highway traffic accidents?

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Summary

Analysis of weather events on German highways and accidents in 2018-19.

Rationale

It analyses whether highway segments that are particularly exposed
to extreme weather events result in more car crashes than usual.

Datasources

Highway Weather Data

- ▶ Metadata: URL
- ▶ Data: URL
- ▶ Data Type: CSV
- ▶ Description: Weather events on specific routes were studied using reanalysis data from all of Germany from Dec. 1, 2017-Nov. 30, 2019. The weather values of 3160 points with 1 km distance were read from the data and averaged or summed up, depending on the parameter. The values were normalized and the highest was given the value 100, the lowest the value 0.

CrashData

- ▶ Metadata: URL
- ▶ Data: 2017 2018 2019
- ▶ Data Type: ZIP/CSV
- ▶ Description: Road traffic accident data of 2017 to 2019 of Germany.

Transformations

1. Preporcessing of the weather data
   - Give each weather measure point a unique ID
   - As the measure points are distributed one kilometer apart from each other, each points gets an kilomter marker
2. Preprocessing of the crash data
   - Dropping rows with irrelevant data (turn accidents, bike accidents, etc.)
   - Drop columns with irrelevant data
3. Connect the crash data with the weather data
   - For each crash, find the closest weather measure point (Treshold: 600m)
     - Drop rows where no point is within the treshold
     - If there are multiple points within the treshold, select the one closest
   - Merge crash data to the weather data
4. Normalize the combined data per Route

Analysis of all routes combines

During the first analysis all routes are looked at. The first map shows the location of the routes. The second map shows the number of crashes per kilometer normalized. The third map shows the normalized weather events per kilometer. The higher the number the more and severe weather events occured.

Map of all the routes

Strecke
- Aschaffenburg_Fuessen
- Hamburg_Schwieberdingen
- Karlsruhe_Muenchen
- Koeln_Dresden
- Muenchen_Garmisch_Partenkirchen
- Muenchen_Nuernberg
- Muenchen_Salzburg
- Nuernberg_Suhl
- Wuerzburg_Berlin
- Wuppertal_Kassel

Conclusion

The analysis investigates whether highway segments exposed to extreme weather events lead to more car crashes. Here are the key findings:

1. Initial Analysis:
   - ▶ The number of crashes is higher in the south of Germany, where severe weather events also occur more frequently.
2. Correlation Analysis:
   - ▶ The correlation between the number of crashes and weather events is not strong.
   - ▶ Wind-related events are negatively correlated with crashes, indicating that more wind on the highway is associated with fewer crashes.
   - ▶ 'Niederschlag' (precipitation) shows a positive correlation, meaning that more precipitation leads to more crashes.
3. Random Forest Regressor:
   - ▶ 'Black Ice' and 'Windböen' are the most important weather factors for predicting crash likelihood.
   - ▶ None of the features stand out significantly in predicting crash likelihood.