

Topic: Traffic Crashes in Chicago

Research Question: What are the primary hotspots of traffic crashes in Chicago? Are there months when car crashes occur more frequently?

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Data Collection:

- Datasets derived from the City of Chicago's Data Portal:
https://data.cityofchicago.org/Transportation/Traffic-Crashes-Crashes/85ca-t3if/about_data
- Data collected from "Transportation" section of data portal
- Dataset "Traffic Crashes – Crashes" selected for study

Data Clean Up:

- Filtered data to exclude null locations (longitude and latitude).
- Dataset filtered to include crashes which occurred during 2023.
 - o January 1st, 12:00am, 2023 to December 31st, 11:45pm, 2023
- Outliers removed
 - o Crashes reported to have occurred in the Atlantic Ocean.

Methods:

First, we projected the car crash data onto the Illinois county map. We analyzed the total number of car crashes per month to determine if car crashes occurred more in certain months. Next, we created a space time cube by month which allowed us to look at our crash data from a different perspective, according to month.

Once the space-time cube for instances of car crashes in Chicago monthly was created, we performed an optimized hot spot analysis. Then, we performed an emerging hot spot analysis. The results of each hot spot analysis were compared to each other. Then, we looked at local outliers to see where they were located compared to the hot spots.

After the hot spot analyses, we viewed our created space-time cube in 3D via a local scene. In the local scene, the data was analyzed for potential hot spots, cold spots, and outliers.

Analysis:

Car Crashes Per Month:

Analysis of the total number of car crashes in Chicago per month in 2023 did not reveal a pattern. Of the 109,690 total crashes in 2023, the number of crashes per month were

distributed relatively evenly throughout the 12 months. The three months with the highest number of crashes were May (10,039 crashes), August (9,687 crashes), and October (9,993 crashes).

Total crashes per month:

January – 8,039
February – 8,030
March – 8,808
April – 8,933
May – 10,039
June – 9,499
July – 9,437
August – 9,687
September – 9,530
October – 9,993
November – 8,671
December – 9,024

Optimized Hot Spot Analysis of Car Crashes:

Hotspots of traffic crashes are concentrated in downtown Chicago, central Chicago, and in northwest Chicago. We also see hotspots around major driving areas, such as the main highways in the city. Cold spots are around the city's outskirts including on the southside, eastside, and northeast side of Chicago.

Emerging Hot Spot Analysis of Car Crashes:

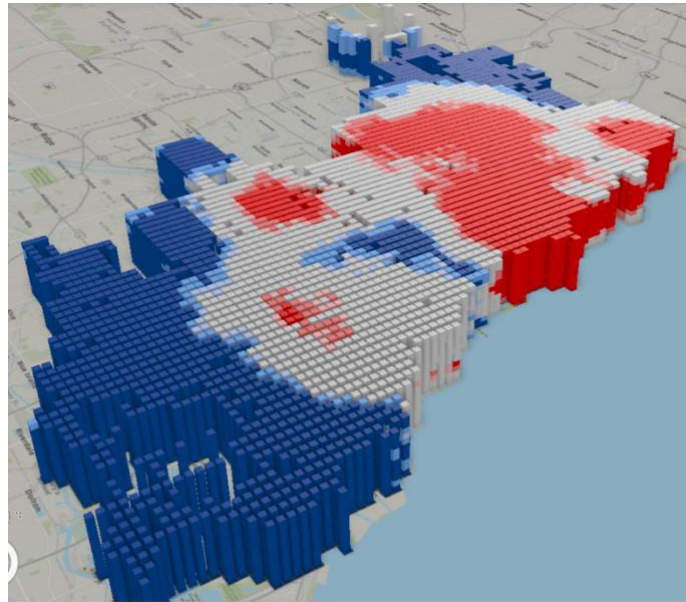
Most persistent hotspots of traffic crashes are in downtown Chicago. Emerging hotspots of traffic crashes are located throughout central and north Chicago. There are a lot of intensifying hot spots on the north side of the city, meaning that those locations have been statistically significant for 90% of the time-step intervals. There are very few emerging cold spots of crashes, but most of the cold spots in Chicago (concentrated on the southern and eastern outskirts of the city) are persistent.

Local Outliers of Car Crashes:

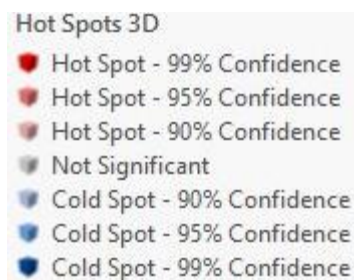
Low-high outliers are scattered throughout central and northeastern Chicago, while high-low outliers are between where cold spots begin and central Chicago. We can see a high-low outlier at O'Hare Airport, which makes sense, as there is not a lot of traffic in the surrounding areas. A high amount of car accidents are where people get picked up/dropped off, which makes it an outlier in that area.

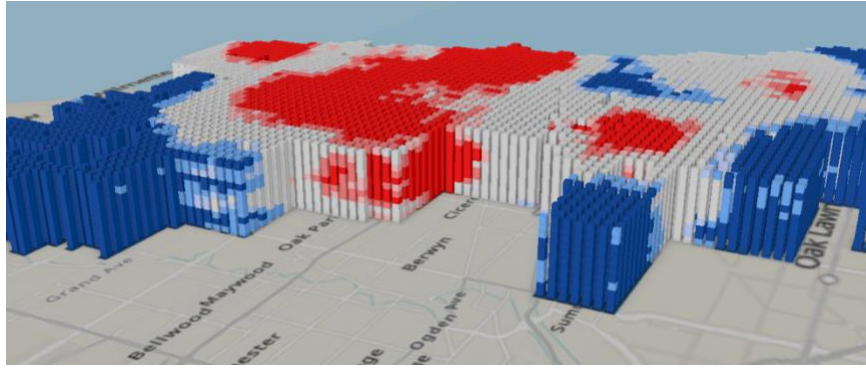
3D Hot Spot Analysis:

Analysis of the space-time cube of car crashes that occurred in Chicago throughout 2023 by month showed a pattern. Hotspots of car crashes can be seen in downtown Chicago (in the upper center of the city ranging from the lake to the west end of the city), in the northernmost area of the city next to Lake Michigan, and in central Chicago. Cold spots of car crashes throughout 2023 occurred in the northwest area of Chicago, below downtown to the east, on the westside, and throughout the southside of Chicago.

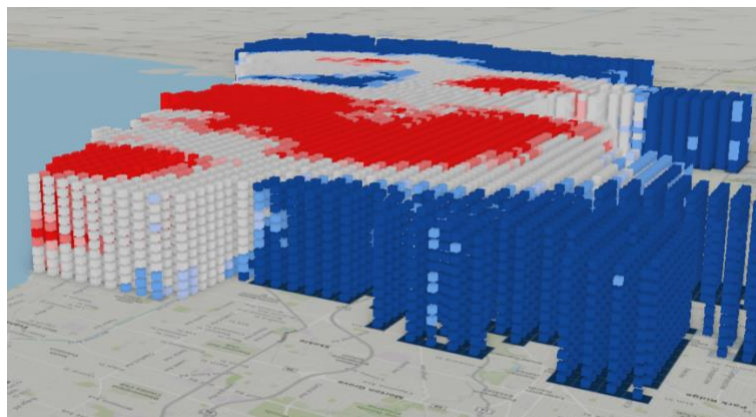


In the 3D visualization of the space-time cube, red cubes indicate a hotspot. The darker the shade of red the higher the confidence level of the hotspot. Cold spots, however, are represented by blue cubes with the darker shades indicating the highest confidence levels of the cold spots.

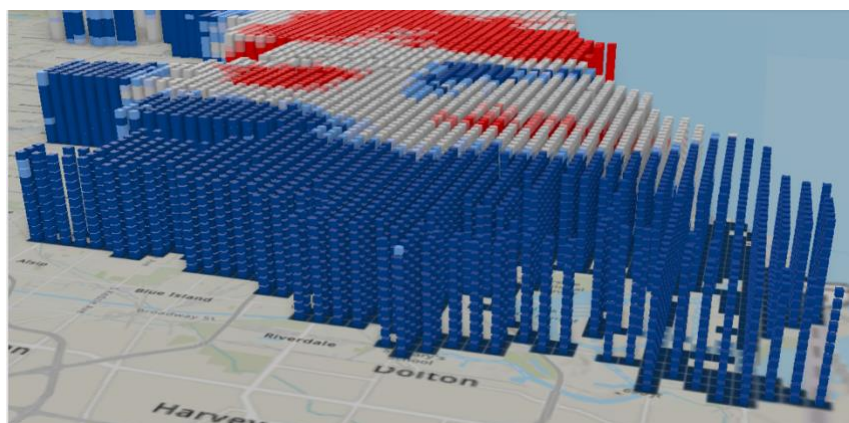




The hotspot of car crashes in central Chicago near the downtown area has a primary confidence level of 99%. The confidence level of the hotspot slightly decreases to 90%-95% on the outskirts of the hotspot.



The hotspot and cold spot in northern Chicago display more fluctuation than the other hotspots and cold spots of crashes throughout the city.



The cold spot on the south side of Chicago primarily has a confidence level of 99%. The confidence level of the cold spot decreases slightly on the northern most edge of the cold spot.

Conclusions:

Although no patterns were determined in the monthly timing of car crashes in Chicago in 2023, patterns were found in the location of car crashes in 2023. Hotspots of car crashes were in the northeast, downtown, and central areas of Chicago all with high confidence levels. Additionally, cold spots of crashes were below downtown to the east, on the westside, and throughout the southside of Chicago all with high confidence levels.

Further research could take place to determine if there is a pattern on the hourly time of car crashes in Chicago, but our research concludes that in 2023 there were geographic patterns where car crashes were more and less frequent throughout Chicago.