Automation of risk modelling of wildlife vehicle collisions.

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Joint work with Fabian Transchel

2026 | Wernigerode, Germany

Data Science & Telematics

We cooperate in the field of motor insurance risks with the

E+S Rückversicherung AG.
(German branch of Hannover Re)

Topic Classification

Pay As You Drive

- Evaluation according to mileage

Pay Where You Drive

- Location-based regional class
- Risk exposure
- Usage profiles

Pay How You Drive

- Behavioural profiles
- Manoeuvre recognition

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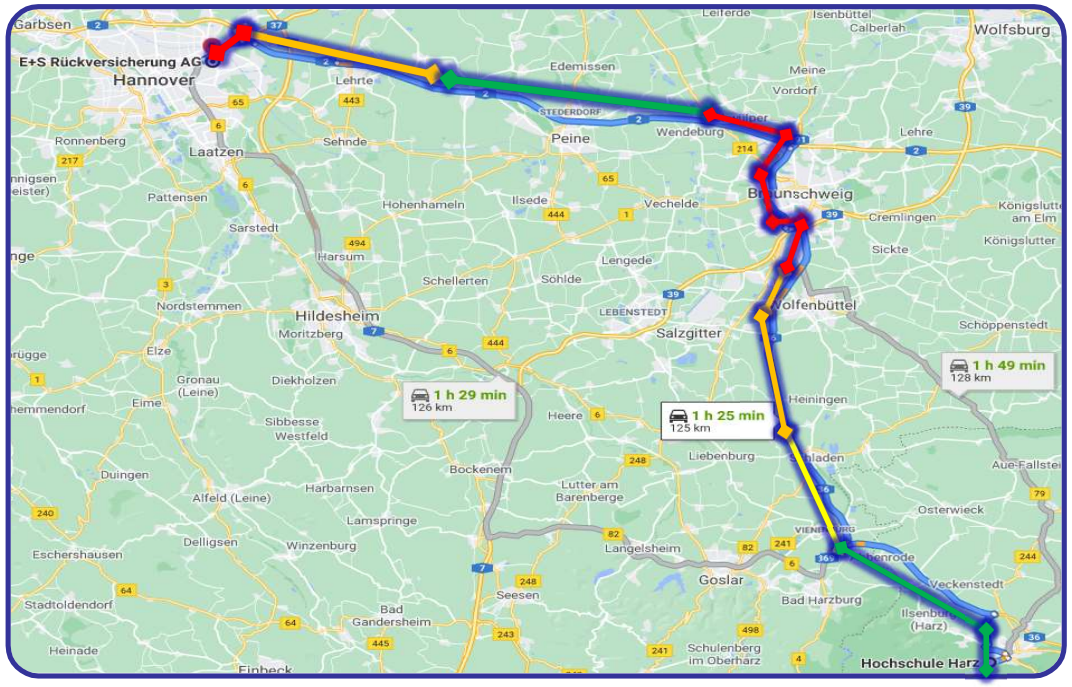
Topic Classification



Source: Google Maps

Substitute models

- Location-based regional class
- Environmental context provides risk exposure
- Driving performance adjusted use profiles
- Wildlife-vehicle collision model as part of a comprehensive risk exposure model.

Why wildlife vehicle collisions?

Designed by vladimircech / Freepik

Why Wildlife-Vehicle Collisions?

Health Hazards

2.322 personal injuries
10 deaths [1, 2]

Wildlife-Vehicle Collisions

295.000 Wildlife-Vehicle Collisions (WVC) [3]

Insurance Damage

885.000.000 €
+17% [4]

Endangered Species

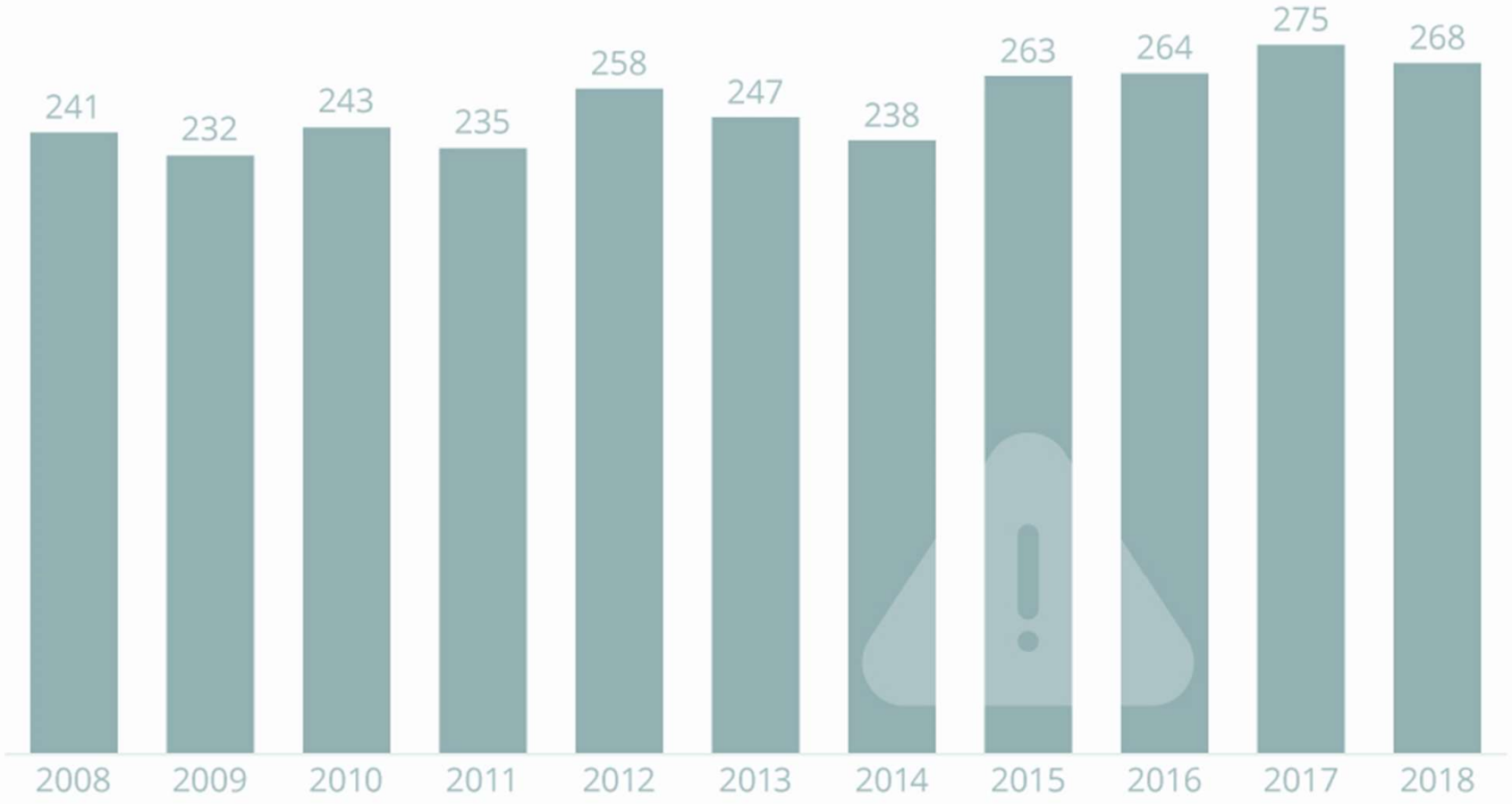
21 endangered species threatened by WVC's in the USA [5]

Wildlife Passage

3.000.000 € per bridge [6] plus fences and maintenance.

Number of wildlife accidents remains high

Number of insured cars Accidents with animals. (in 1,000)

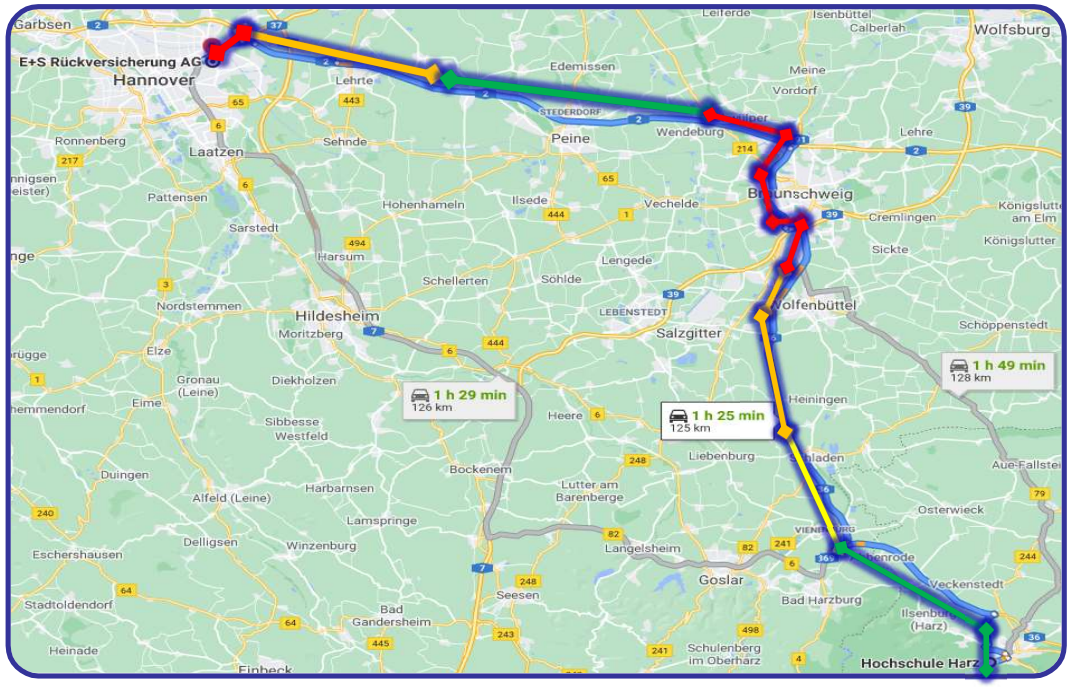


Source: GDV

What do we need for that?

Topic Classification

Risk Factors



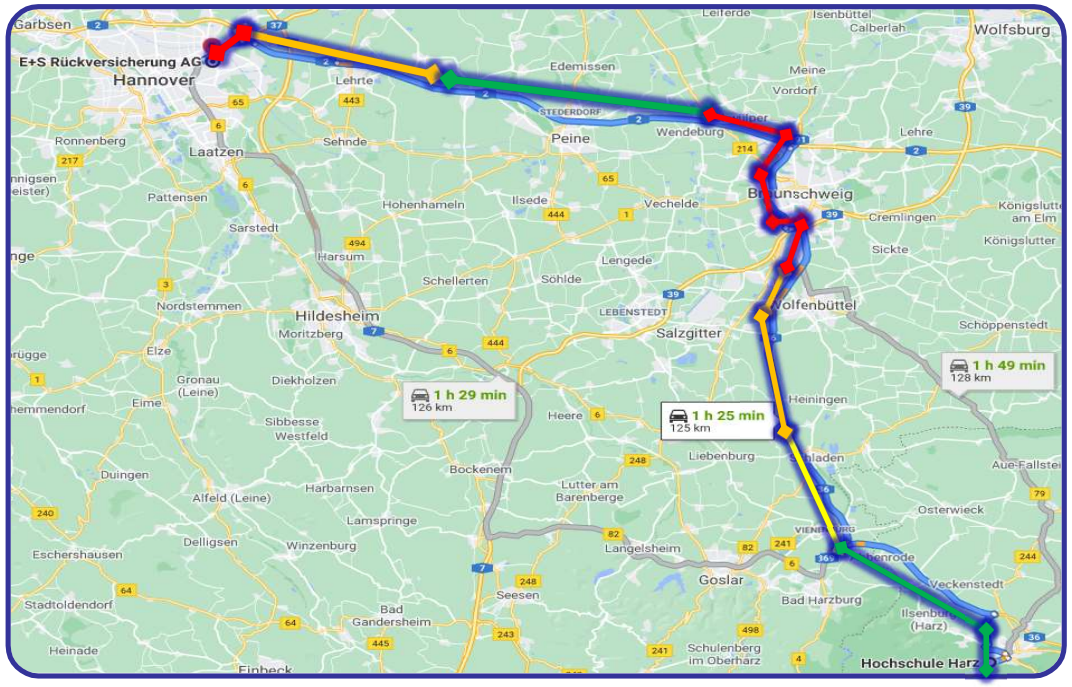
Google Maps

Traffic Density

Designed by macrovector / Freepik

Topic Classification

Risk Factors



Google Maps

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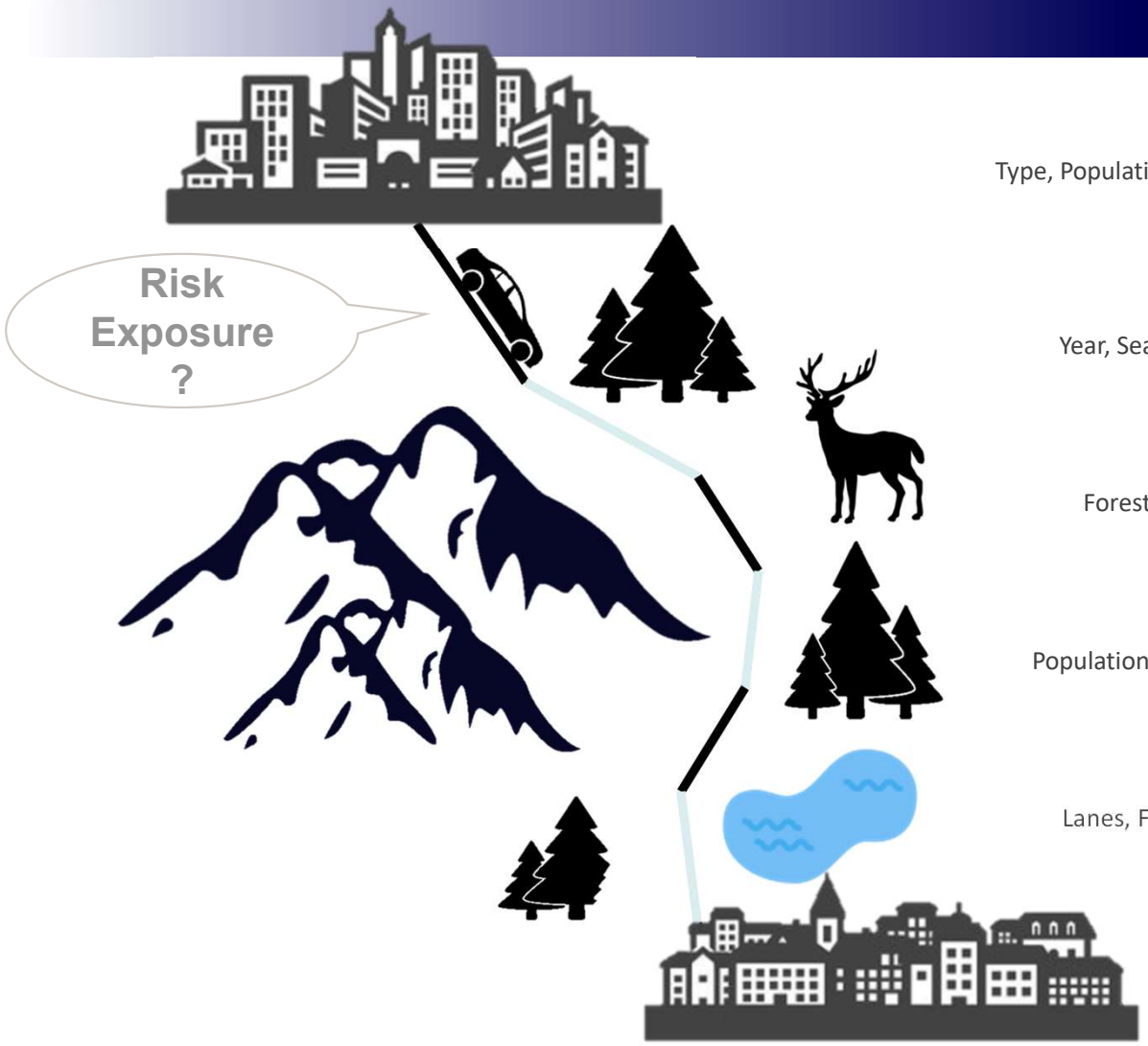
Complex Influences



Type, Population, Size, Habitat, Life Cycle — **Animal**

Year, Season, Time of Day, Holidays — **Time**

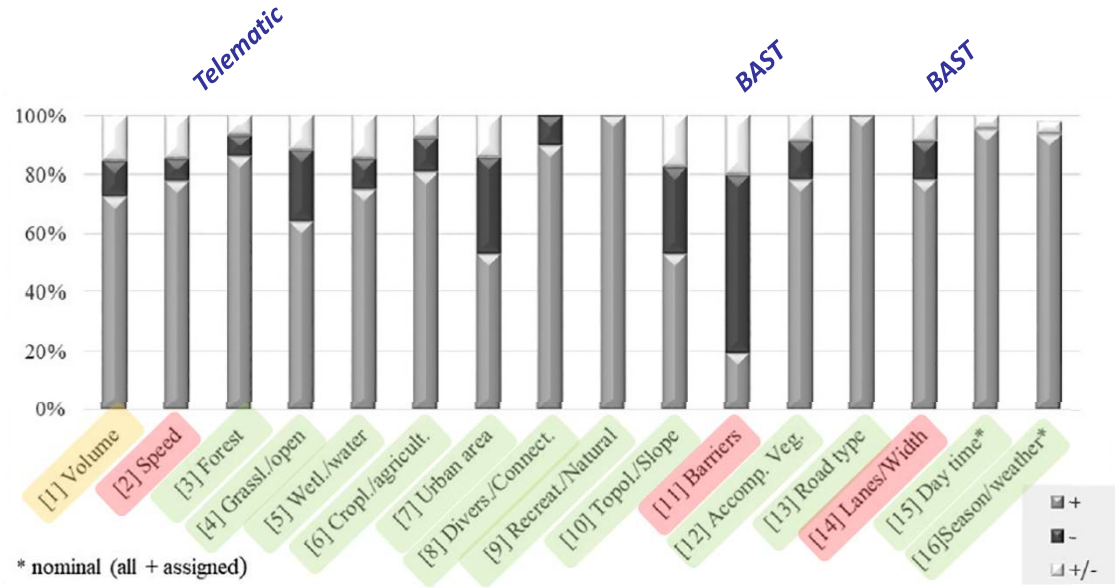
Forests, Fields, Lakes, Mountains — **Topology**

Population Density, Climate, Weather — **Environment**

Lanes, Fences, Bridges, Speed limit — **Infrastructure**

Age, Speed, Occupation — **Driver**

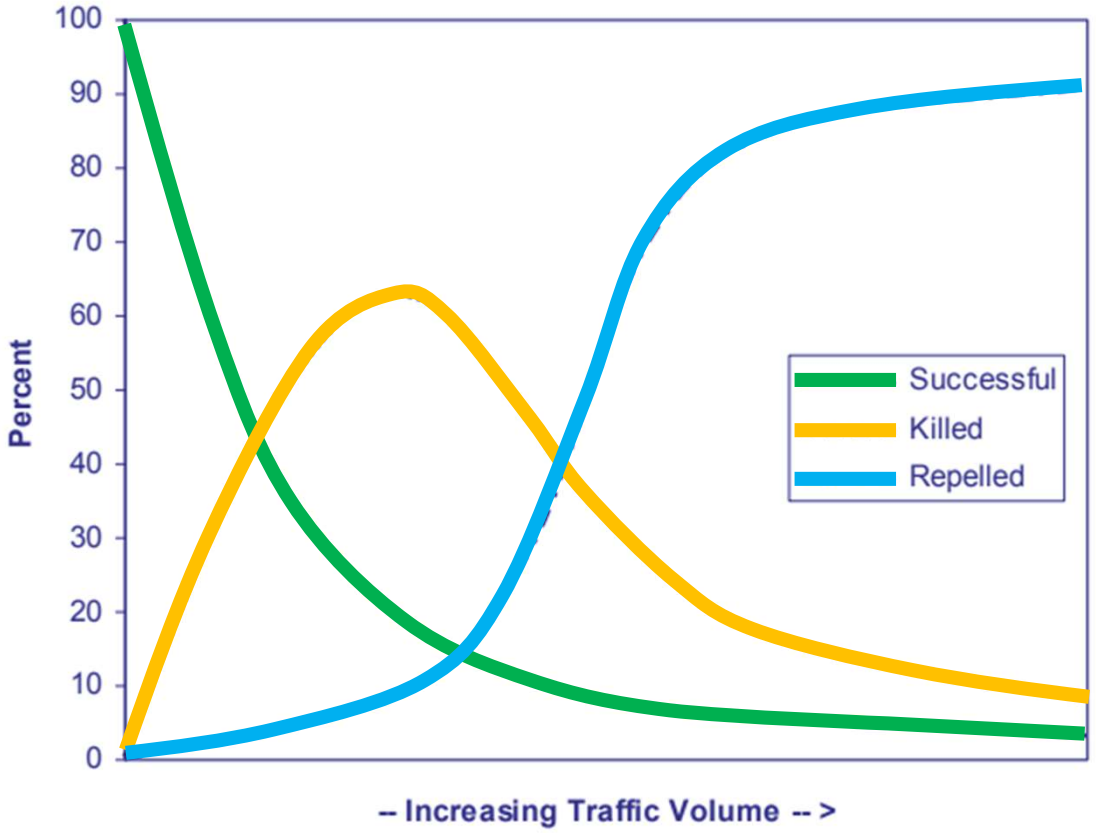
Complex Influence Factors



Source 18: Pagany (2020). Colored overlays added by the author.

Percentage of
(+) reinforcing,
(-) decreasing and
(+/-) inconclusive
effect factors of the reviewed studies on WVCs.

Complex Influence Factors



Theoretical relationship between traffic volume,
successful wildlife crossing and road mortality (Source: Seiler (2003)).

Source 16: Seiler (2003). Colored overlays added by the author.

The Source Data

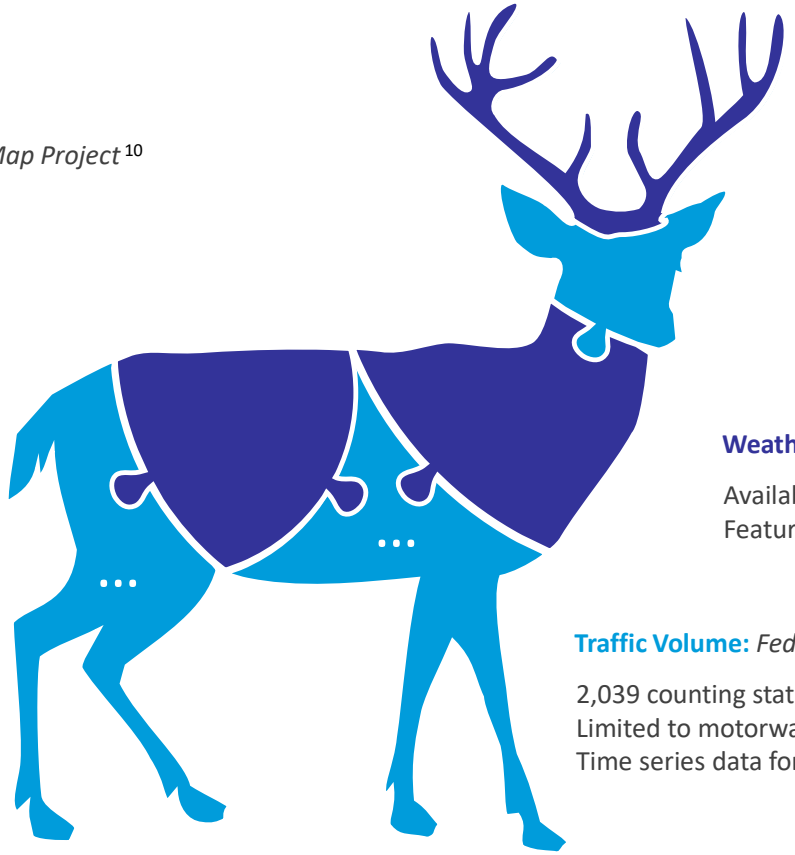
Available Data

National and state borders: *EUROSTAT*[8]

geocoded data of the national and state borders

Land use & roads: *OpenStreetMap Project*[10]

OSM provides:
- Road and land use data
- Freely available
- Maintained by volunteers



WVC Data & Time: *state police*

Data of 6 federal states with coordinates and time data for at least 5 years

Weather: *German Weather Service (DWD)*[11]

Available for time intervals of 15 minutes
Feature engineering required

Driver: *Telematic*

Proprietary sources only [out of scope]

Traffic Volume: *Federal Highway Research Institute (BASt)*[9]

2,039 counting stations in 2020
Limited to motorways and federal roads
Time series data for traffic from literature (hydrographs)

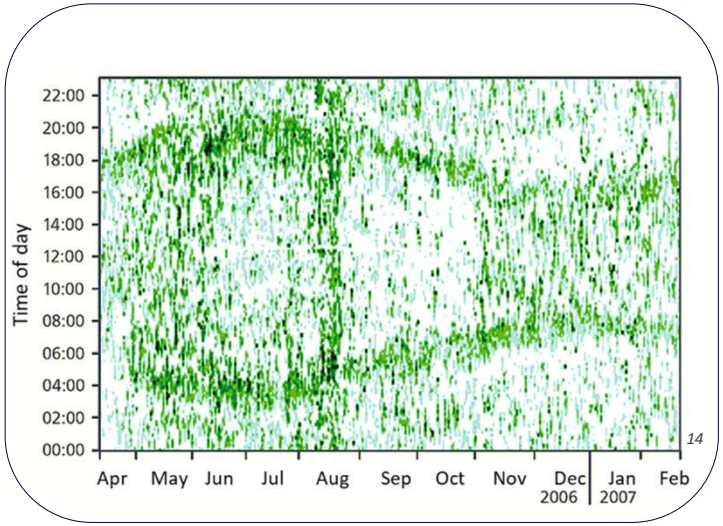
Data Acquisition

State	Status
Hesse	**received**
Mecklenburg-Western Pomerania	**received**
Rhineland-Palatinate	**received**
Saxony-Anhalt	**received**
Schleswig-Holstein	**received**
Thuringia	**received**
Brandenburg	wait for data
Lower Saxony	on-hold
Baden Württemberg	rejected
Bavaria	rejected
North Rhine-Westphalia	without feedback
Saxony	without feedback
Berlin	not requested
Bremen	not requested
Hamburg	not requested
Saarland	not requested

Data Insights

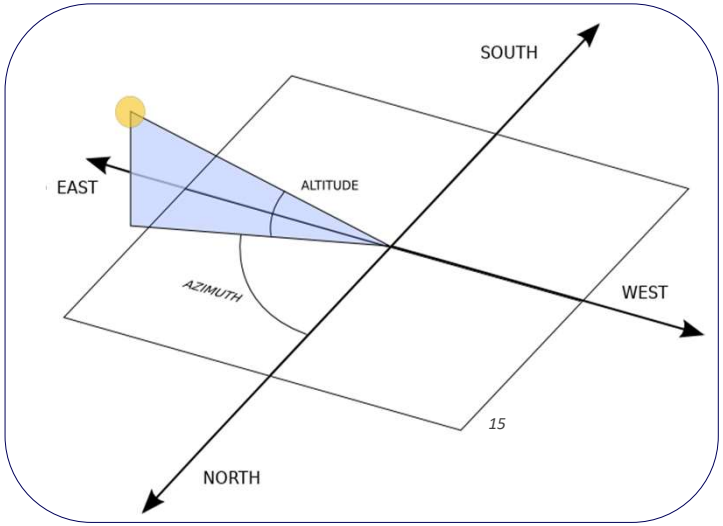
Temporal Influence Factor Examples

Daily activity of the deer



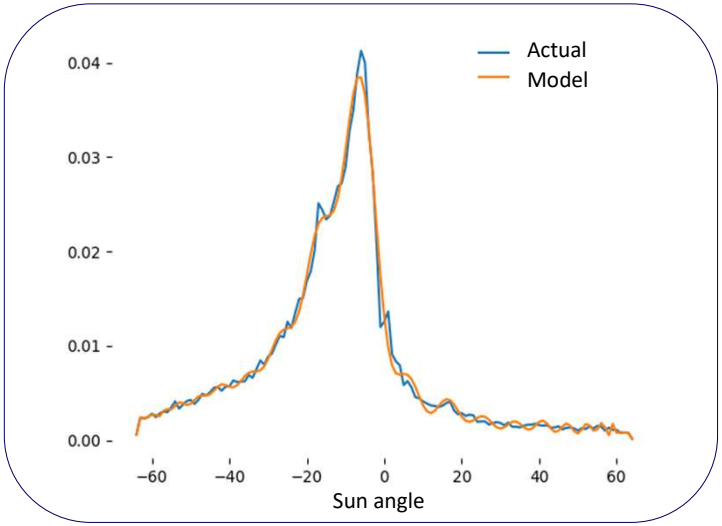
Source 14: Krop-Benesch, A., et al. (2013).

Inclination of the sun

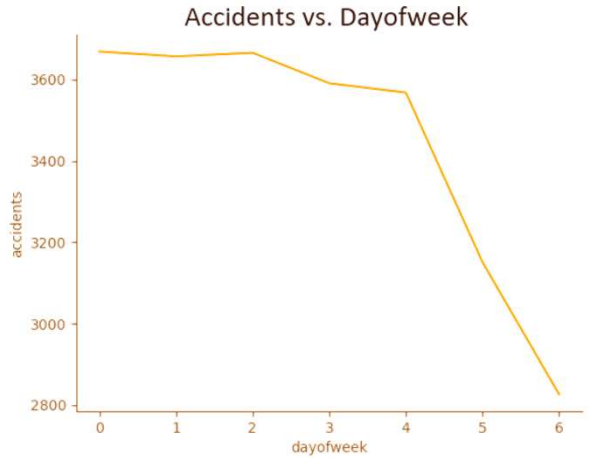


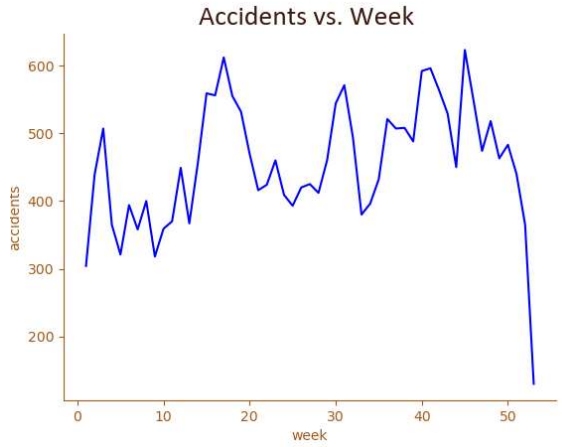
Source 15: Stafford, B. (2014).

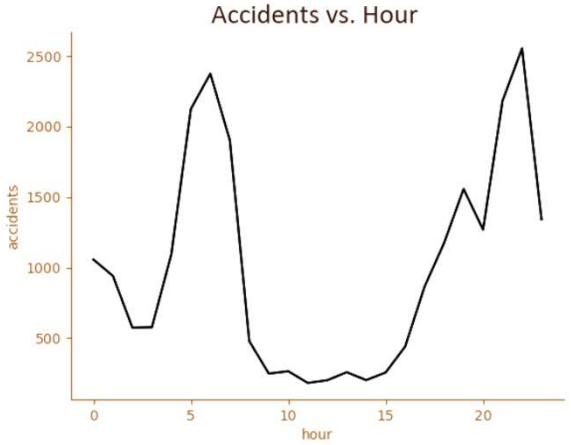
Accidents (normalised) per sun angle

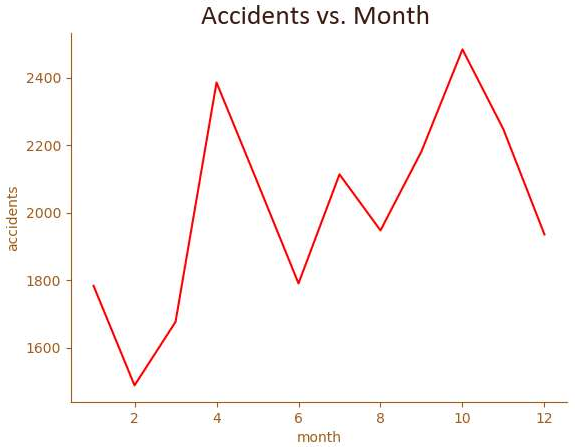


Temporal Influence Factors



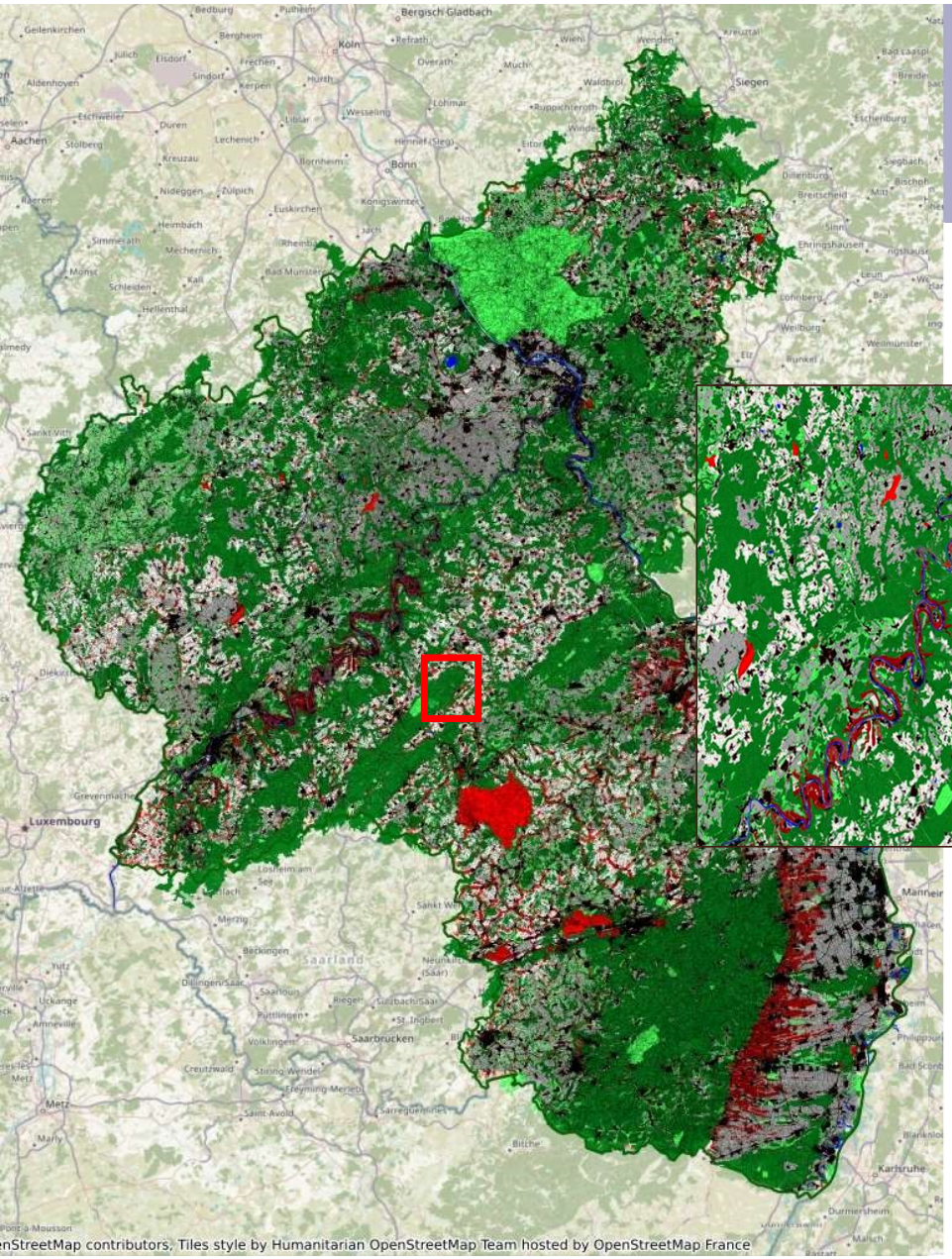


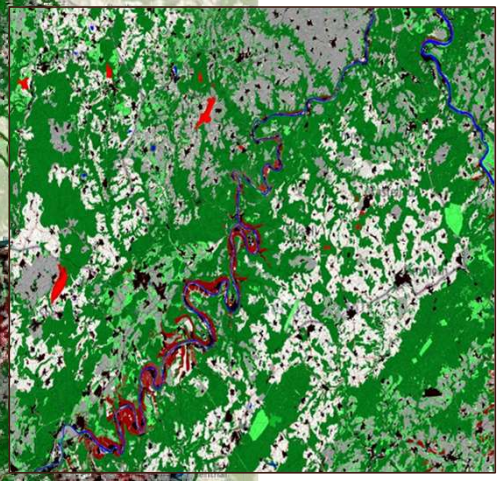


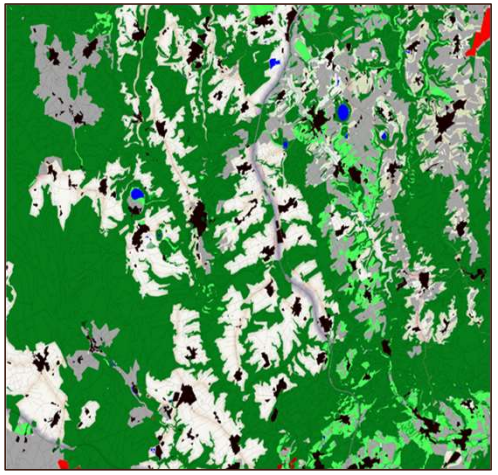


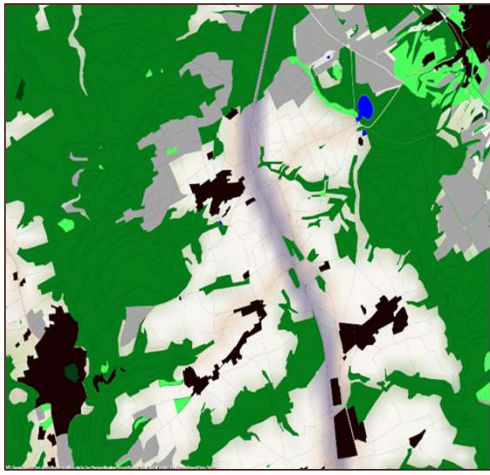
Wildlife Vehicle Collisions in Rheinland-Pfalz 2019/2020 – Source: MINISTERIUM DES INNERN UND FÜR SPORT RHEINLAND-PFALZ

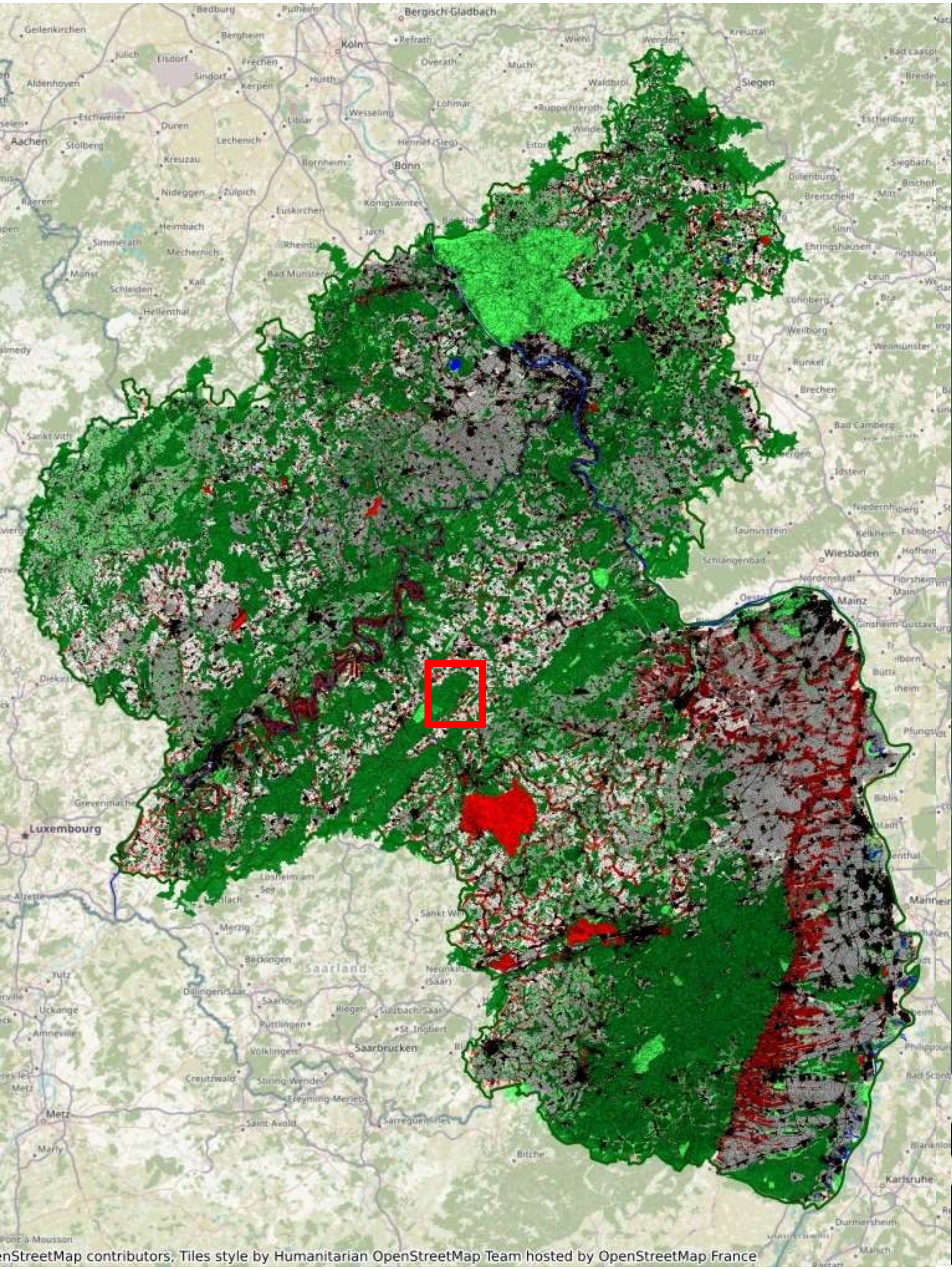
Insurance
Data Science Conference

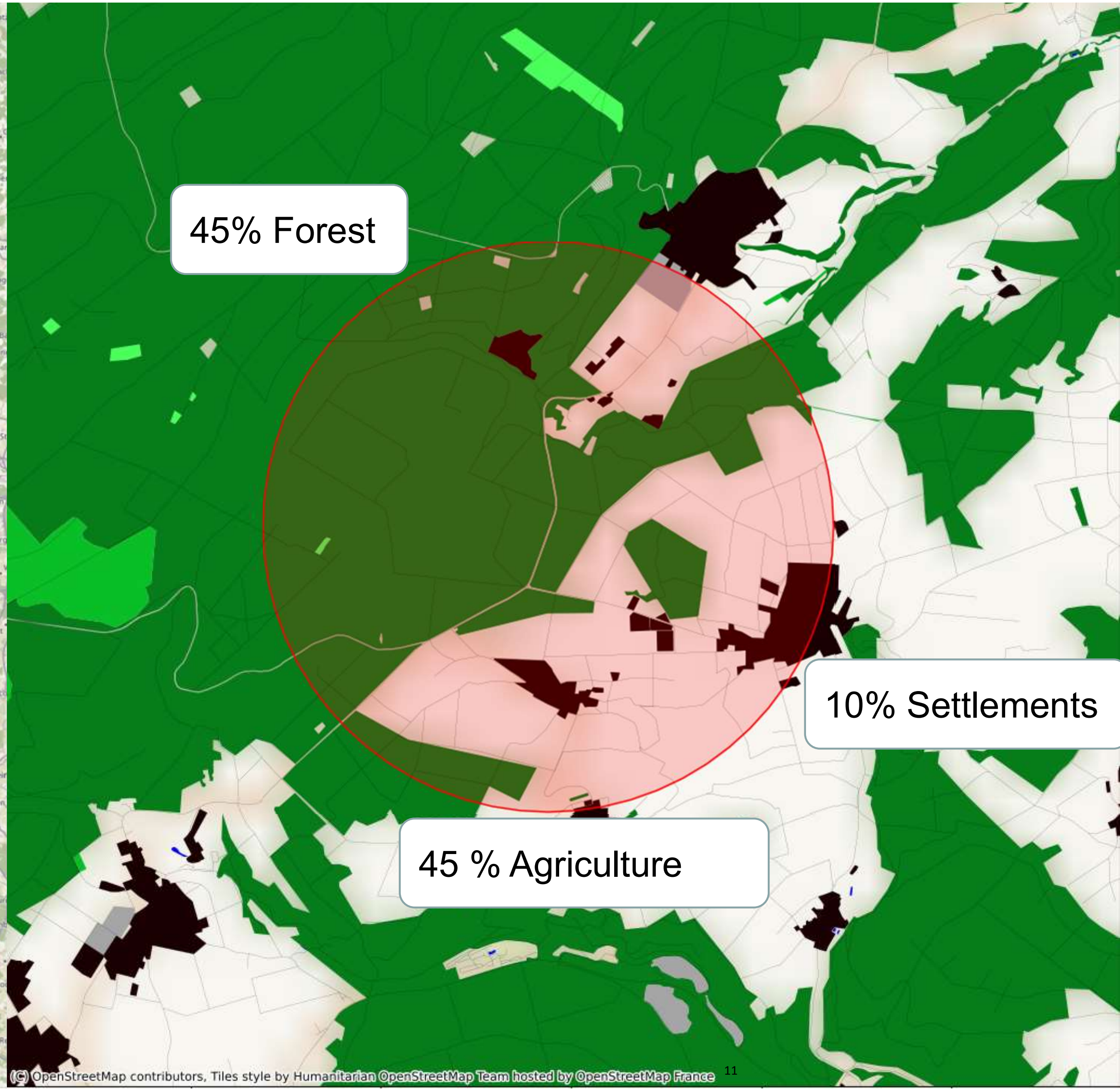




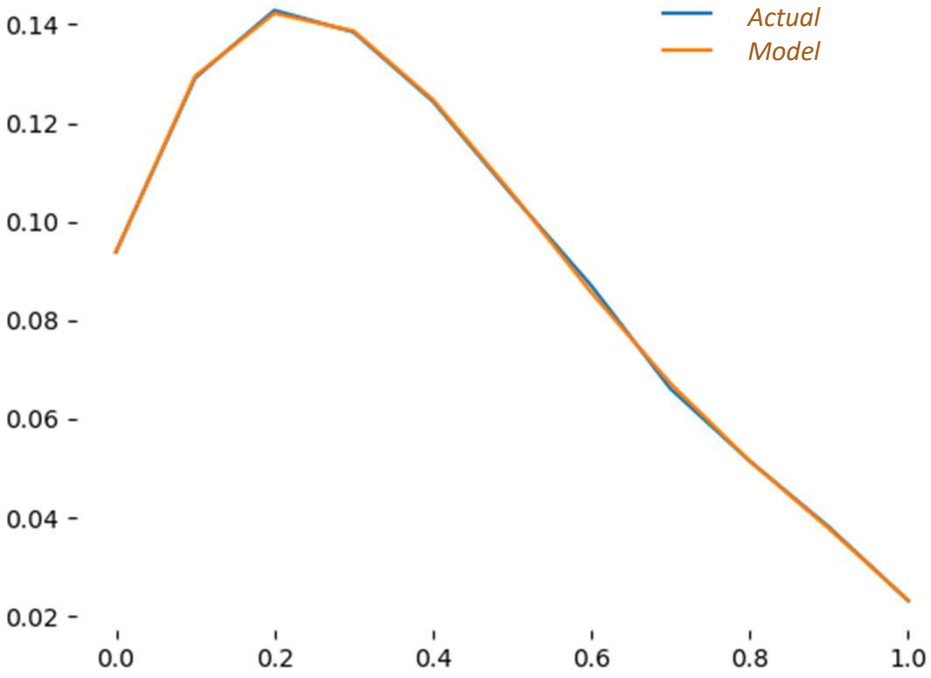


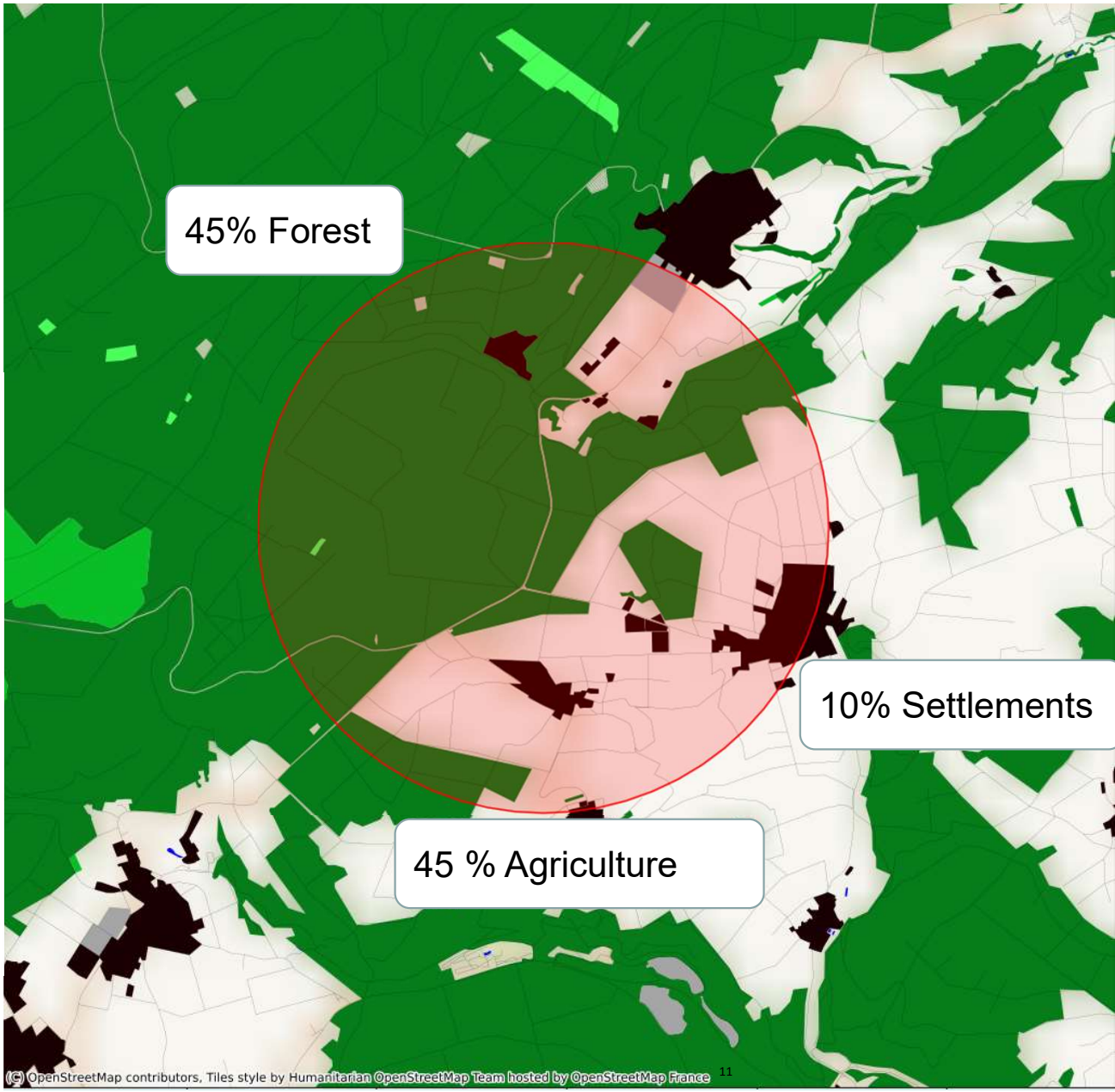


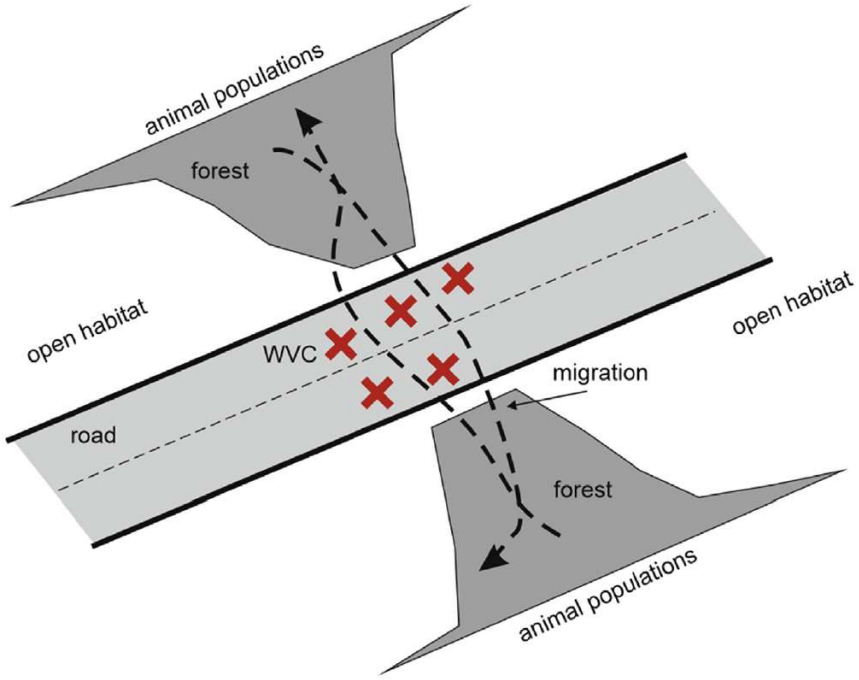

enStreetMap contributors, Tiles style by Humanitarian OpenStreetMap Team hosted by OpenStreetMap France


45% Forest
10% Settlements
45 % Agriculture
(C) OpenStreetMap contributors, Tiles style by Humanitarian OpenStreetMap Team hosted by OpenStreetMap France

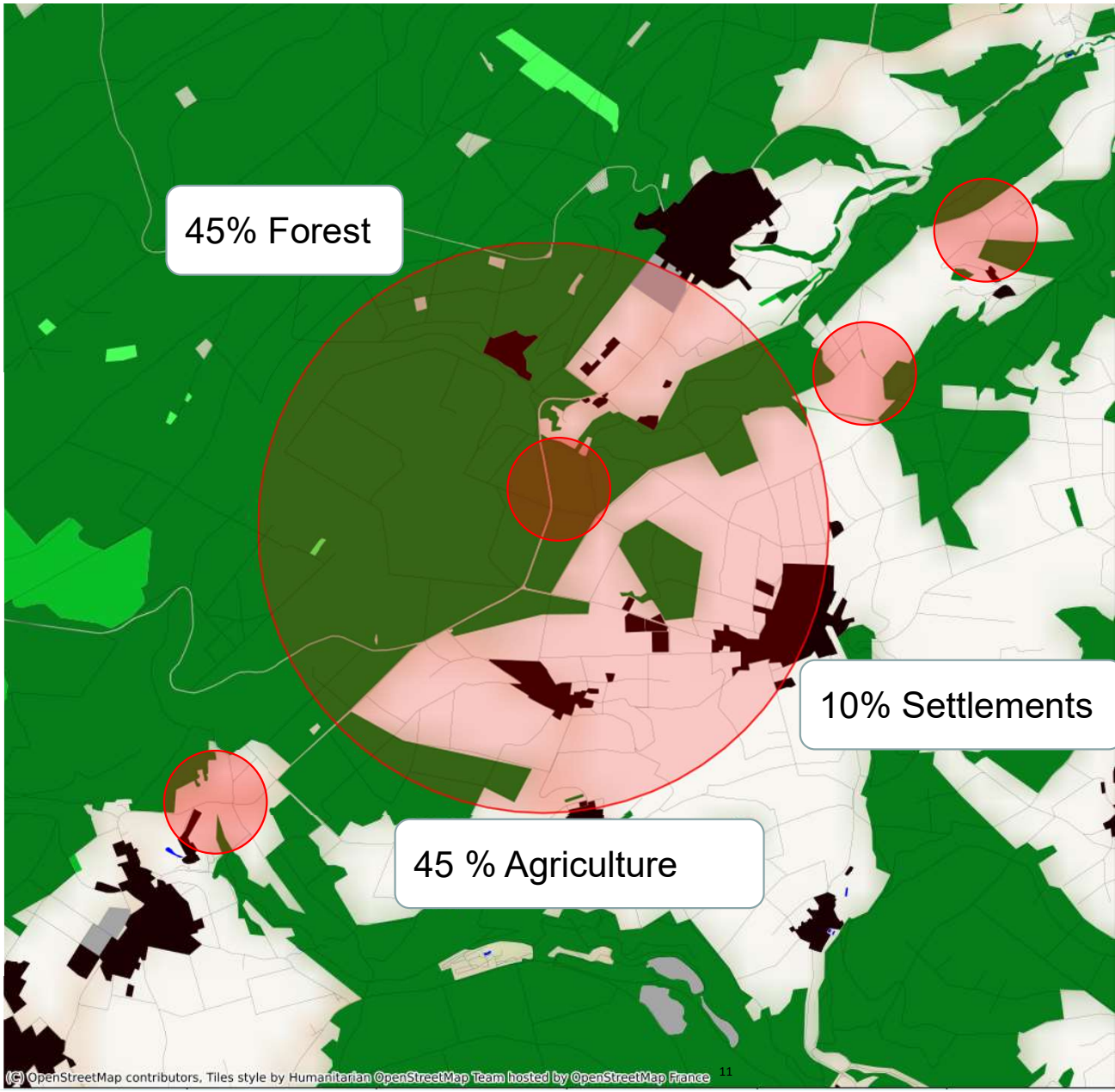
Accidents per forest density (normalized)







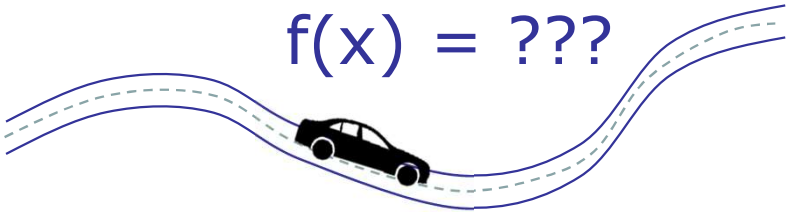
Source 17: Bil, M., et al. (2019).

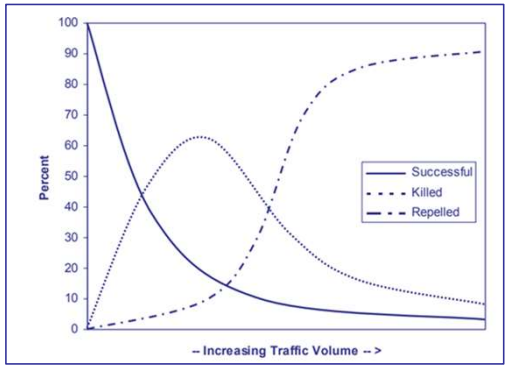


The Hypothesis

Baseline Approach

f(x) = ???





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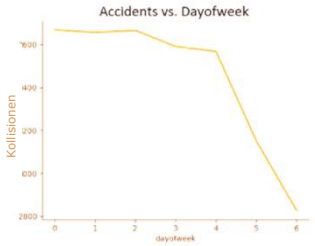

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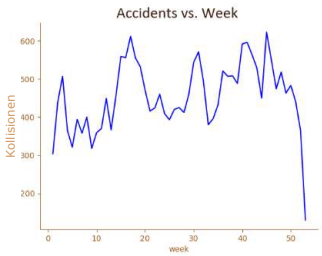

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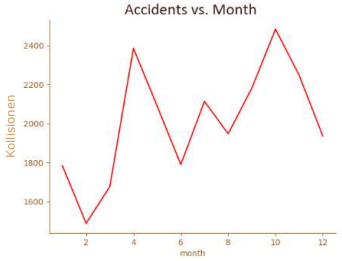

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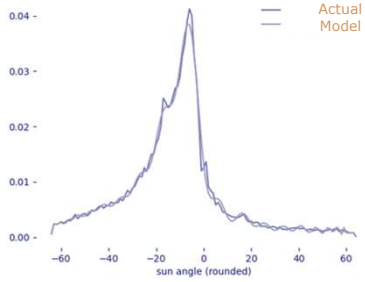


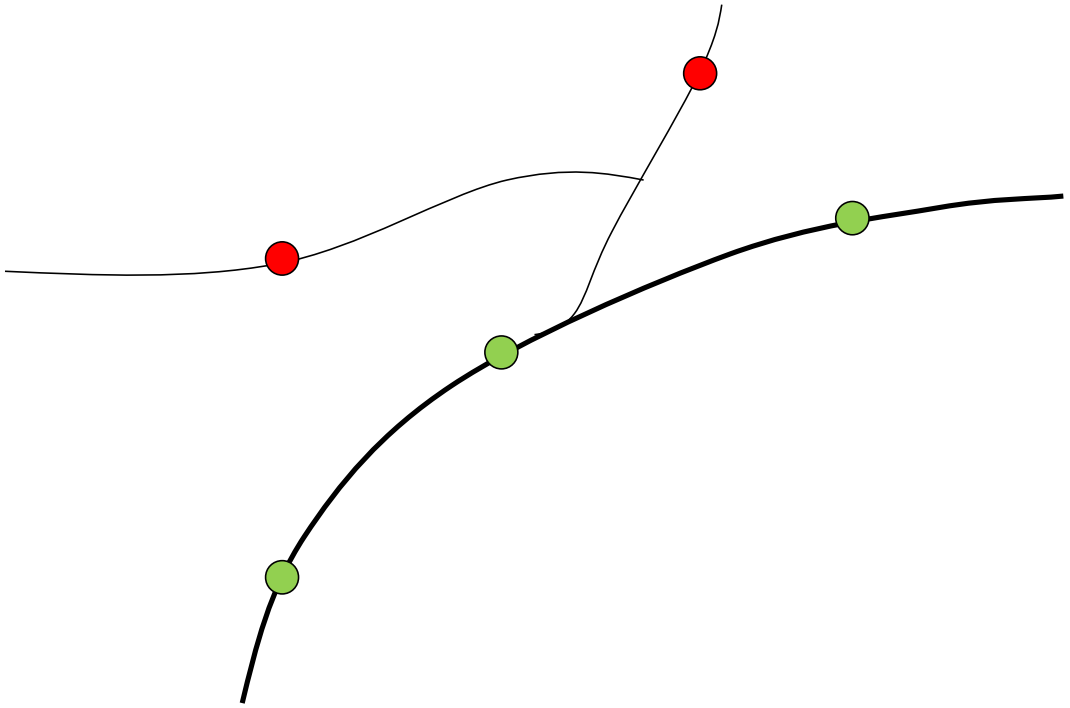
Future Research

Future Research

Traffic Density

Designed by macrovector / Freepik

Traffic Counting Stations



Future Research

Telematics-supported dynamic hot-spot warnings

Image Source: https://commons.wikimedia.org/wiki/File:Australia_animal_warning_sign.jpg

5-10% of the drivers stopped 200 metres after a warning sign
were able to remember it.

Source 19: Drory, A., et al. (1982)

Topic Classification

Driving Simulator

Pay How You Drive

- Behavioural profiles
- Manoeuvre recognition

Thank you!

Andreas Hofmann

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Joint work with Fabian Transchel

2026 | Wernigerode, Germany

Sources

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