
An Interactive Map-based dashboard for Urban Traffic Collision Analysis

Group 2

This project is about creating an interactive map-based dashboard that helps users explore and understand urban traffic accident data across events, commute routes, neighborhoods, and school zone levels.

Problem & Motivation

What's the problem?

- Traffic safety dashboards isolate spatial scales and fail to link citywide, neighborhood, and street-level risks.

Why do we need to fix it?

- Important contextual variables(severity, premises) are not visualized together, leading to incomplete understanding.

What motivates our system?

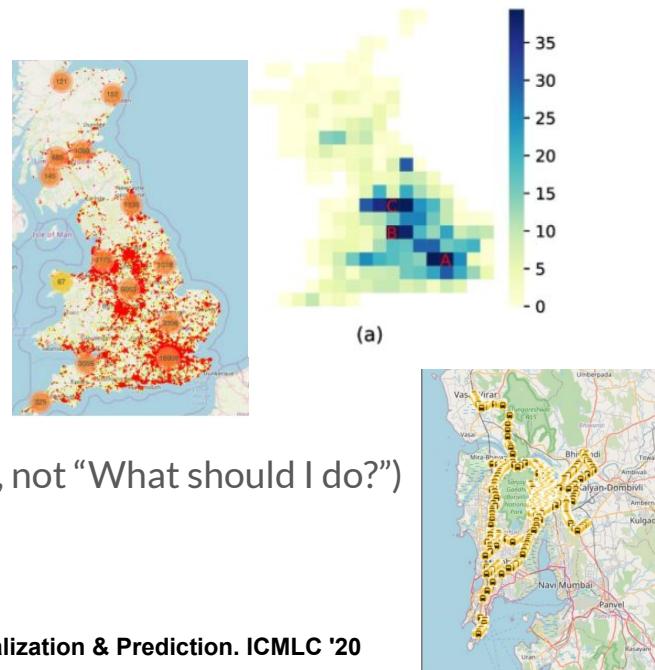
- Multi-scale views reveal complementary safety insights.
- Combining collision data with contextual factors helps explain not just *where*, but *why* collisions happen.
- A coordinated system enables more informed safety decisions, especially in sensitive areas like school zones.

Prior Work

- Clustered Hotspots displayed on interactive map [1, 4 Feng]
- Transport Network with various waypoints [2 Madhuri]
- Spatial Heatmap with grid-based intensity encoding [3 Kun]

Challenges:

- Limited decision-support (most answer “What happened?”, not “What should I do?”)
- No detailed sublevel information.



[1] Feng et all. Towards Big Data Analytics and Mining for UK Traffic Accident Analysis, Visualization & Prediction. ICMLC '20

[2] Madhuri et all. Analysis and Visualization of Public Transport for Integrated monitoring dashboard : Case Study of Thane, Maharashtra, India. 2022

[3] Kun et all. Analysis and visualization of accidents severity based on LightGBM-TPE. Chaos, Solitons & Fractals 157, 111987 (2022).

[4] Feng et all. Big data analytics and mining for effective visualization and trends forecasting of crime data. IEEE Access 7, 106111–106123 (2019).

Our Contributions

Coordinated Multi-Granularity Framework

- We introduce a multi-level, network-aware framework—citywide dot/hex maps, neighborhood polygons, and school-zone street segments—that supports smooth transitions across spatial scales.
- This design reveals risks along curves, intersections, and complex road structures that planar point or heat maps cannot capture.

Integrated Multi-Source Safety Context

- Collision data are integrated with demographics, severity, premises, time-of-day, and roadway features to explain *why* risks emerge, not just *where*.
- Victim age and sex enable population-aware risk profiles and highlight land-use signals such as school-related youth activity or proximity to senior facilities.

School-Zone Risk Module for Actionable Insight

- A dedicated module provides segment-level safety ratings, buffer-based risk views, and yearly trend summaries for school areas.
- Focusing on actual routes children travel enables actionable insights for identifying unsafe access segments and prioritizing interventions.

Method and System

System Approach

Our system adopts a three-module workflow—citywide exploration, community profiling, and school-zone safety—designed to support reasoning across spatial granularities while avoiding visual clutter. Each module focuses on a specific analytical task but shares consistent encodings and filters for smooth transitions.

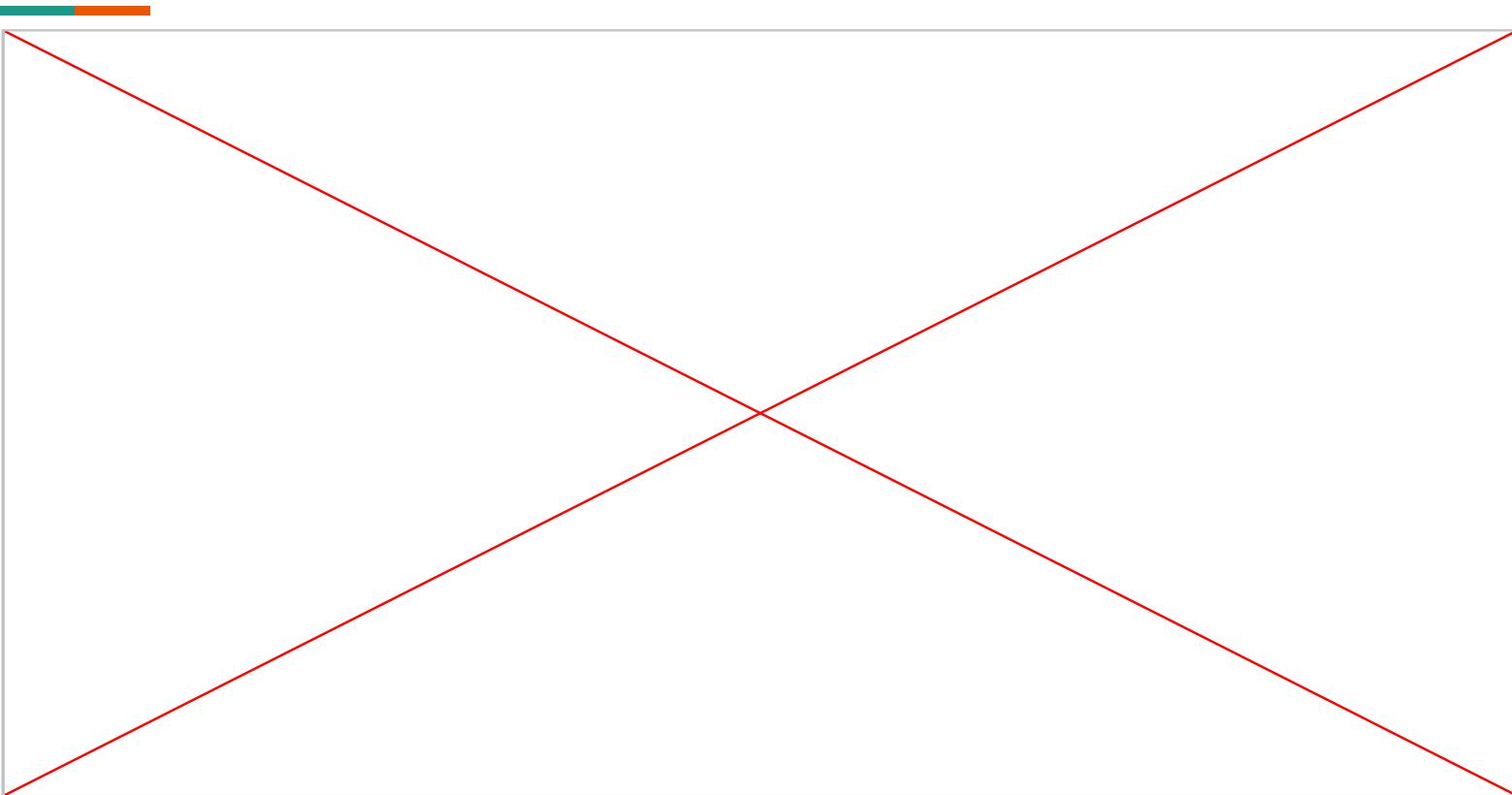
Data & Processing

Collision reports are cleaned, geocoded when necessary, time-normalized, and aggregated to neighborhoods and street segments. This preprocessing enables point-level, area-level, and segment-level metrics that power the coordinated interactions across all modules.

Key Techniques

- 1) **Spatial-Temporal Filtering** – Dot map/Hexagon map ↔ time range bar charts
- 2) **School-Zone Risk Visualization** – Collision Density Around Schools
- 3) **Choropleth + Profiles** – Area risk with demographic context

Results and Evaluation



Conclusion

Conclusion

- Dashboard linking city, neighborhood, and school-zone views
- Supports spatio-temporal insight and school-zone safety assessment

Limitations & Future Work

- Current prototype is based only on historical data
- Future work: expert studies, real-time & predictive data, and safe-route recommendations