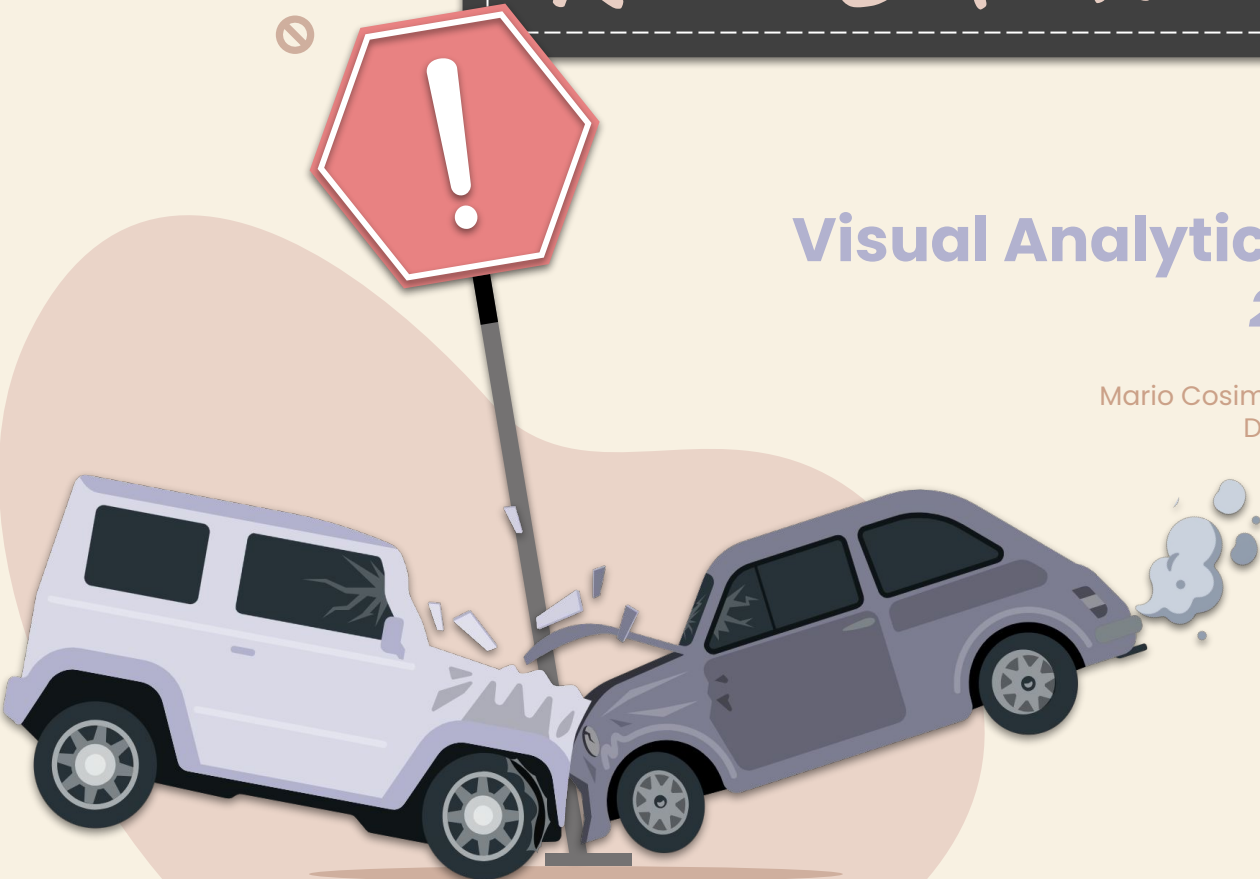


Rome Safe Roads

Visual Analytics project 2023-2024

Mario Cosimo Angelini [2029254]
Daniela Rieti [1762973]





Topic

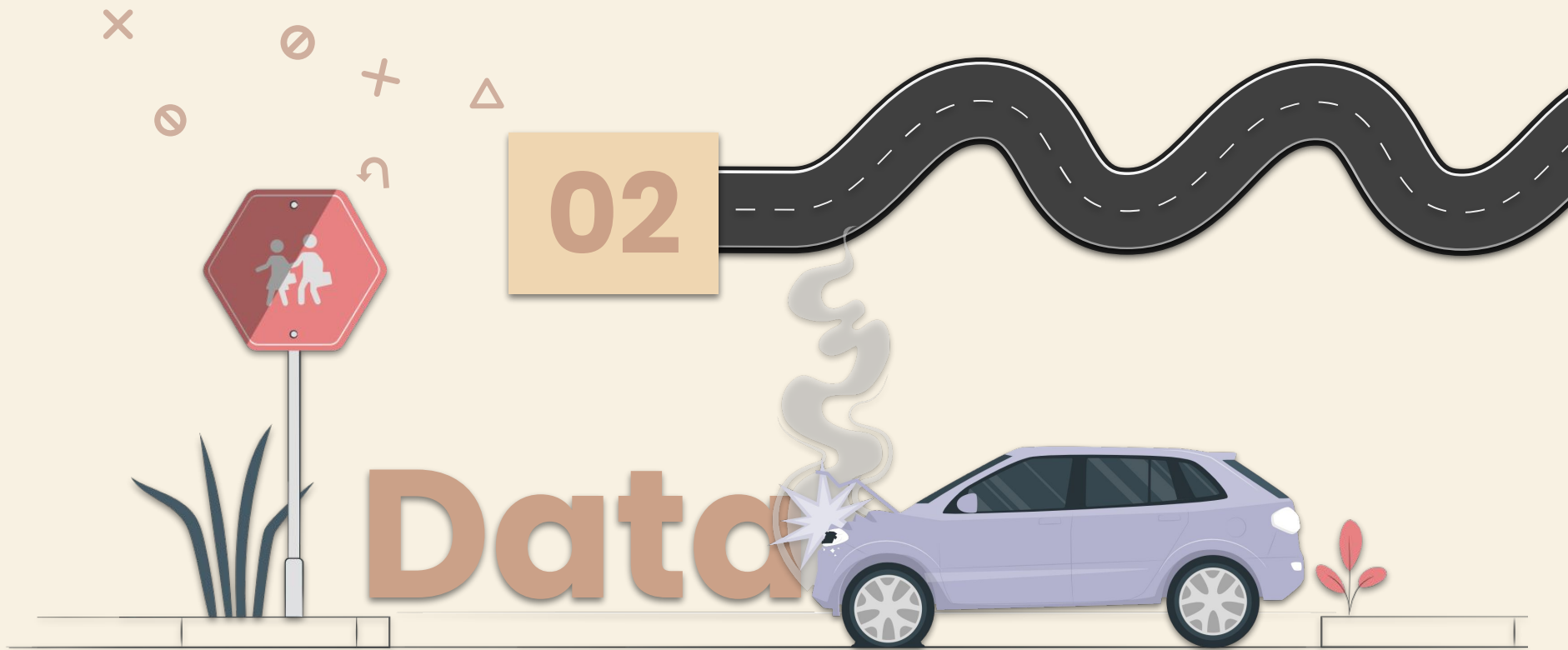
Rome Safe Roads

Road accidents are a significant contributor to global mortality and injuries.

In a bustling metropolis like Rome, an average of 79 accidents occur daily, resulting in 0.3 fatalities and 100 injuries.

The study and analysis of traffic accidents can provide valuable insights for Rome Municipality into the underlying causes, consequences, and risk factors associated with these incidents, ultimately aiding the development of effective road safety strategies.





Data sources 1/2



The data was collected from the official website of the Municipality of Rome ([Road accident dataset](#)).

The website contains data available in several formats (*xml*, *json*, *csv*) and grouped by month. For the conducted analyses only *.csv* files have been considered.

Some main fields in the chosen dataset are the following:

- *Protocollo*
- *DataOralIncidente*
- *NaturalIncidente*
- *particolaritastrade*
- *TipoStrada*
- *FondoStradale*
- *Pavimentazione*
- *Segnaletica*
- *CondizioneAtmosferica*
- *Traffico*
- *Visibilita*
- *Illuminazione*
- *NUM_FERITI*
- *NUM_RISERVATA*
- *NUM_MORTI*
- *NUM_ILLESI*
- *Longitude*
- *Latitude*
- *StatoVeicolo*
- *TipoVeicolo*
- *TipoPersona*
- *Sesso*
- *Tipolesione*
- *Deceduto*
- *DecedutoDopo*
- *CinturaCascoUtilizzato*
- *Airbag*

Data sources 2/2



The entire data source used for the system has the following dimensions for each year:

- 2019 contains 79.283 tuples
- 2020 contains 54.222 tuples
- 2021 contains 73.100 tuples
- 2022 contains 47.060 tuples

Therefore, the total number of tuples given by summing all the four years is 253.665 while 37 are the attributes.

The **AS** (*AngeliniSantucci*) **Index** of the dataset defined as:

$$AS = \#tuples \times \#dimensions \quad \rightsquigarrow \quad AS = 253.665 \times 37 = 9.385.605$$

Data pre-processing



DATE

Data organizing
in time unit and
accident
counting



ACCIDENT NATURE

Data filtering and
grouping by different
natures



DISTRICT

Fatal accident
counting and
grouping by
district



PCA

Variables
choice for
clustering
fatal/non-fatal
accidents in
two dimensions





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03



Visualizations

VERTICAL BAR CHART

It visually represents the number of different accident natures on roadways

CHOROPLETH MAP

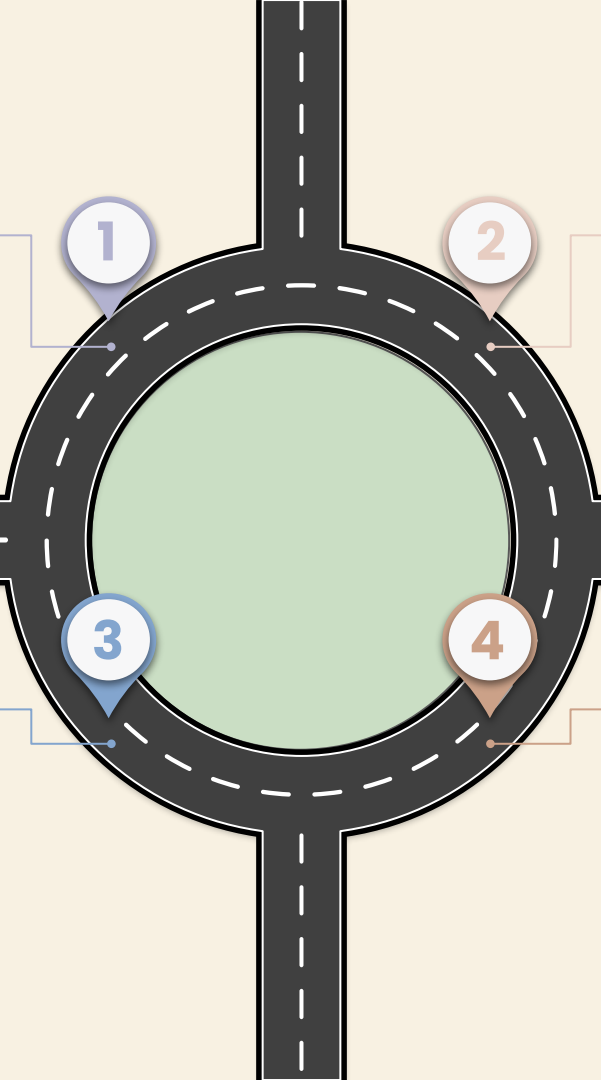
It allows to show road safety dynamics in the city of Rome

TIME SERIES

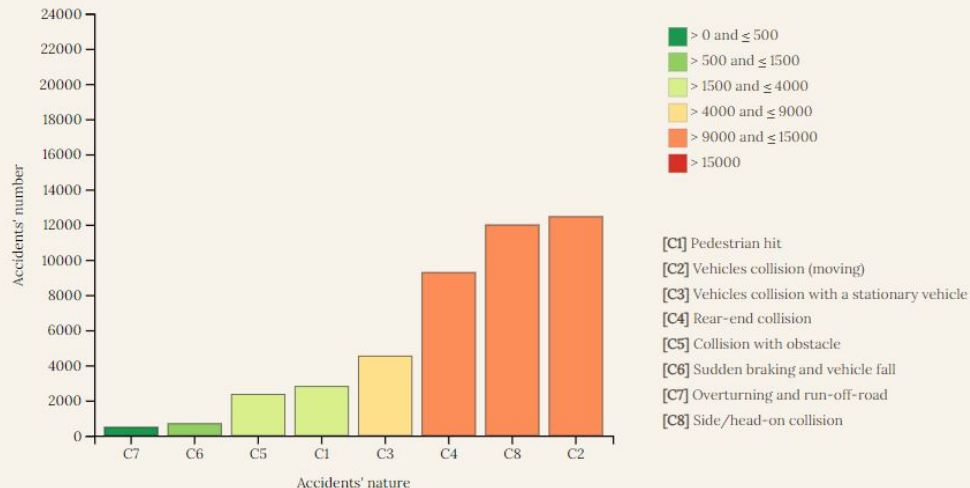
It displays the yearly trends of all road accidents within the capital

SCATTER PLOT

It plots the result of the dimensionality reduction using the technique of Principal Component Analysis (PCA)



Vertical Bar Chart



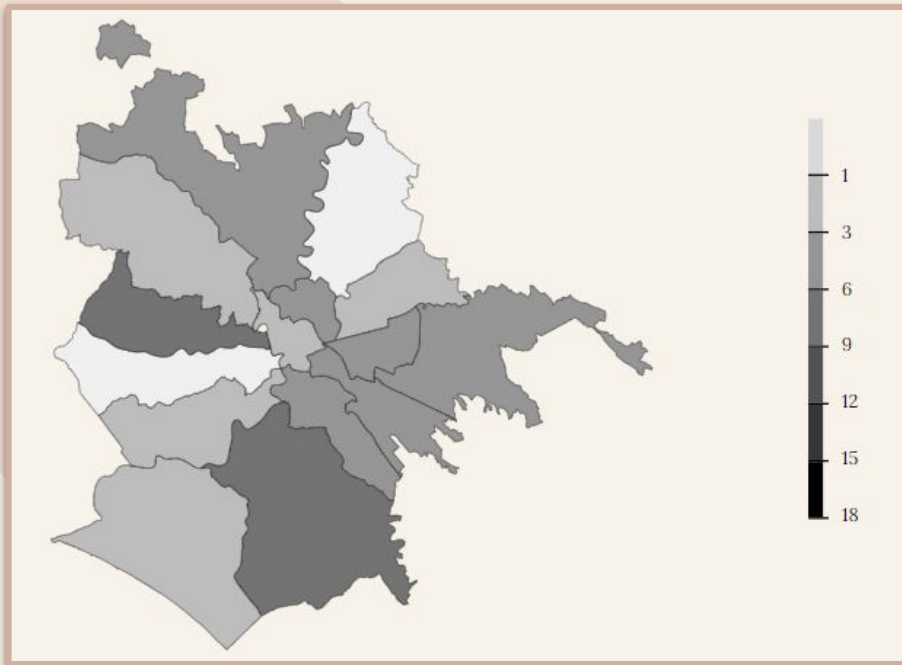
Visualization

By organizing accident natures along the x-axis and quantifying them on the y-axis, the chart provides an overview of the number of the occurred accidents for each nature.

Insights

- Weather conditions influence
- Critical accidents nature

Choropleth Map



Visualization

The chart consists of a map subdivided into 15 districts, each characterized by an associated color representing the number of fatal accidents that occurred within its geographic boundaries.

Insights

- Safer Districts
- Critical fatal accidents nature
- Star-shaped of accidents concentration

Time Series

Visualization



Visualization

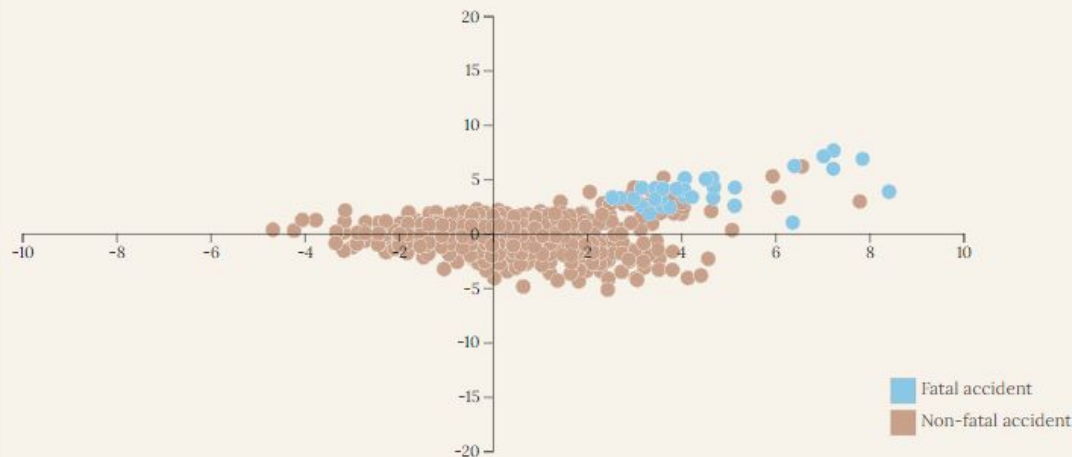
The chart offers a temporal perspective. The time is represented on the x-axis while the y-axis quantifies the number of accidents, visualizing the continuous evolution of accidents throughout the year.

Insights

- Peaks comparison
- Curve dip in summer season
- Impact of Lockdown on Road Accidents in 2020



Scatter Plot



Visualization

The chart plots the result of the dimensionality reduction using the technique of Principal Component Analysis (PCA). The points are represented based on two dimensions. In this way it is possible to see which accidents are similar and which are outliers.

Insights

- Cluster patterns in fatal accidents
- Non-Fatal accidents distribution

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04



Analytics

Dimensionality reduction

Principal Component Analysis

The analytical process is focused on applying Principal Component Analysis (PCA) as a technique for dimensionality reduction.

In Rome Safe Roads system, steps are the following:
Steps needed are the following:

- Dataset preprocessing including the handling of missing data, feature normalization and outlier management
- Data standardization
- Selection of two principal components to compute PCA. The key variables identification is based on observed variance

The resulting visualization provides a perspective on the correlation between different factors such as traffic intensity, fatalities, injuries and more.





Intended user

The Rome Safe Roads system can be used as an asset for the dedicated members of the Polizia Locale di Roma. It offers a comprehensive tool for enhancing the operational efficiency and decision-making capabilities.

The system can be considered a force source, enabling to strategically allocate resources where they are needed most.

By identifying critical areas and accident natures, the Polizia Locale di Roma can optimize their own utility and interventions, ensuring a customized and effective approach to enhancing road safety.



Application cases



Preventive season traffic management

Polizia Locale di Roma and traffic authorities enhance road safety through Rome Safe Roads data analysis, signal improvements, and awareness campaigns.

1

Safety initiative impact assessment

Polizia Locale di Roma deploys June safety plan using Rome Safe Roads data to monitor and adapt strategies based on accident trends analysis.

2

Future Improvements

Future perspectives

Traffic city management

Urban planning and integration with transport agencies allows faster interventions in specific situations

IoT Integration

Responsive Traffic Management with Advanced Sensors

Collaborative research

Partnering with authorities for a more accurate dataset.

References 1/2

Dataset

[1] Comune di Roma. Traffico stradale di Roma. Open Data del Comune di Roma.(2022). <https://dati.comune.roma.it/catalog/dataset/d108>

Tools

- [2] Cynthia Brewer, Mark Harrower and The Pennsylvania State University, ColorBrewer (Version 2.0) [Source Code]. <https://colorbrewer2.org>
- [3] Openpolis. (2023). Geojson-italy. <https://github.com/openpolis/geojson-italy>
- [4] Pedregosa, F., Varoquaux, G., Gramfort, A., Michel, V., Thirion, B., Grisel, O., ... & Vanderplas, J. (2011), Scikit-learn (Version 1.3.2)[Source Code]. <https://github.com/scikit-learn/scikit-learn>
- [5] Michael Bostock, D3.js (Version 4.13.0) [Source Code]. <https://d3js.org/>
- [6] Wes McKinney, Pandas (Version 0.25.3) [Source Code]. <https://pandas.pydata.org/>

Related works

- [7] Antonio Comi, Antonio Polimeni, Chiara Balsamo, Department of Enterprise Engineering, University of Rome Tor Vergata, 00118 Rome, Italy, Road Accident Analysis with Data Mining Approach: evidence from Rome from 24th Euro Working Group on Transportation Meeting (2022), edited by Margarida Coelho, volume 62, pages 798-805. [Online] Available: https://www.sciencedirect.com/science/article/pii/S2352146522002265?ref=pdf_download&fr=RR-2&rr=83f4d021eb03bb0b
- [8] Giuliano Muratore, Aldo Vannelli, Davide Micheli, CNIT Bologna Italy, Telecom Italia, Rome, Italy, Rome vehicle accidents analysis and city riskiness prediction by Artificial Intelligence in Transportation Engineering, volume 12 (2023). [Online] Available: <https://www.sciencedirect.com/science/article/pii/S2666691X2300012X>

References 2/2

The entire work is published on the GitHub page



Tap here

- Discover the **live version** of the project through the following link:
<https://2029254.github.io/RomeSafeRoads/>
- A detailed **scientific paper** have been realized to provide a complete project documentation: <https://github.com/2029254/RomeSafeRoads/blob/main/docs/ScientificPaper.pdf>

Innovation begins with collaboration.
Share your thoughts!



**THE
END**



Thank you for the attention!

Let's go to the demo!