Neighborhood Visualization and Analysis: A Guide to Los Angeles for Travelers and Residents

Peter Zhao[1], Minsang Yoo[1], Cindy Jiang[1], and Paul Yoo[1]

University of Southern California, Los Angeles, CA, USA
peterz, minsangy, pkyoo, cindyjia@usc.edu

Abstract. This paper presents an interactive visualization platform that integrates diverse datasets—crime data, hotel ratings, restaurant density, and bike-sharing infrastructure—into a unified system. The platform aims to empower both visitors and residents of Los Angeles with actionable insights into safety, amenities, and accessibility. By employing 3D visualizations and an intuitive interface, the project provides a holistic approach to urban analysis, addressing gaps in existing tools. The results offer a valuable resource for planning trips, evaluating neighborhoods, and navigating the city efficiently, particularly with the upcoming Olympic Games and FIFA World Cup in mind.

1 Introduction

Los Angeles, a city of global cultural and economic importance, will soon host the Olympic Games and FIFA World Cup. While these events will showcase the city on a global stage, they also highlight ongoing challenges in urban safety and accessibility. Los Angeles has long struggled with safety concerns, making it difficult for visitors and residents alike to navigate its neighborhoods confidently. Existing tools like Citizen and Yelp address specific needs but fail to integrate safety data, amenities, and transit options into a single, accessible platform.

This project fills that gap by creating an interactive visualization platform that integrates crime incidents, hotel ratings, restaurant density, and bike-sharing infrastructure. By offering a unified view, users can easily make informed decisions about safe neighborhoods, top-rated accommodations, dining options, and efficient cycling routes. The platform aims to simplify decision-making for both visitors and residents.

The need for such a visualization tool is clear. For those unfamiliar with Los Angeles, navigating its complex urban environment can be daunting. An interactive map-based tool with layered data provides an intuitive way to access insights without switching between multiple platforms. This approach offers a streamlined solution for both visitors and residents.

The target audience for this project includes both visitors and local residents. Visitors gain an all-in-one guide to navigate the city safely and conveniently, while residents can compare amenities, evaluate neighborhoods, and plan safer commutes.

The remainder of this paper is organized as follows. First, we review related work on urban visualization and analytics, highlighting existing tools and their limitations. Next, we describe the datasets used in our project and the preprocessing steps required to integrate them. We then discuss the design and implementation of our platform, focusing on technological choices and visualization techniques. Finally, we present demonstration scenarios to showcase the key features of the platform and conclude with reflections on the challenges, limitations, and potential future improvements.

2 Contribution

This project uses innovative visualization techniques, including 3D crime density mapping with Deck.gl, to provide intuitive safety assessments. Challenges such as inconsistent geospatial references and varying time granularities were resolved through data preprocessing. Additionally, balancing complexity with usability was a key design consideration, ensuring that users could access detailed insights without feeling overwhelmed.

Unlike static 2D crime maps that are often cluttered and difficult to interpret, our interactive 3D visualizations offer clear insights into crime density. By integrating hotel and restaurant data into a cohesive system, users can explore detailed graphs and insights through an interactive, personalized interface, providing a more actionable experience than existing tools.

Our project contributes to urban visualization and analytics by tackling the challenge of visualizing large, multimodal, time- and location-dependent datasets. We developed an interactive dashboard that integrates crime data, hotel ratings, restaurant density, and bike-sharing infrastructure into a unified platform, allowing users to explore Los Angeles neighborhoods comprehensively and make informed decisions. We utilized 3D visualizations, including Deck.gl hexagon layers, to represent crime data, enabling users to compare safety levels across neighborhoods. Heatmaps with marker clustering highlight areas with highly rated restaurants, helping users easily identify top culinary spots and assess safer regions. Additionally, our platform visualizes real bike routes, offering insights into safe and efficient cycling paths and supporting sustainable transportation. This project also highlights how generative AI tools can be effectively applied to design and develop scalable visual displays.

3 Related Work

Several studies have employed spatial analyses to examine urban dynamics in Los Angeles, providing relevant information for our project. Research by Jakar et al. [2] uses GIS-based hot-spot techniques to identify crime clusters around key venues, aligning with our goal of visualizing neighborhood safety during large-scale events. Similarly, Van Patten et al. [5] analyze spatial patterns in sexual homicides to improve crime solvability, demonstrating the value of crime mapping in informing policy and decision-making, which parallels our crime visualization efforts. Beyond crime, Lipsitt et al. [3] integrate spatial data to explore neighborhood-level trends in public health, while studies like Soja's *Urban Restructuring* [4] highlight the use of spatial data in examining land use and socio-economic patterns. While these works focus on single dimensions, our project advances this by integrating diverse datasets—crime, hotel ratings, restaurant density, and bike-sharing infrastructure—into a unified platform.

4 Data

To create a comprehensive visualization platform, we utilized datasets from reliable sources, each addressing key aspects of the project: crime incidents, hotel reviews, restaurants, and bike-sharing.

- **Crime Data:** Sourced from Kaggle and based on LAPD records, this dataset includes crime incidents reported in Los Angeles from January 2020 to June 2023. It provides details on crime type, date, time, and location, making it essential for visualizing neighborhood crime patterns and trends.

- **Hotel Reviews Data:** The hotel dataset, also from Kaggle, contains Booking.com reviews for hotels in Los Angeles. It includes scores for cleanliness, service, location, safety, value, and overall ratings. Composite scores were aggregated by neighborhood or zip code to highlight accommodation quality and pricing trends. This dataset is valuable for allowing users to identify top-rated hotels and assess pricing.

- **Restaurant Data:** Sourced from Yelp, this dataset includes restaurant locations, ratings, and cuisine types in Los Angeles. It visualizes restaurant density and identifies top-rated dining spots, offering insights into the city's culinary landscape for residents and visitors.

- **Bike-Sharing Data:** Data from the Metro Bike Share program provides anonymized trip details, including trip ID, duration, start and end times, and station IDs. This structured dataset reveals bike-sharing patterns, enhancing the platform's focus on sustainable transportation.

Relevance and Reliability of Data Sources: The datasets for this project were carefully chosen for relevance, reliability, and comprehensiveness. Crime data from LAPD reports provides a solid foundation for safety analysis, while hotel and restaurant data from Booking.com and Yelp offer trusted insights into amenities and consumer reviews. After preprocessing and standardizing the data, the resulting visualizations accurately reflect real-world conditions. Integrated into an interactive platform, these datasets enable users to make informed decisions about safety, amenities, and accessibility, enhancing the livability of Los Angeles for both residents and visitors.

5 Design and Implementation

5.1 Technologies

We utilized a range of tools to create a functional and visually appealing platform. Figma was used to design the dashboard layout, ensuring usability and providing a clear visual guideline. Development was powered by Vue.js, chosen for its flexibility and scalability, enabling efficient implementation of interactive components. Visualizations were built with Deck.gl for 3D crime density maps and D3.js for interactive charts and graphs[1]. Data preprocessing was conducted using Python libraries like Pandas and GeoPandas, standardizing datasets for visualization tools. Mapbox was selected as the basemap provider for its customization options and seamless integration with Deck.gl.

5.2 Design Process

The design process began with understanding the needs of the target audience—visitors and residents of Los Angeles—and identifying the datasets that could address these needs. Once the datasets were finalized, we used Figma to create a detailed design mockup of the dashboard. This mockup outlined the overall layout, including the interactive map at the center, side panels for navigation, and areas for detailed graphs and charts.

From a data perspective, we selected the most relevant information from each dataset and formatted it for visualization. For example, crime data was aggregated by neighborhood and categorized by type, while hotel ratings were broken down into individual attributes such as cleanliness and service. Restaurant data was clustered geographically to highlight density, and bike-sharing data was processed to show station locations and popular routes. These choices were made to ensure that the visualizations were both informative and easy to interpret. The design also emphasized interactivity, allowing users to click on specific regions to access additional insights. For example, clicking on a neighborhood in the crime map would display detailed graphs about crime trends, while selecting a zip code in the hotel map would reveal the top-rated hotels and their pricing trends.

5.3 Implementation

The implementation involved dividing tasks among team members to work on crime, hotel, restaurant, and bike-sharing visualizations concurrently. During the data preprocessing stage, we carefully selected appropriate GeoJSON files to ensure geographic accuracy and compatibility with the datasets. GeoJSON files were aligned with CSV data for geographic accuracy, ensuring consistency across visualizations. Supplementary graphs enhanced insights, such as crime trends over time and hotel attribute breakdowns.

All components were integrated into a unified platform, resolving layout issues to ensure clarity. However, during this integration phase, we encountered compatibility issues where certain graphs obstructed the view of the main map. To resolve this, we refined the layout and adjusted the layering system so that all visual elements were displayed clearly and without interference. This process involved modifying both the map settings and the positioning of graphs within the interface. Additionally, we made sure that consistent basemaps and geographic projections were used to deliver a cohesive experience.

5.4 GenAI Utilization

Generative AI tools played a supporting role during the implementation phase. Specifically, GenAI was used to troubleshoot and resolve coding errors encountered during development. For example, when integrating Deck.gl with Vue.js, we encountered several technical issues related to rendering and data binding. Generative AI helped us quickly identify the root causes of these problems and provided solutions that saved significant development time.

5.5 Challenges

Key challenges included standardizing basemaps, balancing information density with usability, and integrating heterogeneous datasets. These were addressed by adopting Mapbox for consistent basemaps, using marker clustering and filtering for simplicity, and preprocessing datasets to resolve geospatial and temporal inconsistencies. The result was a cohesive, user-friendly platform that effectively visualized complex urban data.

6 Demonstration Scenarios and Results

The final platform is an interactive dashboard designed to integrate key urban data layers, offering a comprehensive visualization tool for Los Angeles. By combining crime data, hotel ratings, restaurant density, and bike-sharing infrastructure, the platform provides an all-in-one solution for both visitors and residents to make informed decisions about safety, amenities, and accessibility.

Both visitors and residents benefit from a holistic view of neighborhoods, combining safety trends, dining options, and hotel quality to evaluate livability. Granular crime charts and interactive layers offer a detailed understanding of local areas. Cyclists and bike-share users can leverage the trip routes and stations layer, which visualizes commonly used bike paths and station locations. This, combined with the crime heatmap, helps users plan safer and more efficient routes. The results showcase a unified platform where multiple datasets are seamlessly integrated. Key features include 3D crime heatmaps for intuitive comparisons, dynamic charts for detailed insights, and marker clustering for dense restaurant areas. The platform's clear layout and interactive elements enhance usability, enabling informed decision-making and improving safety and convenience for all users.

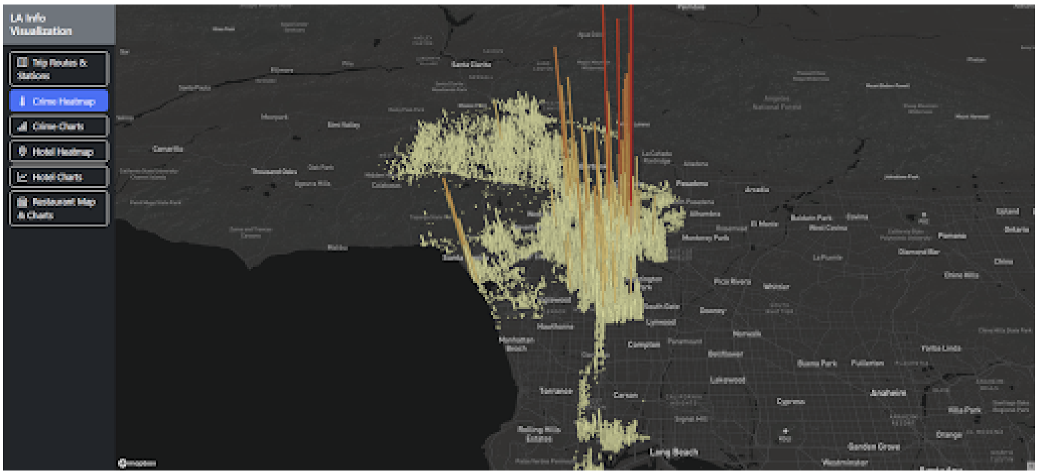

Fig. 1. 3D Crime Heatmap Visualization.

7 Conclusion

This project introduces a comprehensive visualization platform that integrates crime data, hotel ratings, restaurant density, and bike-sharing infrastructure into an interactive dashboard for Los Angeles. Using innovative techniques like 3D crime density mapping and marker clustering, the platform empowers users to make informed decisions about safety, amenities, and accessibility. Key contributions include a unified interface that enables users to explore neighborhoods, evaluate accommodations, and plan safer commutes. The demonstration highlights the platform's ability to seamlessly integrate diverse datasets into an intuitive tool. Features such as interactive maps and dynamic charts provide a holistic view of Los Angeles, while the inclusion of bike-sharing routes supports sustainable transportation. Challenges included integrating heterogeneous datasets, resolving layout conflicts, and balancing complexity with usability. These were addressed through preprocessing, iterative design, and a focus on simplicity. Future work will focus on unifying all map layers into a single interactive map and embedding additional graphs directly onto the map for a more cohesive user experience. Expanding the platform with real-time data and additional metrics could further enhance its utility. In summary, this project provides a solid foundation for urban analysis and visualization, addressing existing gaps and offering practical solutions for navigating Los Angeles.

References

1. Deck.gl: Webgl-powered framework for visual exploratory data analysis. https://deck.gl (2024), accessed: 2024-12-06
2. Jakar, G.S., Gordon, K.O., Avery, B.: Spatial analyses of crime in a host city: contextualizing current crime for future mega-event delivery in los angeles. Journal of Sport & Tourism pp. 1–23 (2024)
3. Lipsitt, J., Chan-Golston, A.M., Liu, J., Su, J., Zhu, Y., Jerrett, M.: Spatial analysis of covid-19 and traffic-related air pollution in los angeles. Environment international **153**, 106531 (2021)
4. Soja, E., Morales, R., Wolff, G.: Urban restructuring: an analysis of social and spatial change in los angeles. Economic geography **59**(2), 195–230 (1983)
5. Van Patten, I.T., Delhauer, P.Q.: Sexual homicide: A spatial analysis of 25 years of deaths in los angeles. Journal of forensic sciences **52**(5), 1129–1141 (2007)