Exploring the car accidents involving pedestrians

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Introduction

Background

Pedestrians are the most vulnerable road users.

Analysis of accidents in a close neighborhood can give a policymakers, politician and educators more arguments to make more insightful decisions or educational actions.

Problem

A local data can reveal which places in the city are the most dangerous for pedestrians and which factors are the most important in preventing the most tragic accidents.

Interest

A local policymakers would be very interested in prediction of places and factors related to accidents. Also teachers and other educators might use this insight to stress the importance of sobriety and obedience with the road rules.

Data

Data and metadata were downloaded from the Seattle Geo Data portal. Data include all types of collisions from 2004 to present.

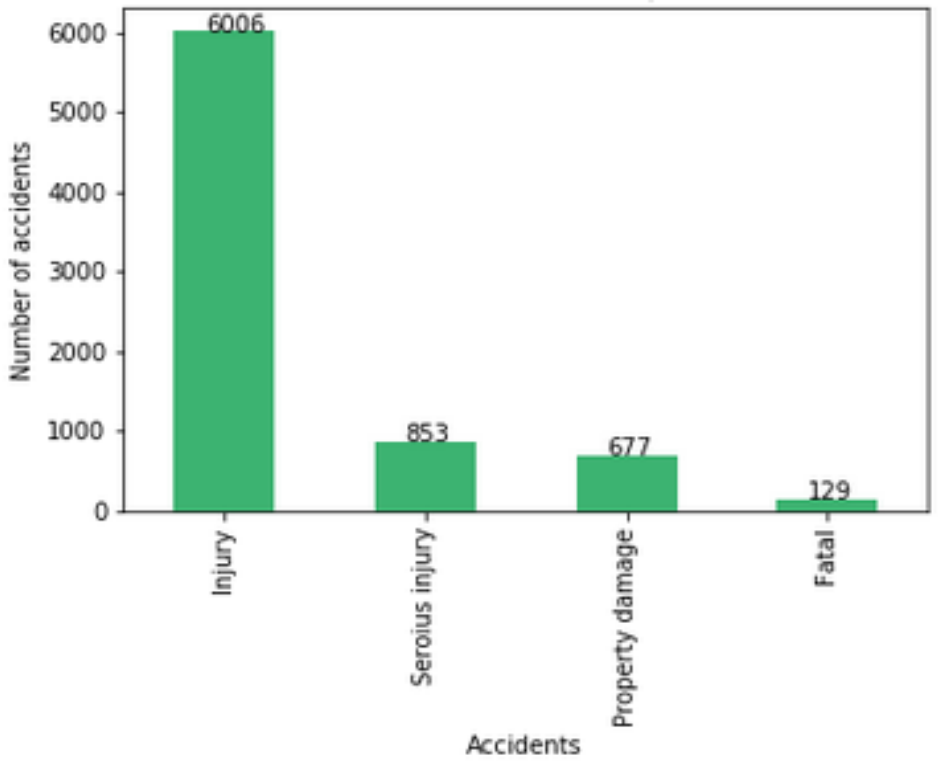
Data are provided by Seattle Police Department and recorded weekly by Traffic Records. The data contains 39 attributes and 221 389 entries.

In the further analysis the dataset was reduced only to the accidents with pedestrians.

The following attributes were used:

X,Y (geographic location)	WEATHER
ADDTYPE (Collision address type: Alley, Block, Intersection)	PEDROWNOTGRANTED (whether or not the pedestrian right of way was not granted)
LOCATION	ROADCOND
SEVERITYCODE	LIGHTCOND
INCDATE (date of accident)	SPEEDING
INATTENTIONIND (whether or not collision was due to inattention)	UNDERINFL (whether or not a driver involved was under the influence of drugs or alcohol)

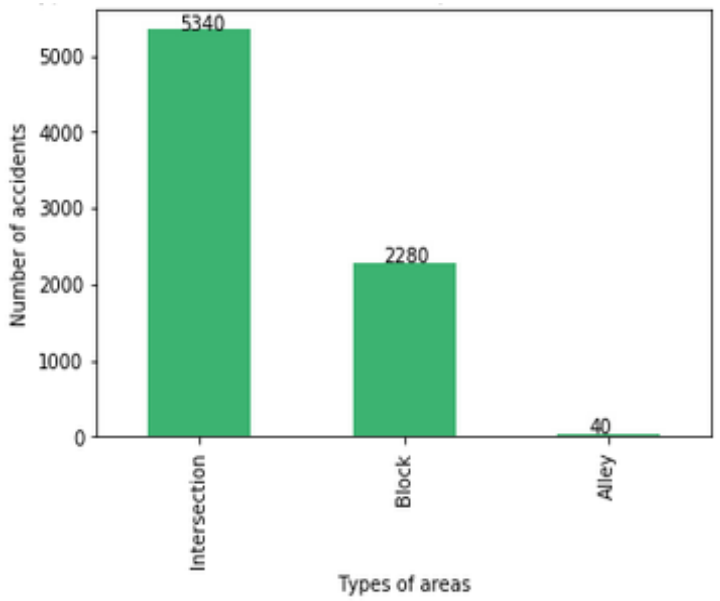
Outcomes of accidents with pedestrians



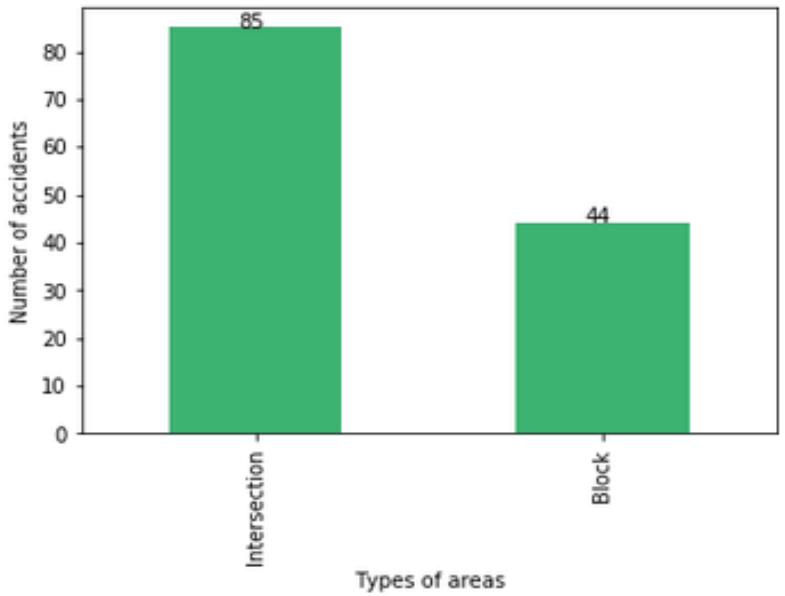
The most frequent outcome of accidents with pedestrians were a non-serious injuries (6006), the second group were serious injuries (853) and third were the accidents involving only a property damage (677). The smallest group were the fatal accidents – 129 cases.

Types of areas where accidents with pedestrians were most frequent

All accidents

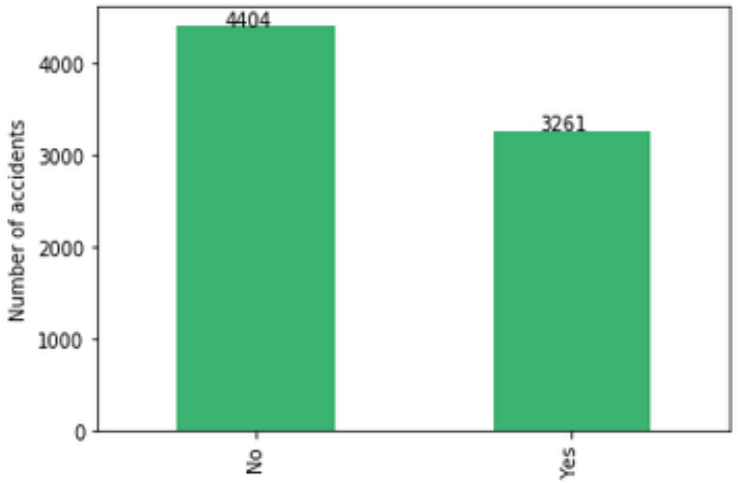


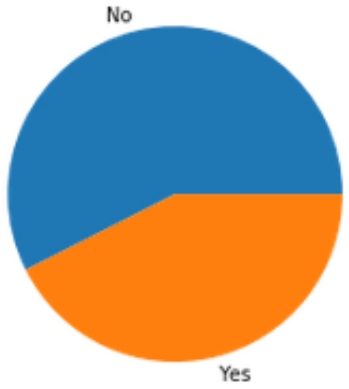
Fatal accidents



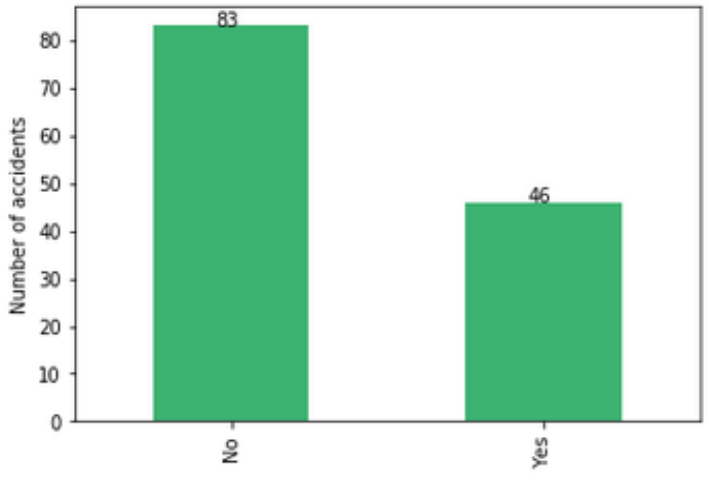
Pedestrian’s right violation

All accidents



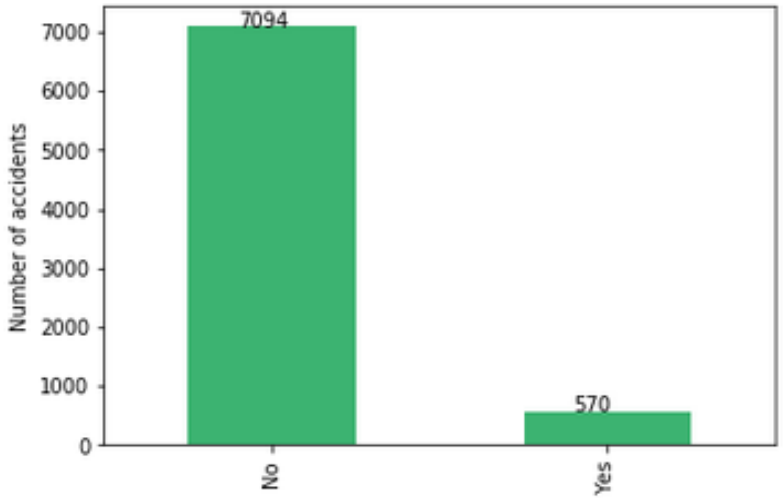


Fatal accidents

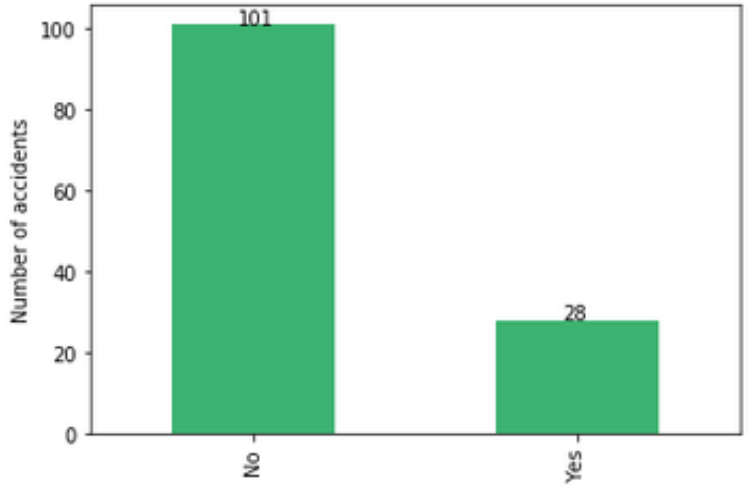


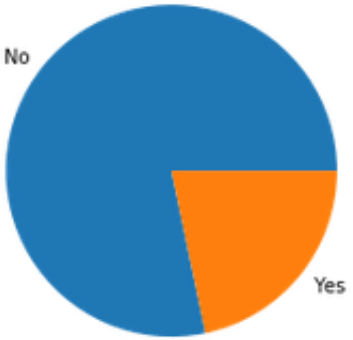
Driver under influence of drugs or alcohol

All accidents



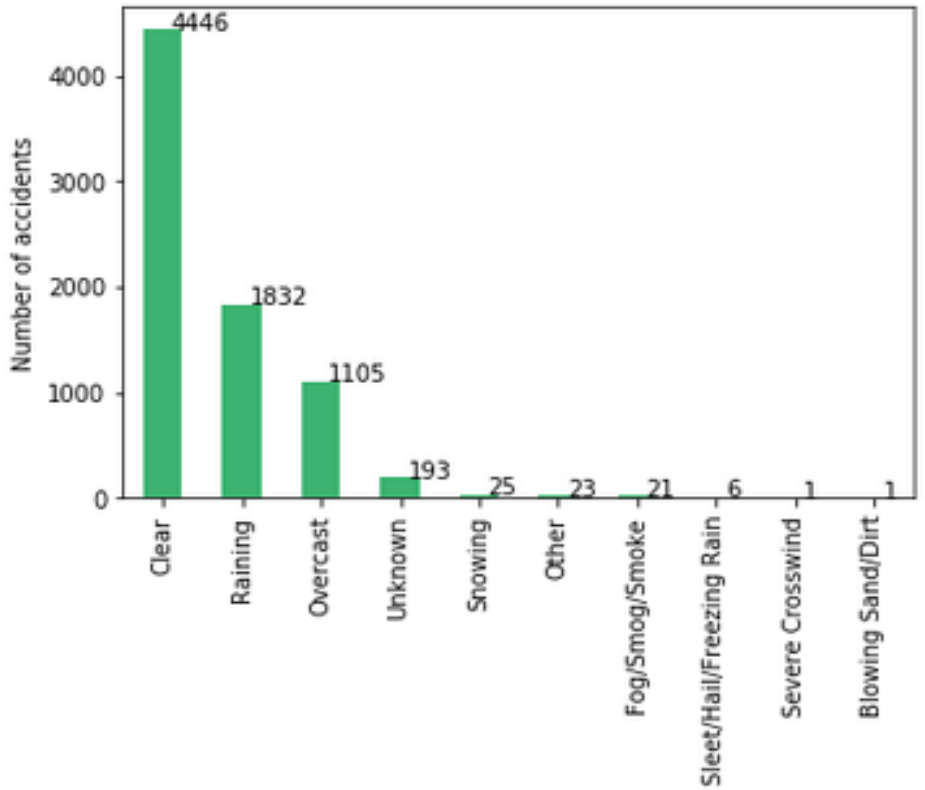
Fatal accidents



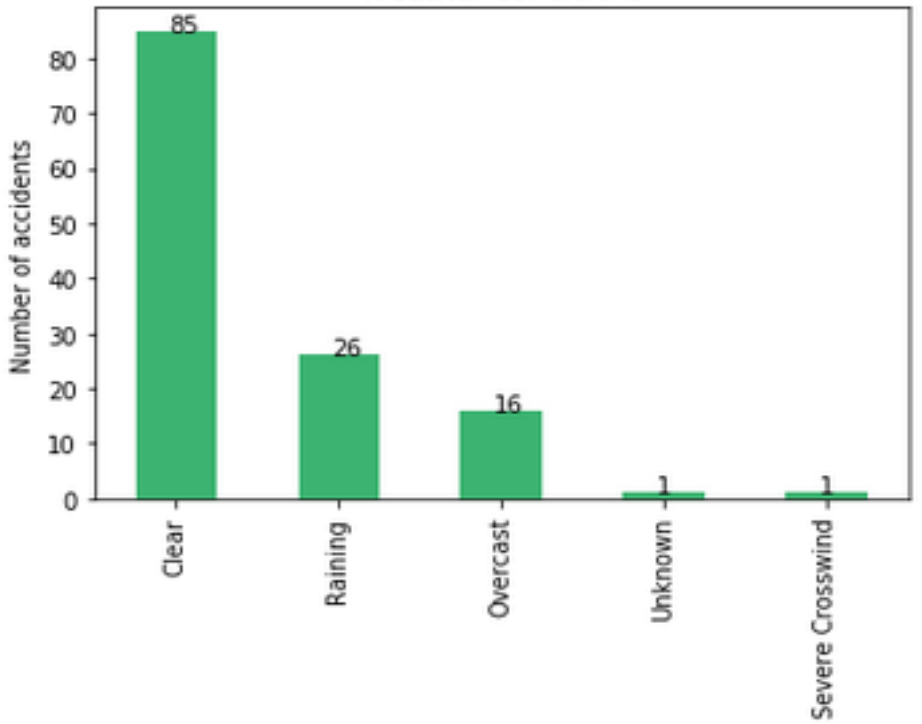


Weather conditions

All accidents

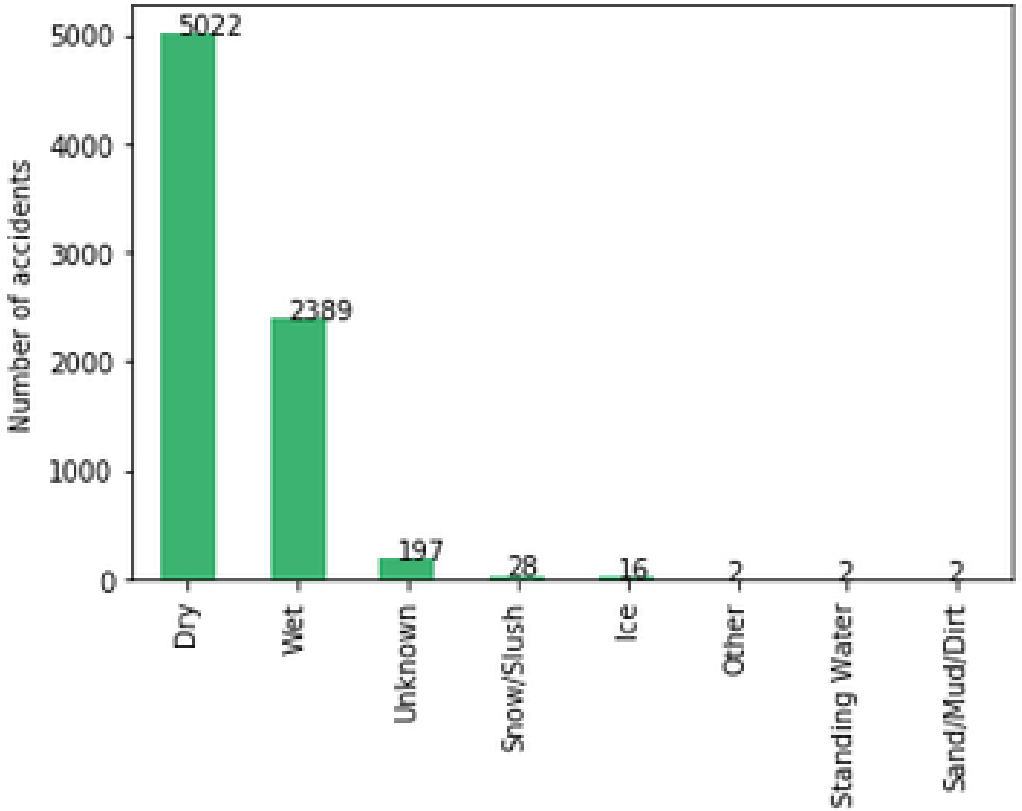


Fatal accidents

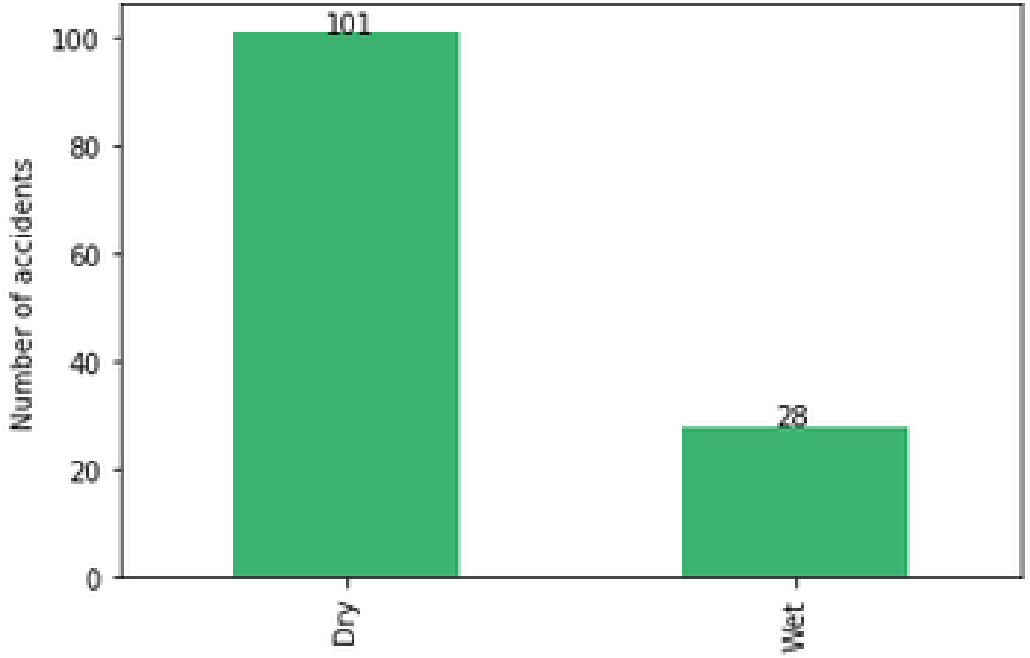


Road conditions

All accidents

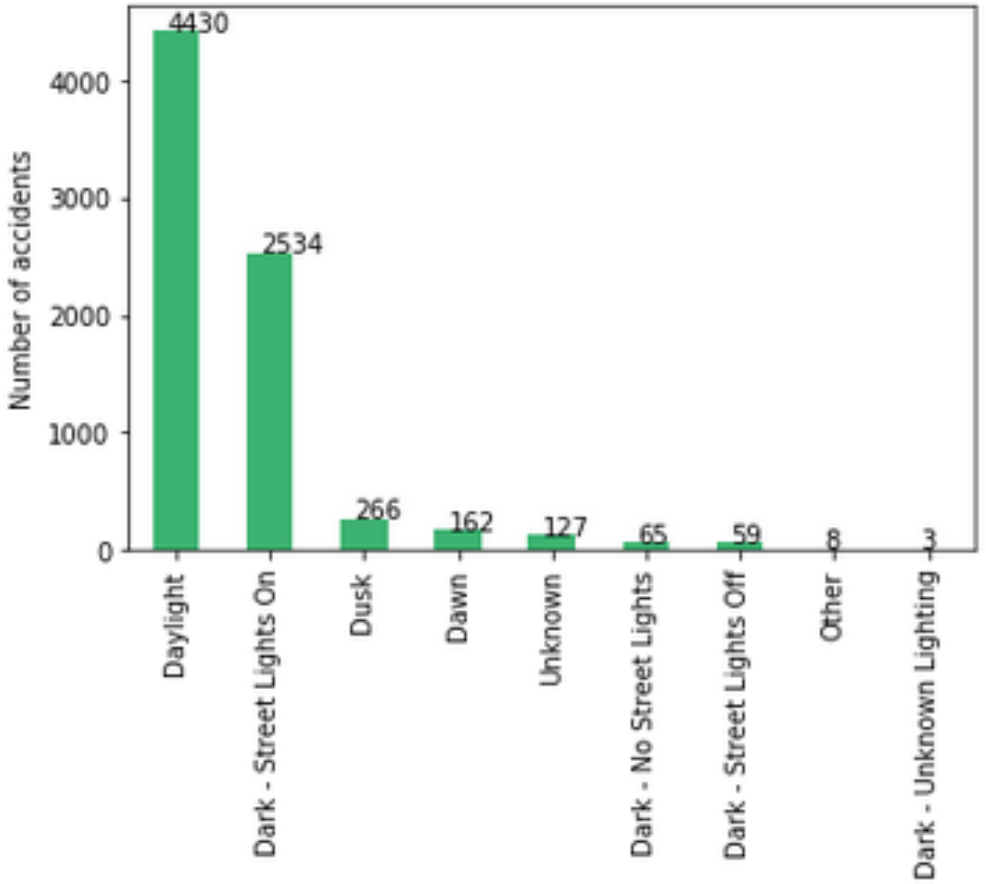


Fatal accidents

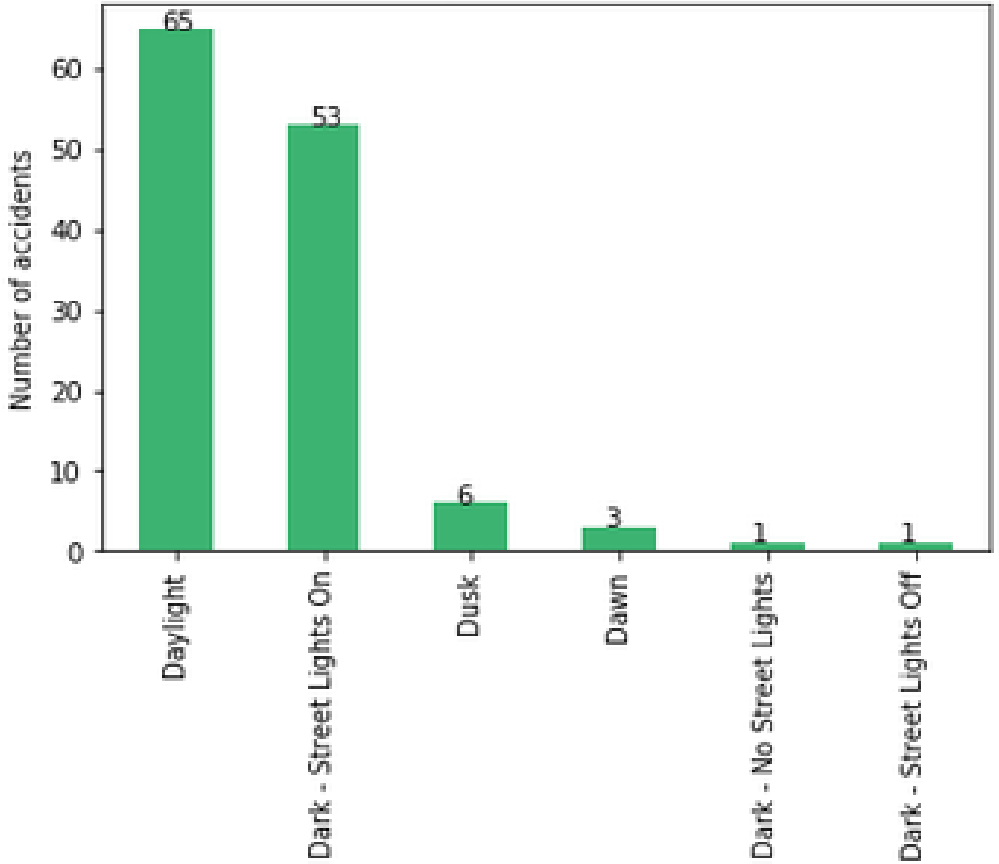


Light conditions

All accidents

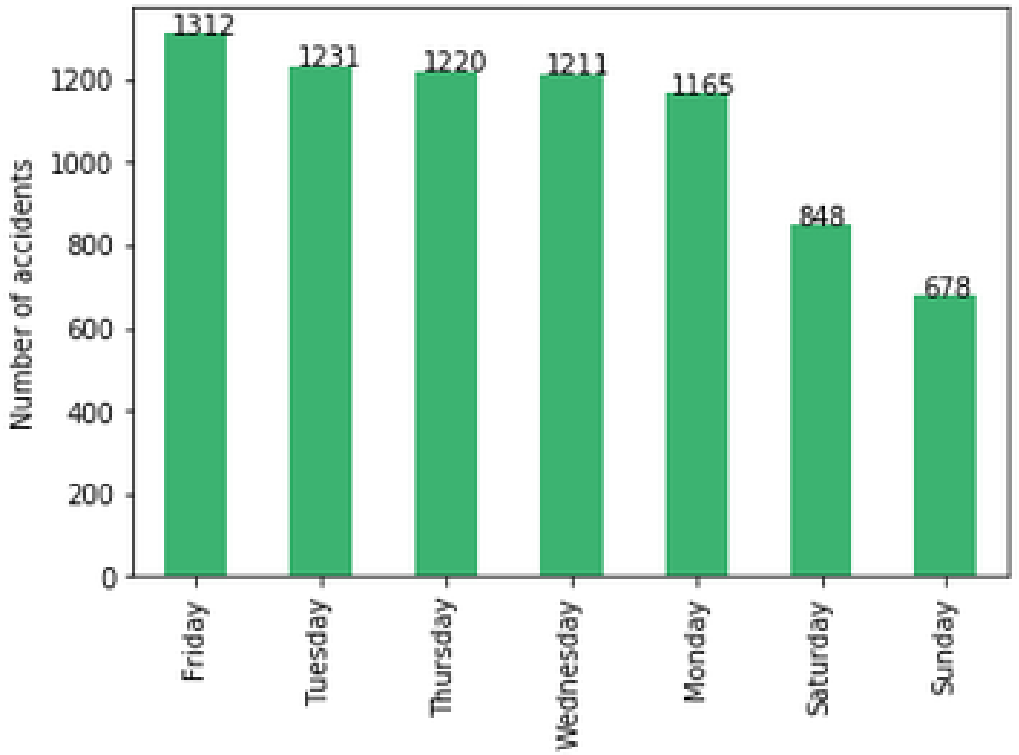


Fatal accidents

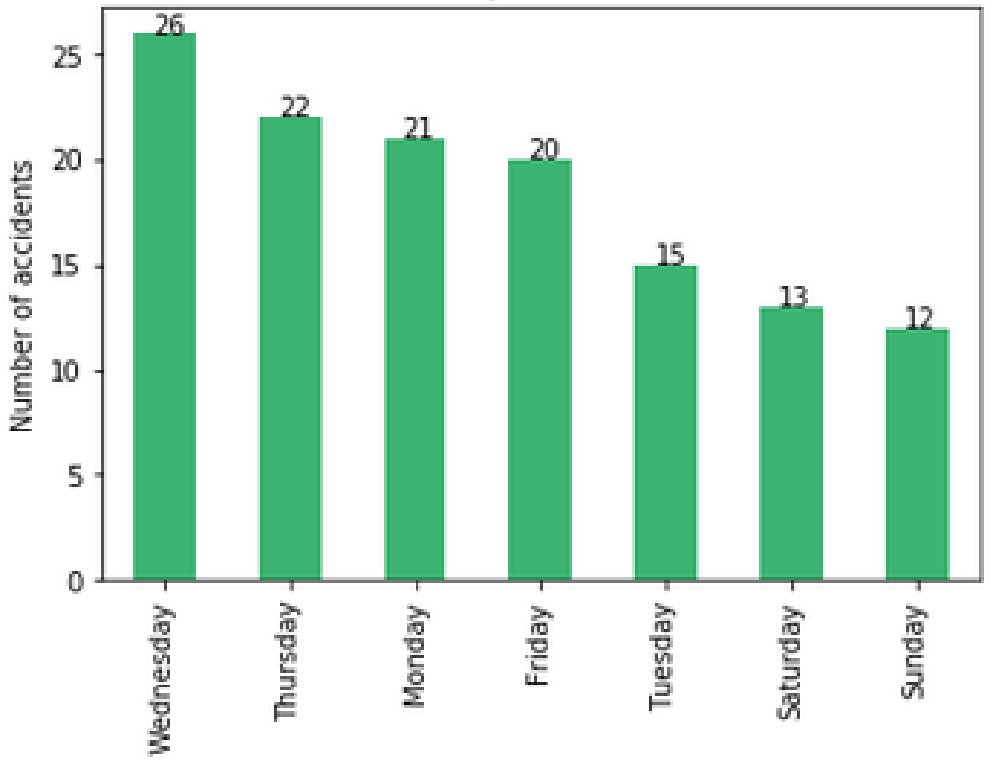


Day of week

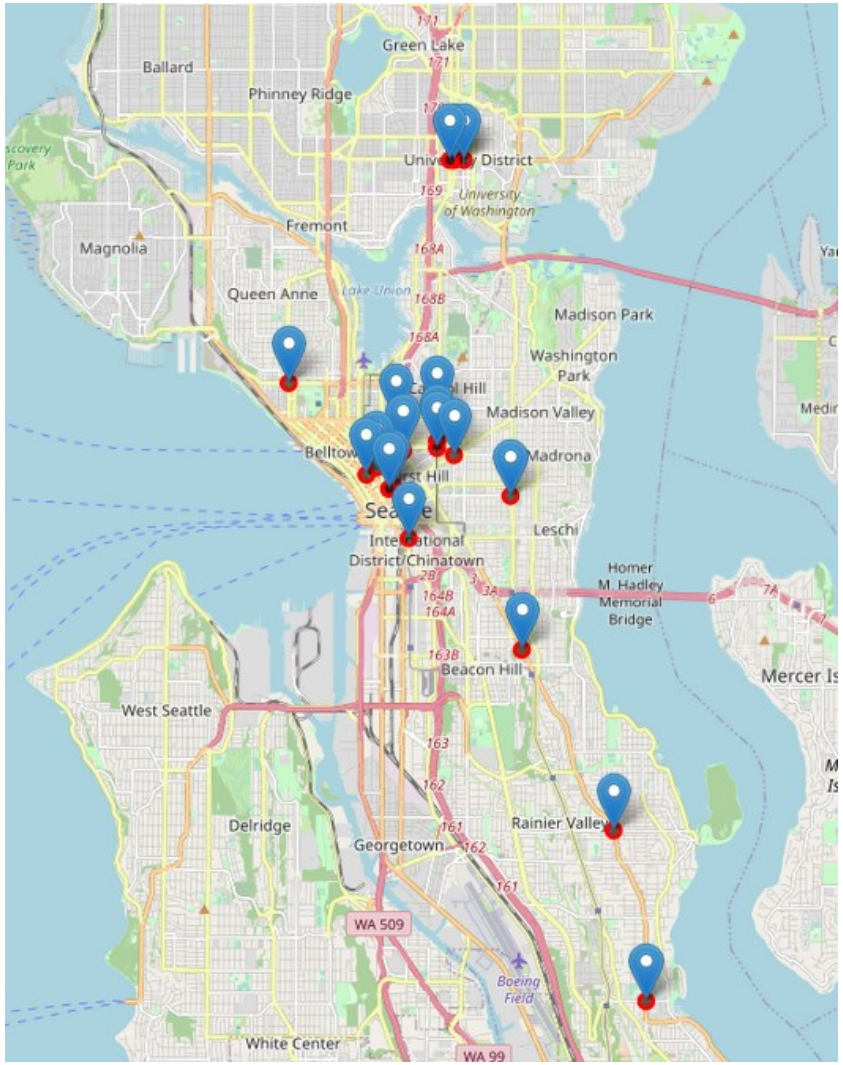
All accidents

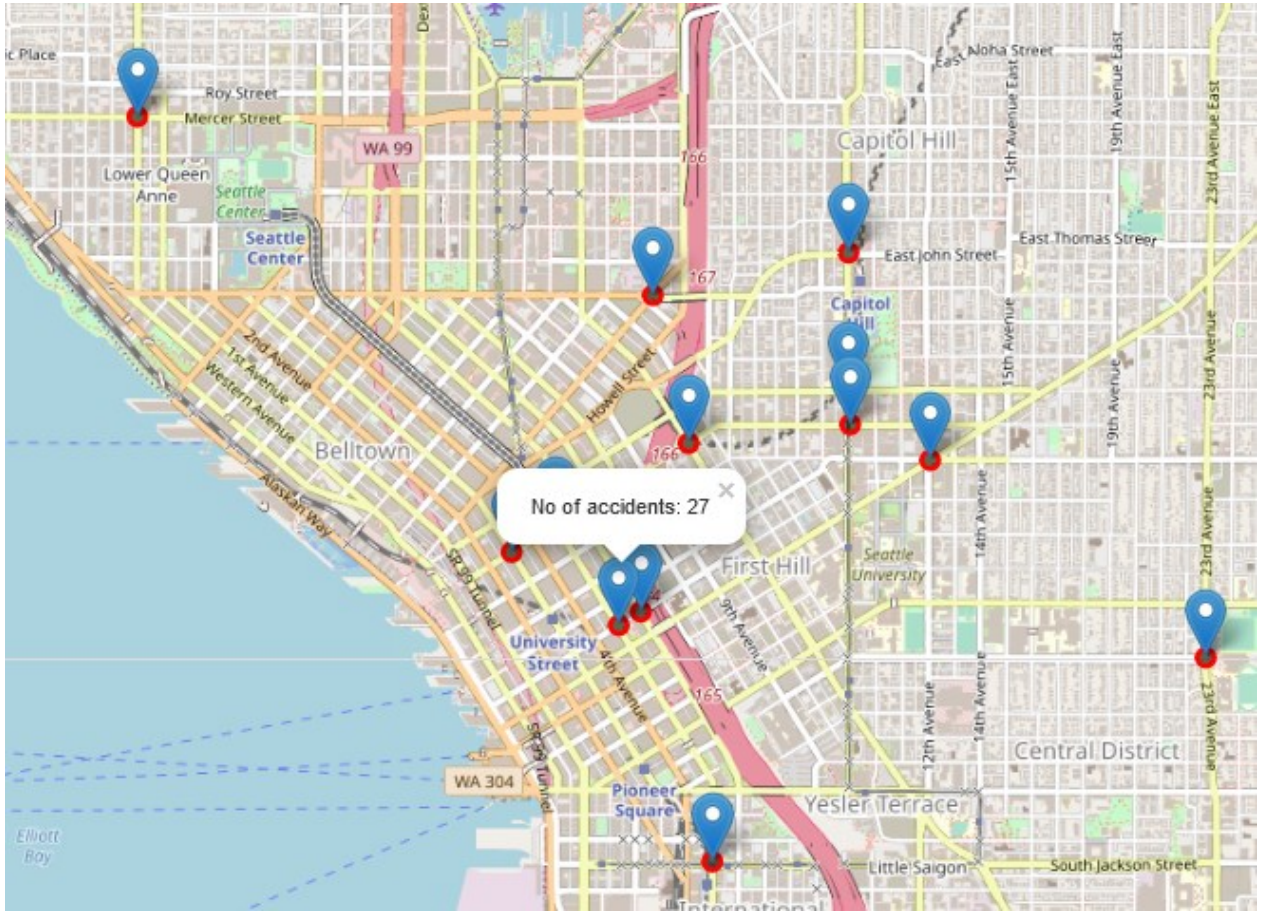


Fatal accidents

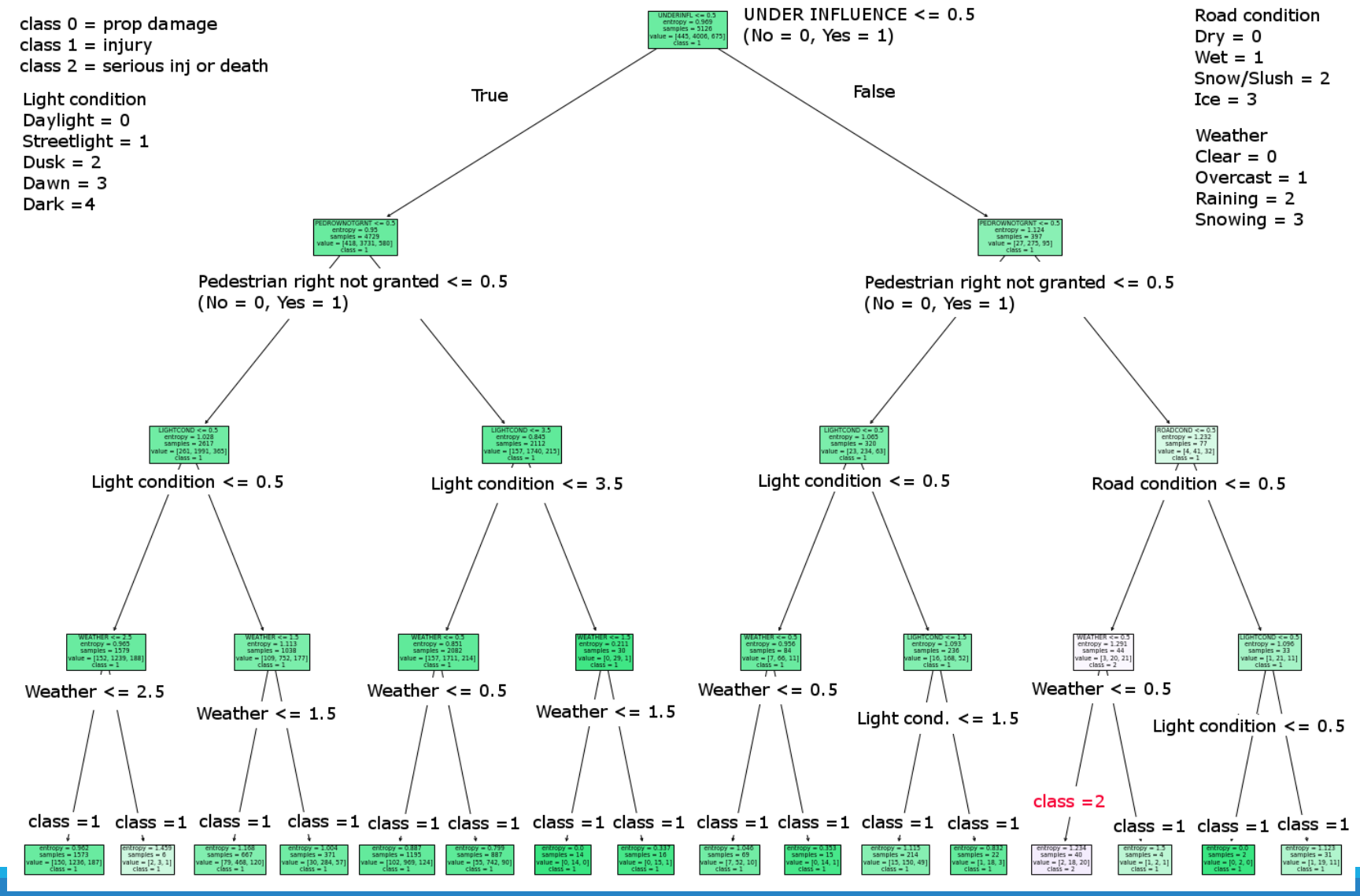


Most dangerous intersections (all accidents)



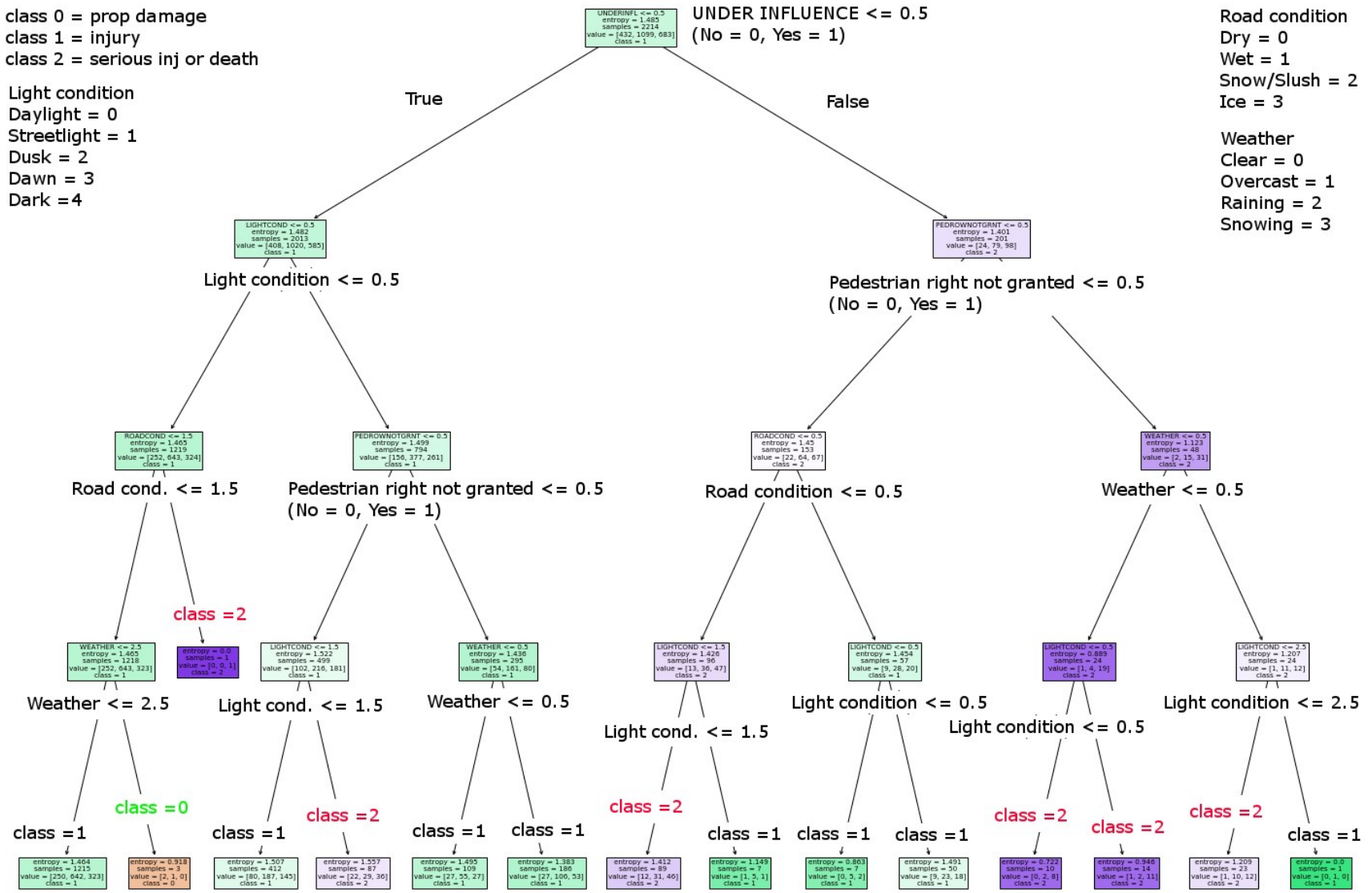


Unbalanced decicion tree



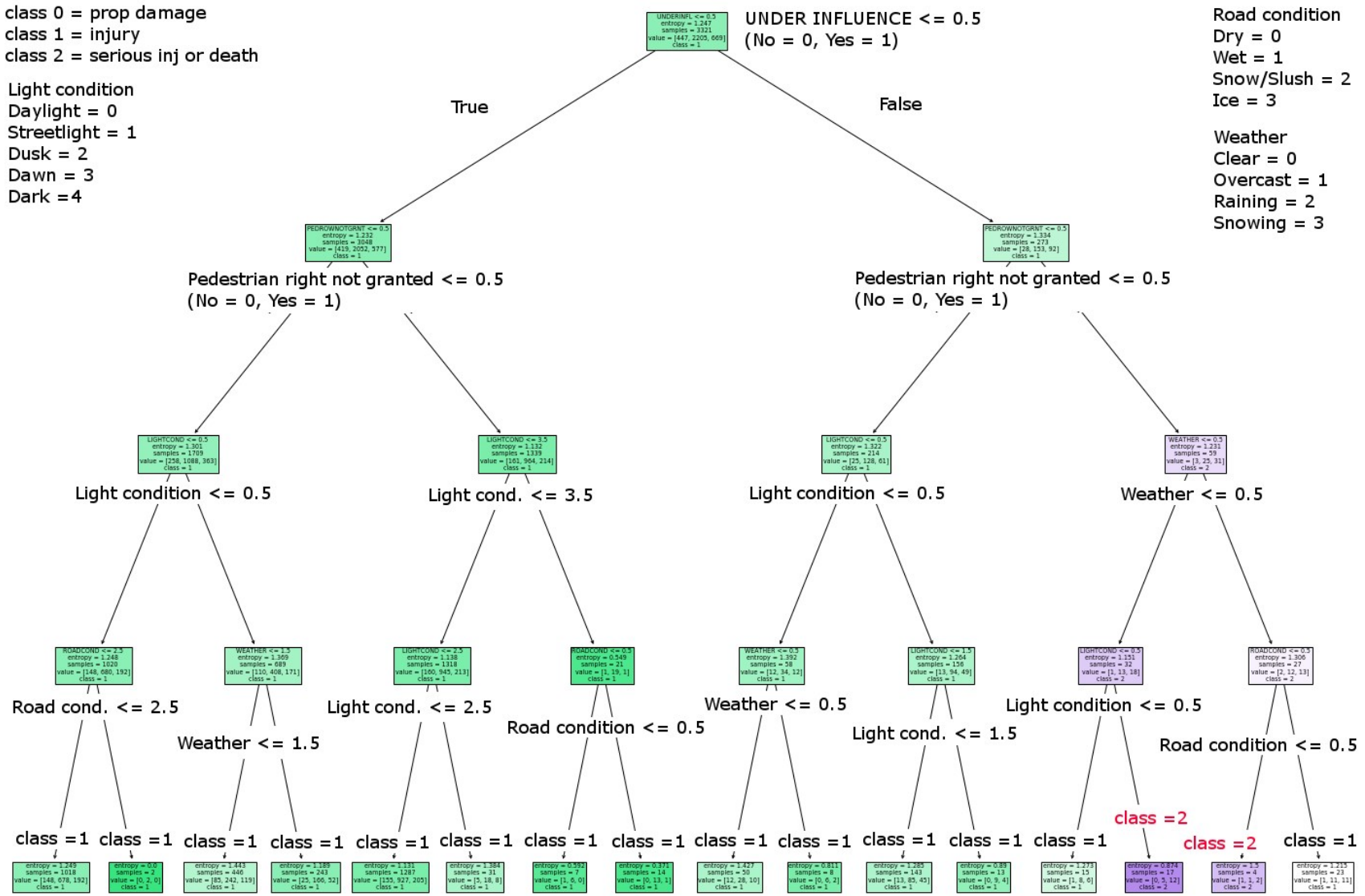
- All data taken into account,
- Fatal accidents and accidents with a serious injuries joined (class = 2).
- **Accuracy**: 0.79.
- Too much data related to class 1 (minor injury) caused, that the fatal outcome is underestimated in unbalanced model.
- Predicted 1 path leading to an accident with fatal or serious injury outcome.

Balanced decicion tree 1:1



- Number of accidents with a minor injuries were equaled with other types of accidents (fatal, serious injury and property damage - 1582).
- Fatal accidents and accidents with a serious injuries joined (class = 2).
- **Accuracy**: 0.52.
- Low accuracy.
- Predicted 6 paths leading to an accident with fatal or serious injury outcome.

Balanced decicion tree 1:2



- Number of accidents with a minor injuries were taken twice more than other (3164).
- fatal accidents and accidents with a serious injuries joined (class = 2).
- **Accuracy**: 0.67.
- Acceptable accuracy.
- Predicted 2 paths leading to an accident with fatal or serious injury outcome.

Conclusions and Recommendations

- The main cause of the most tragic accidents is drug or alcohol usage leading to violation of pedestrian's right. In this case the recommendations are:
  - conduct/intensify the educational campaign aimed at reducing the number of drunk (drugged) drivers,
  - increase the number of police patrols in order to increase the probability of elimination of drunk drivers before it comes to an accident,
  - conduct/intensify the educational efforts in teaching all potential pedestrians (especially children), that their rights always can by violated and they need to be careful when crossing the intersections.
- Less probable, but also important is the bad light and road conditions factor. In this case the recommendations are:
  - improve the street lightning on the intersections and improve the lighting repair system,
  - improve the snow clearing system in winter.
- In above analysis, 19 intersections where more than 15 accidents happened, were detected. In the case of fatal accidents such coincidence was not detected. In order to reduce the number of accidents on those intersections one can:
  - inform the drivers and pedestrians, that those intersections are especially dangerous and a special care is needed (for example marking it as a "black city spots"),
  - improve the street lightning and repair system on those intersections,
  - improve the snow clearing system in winter.