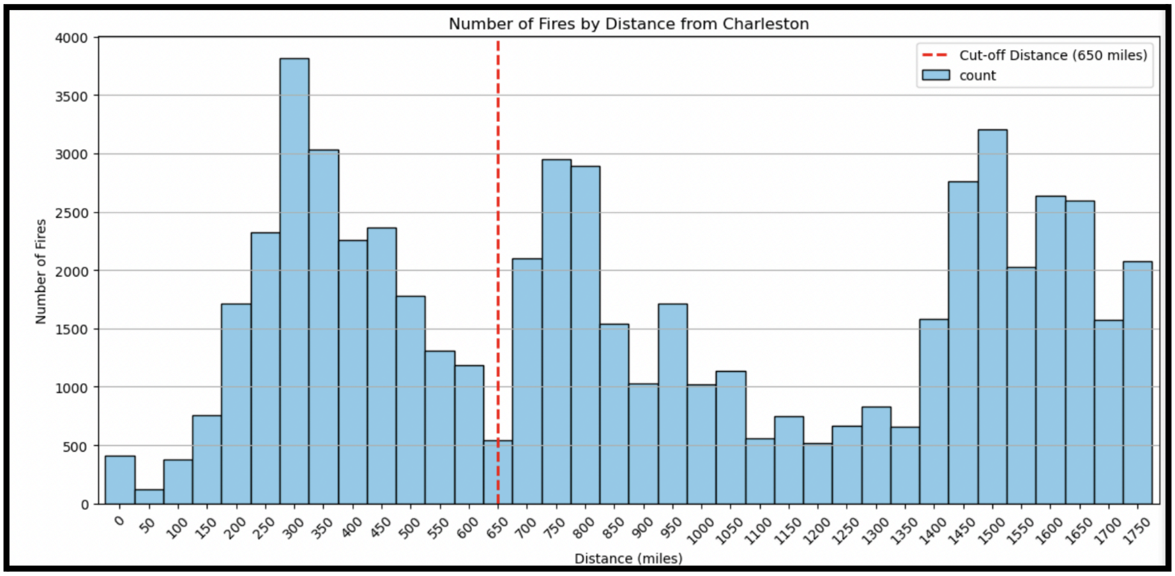
Writing and Reflections

Distance-Based Fire Distribution



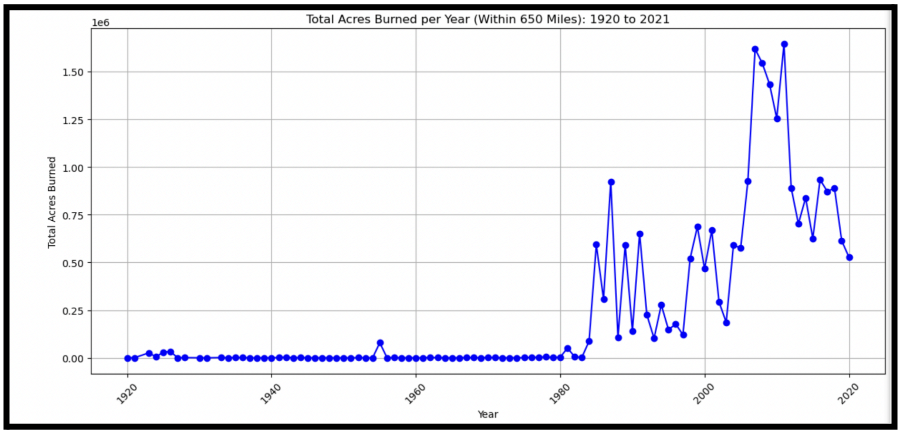
The histogram provides a comprehensive view of fire occurrences around Charleston, presenting fire counts in 50-mile intervals up to a maximum distance of 1800 miles. Each x-axis tick represents the start of a 50-mile range: for example, "0" indicates the 0-50 mile bin, "50" represents 50-100 miles, and so on. To obtain cumulative counts over broader ranges, such as 0-100 miles, counts from relevant bins would be summed.

Distinct patterns emerge from the data. Fires are relatively sparse in areas close to Charleston, with notable clusters appearing at distances of 300-400, 750-800, and 1400-1500 miles. This distribution suggests potential geographic or environmental factors influencing fire occurrences at further distances from the city. The 650-mile cutoff, marked by a red dotted line, helps narrow the analysis in line with project guidelines.

Within this 650-mile range, the data distribution appears roughly normal, suggesting that factors like climate, vegetation, or human activity may be relatively stable near the city. Beyond 650 miles, the distribution becomes more irregular, with distinct peaks and troughs likely due to varying environmental conditions or land use.

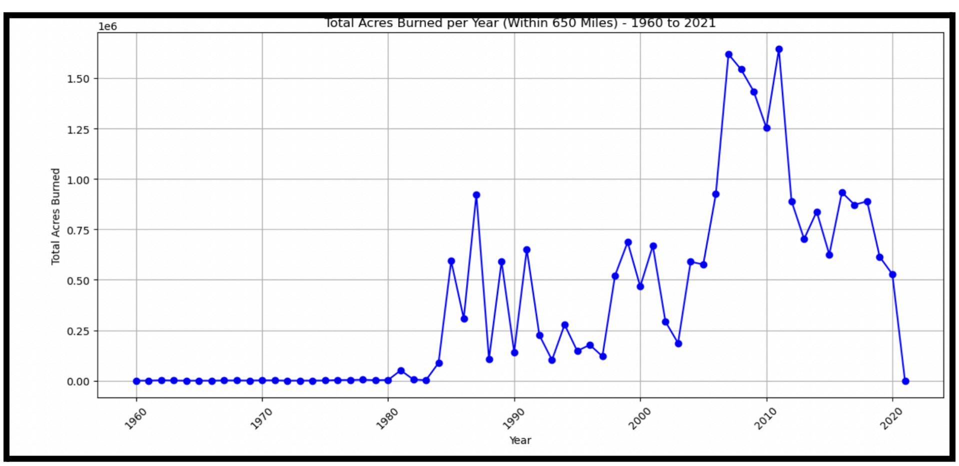
The histogram effectively communicates general fire density patterns and specific areas with higher fire activity around Charleston. The clear labeling and cutoff marker assist with interpretation. The underlying data was prepared by calculating the shortest distance from Charleston's GPS coordinates to the periphery of each fire, with fire counts aggregated in 50-mile intervals.

Annual Acres Burned by Distance

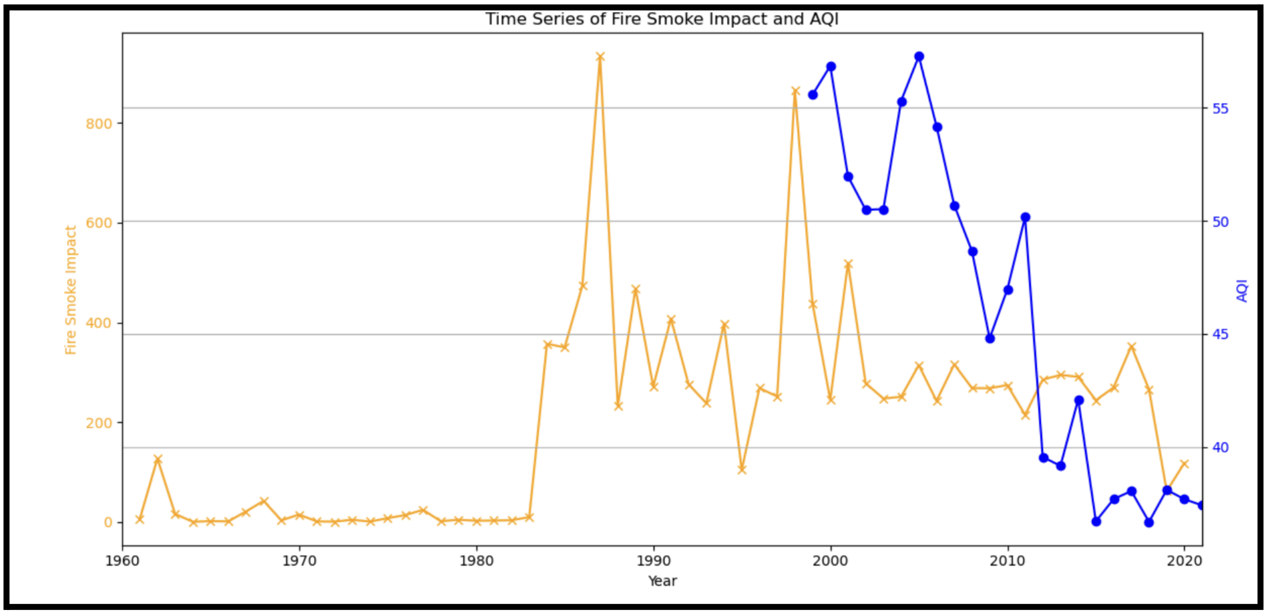


The graph above illustrates a time series of total acres burned by fires each year within a 650-mile radius of Charleston, South Carolina, spanning from 1920 to 2020. Although the dataset starts in 1920, significant fire activity primarily appears from 1960 onward, with prominent peaks around 2010, suggesting an increase in larger fire events over recent decades. Each point on the line represents individual yearly data, with the x-axis displaying years in ascending order and the y-axis showing total acres burned (scaled in millions). The absence of data beyond 2020 reflects missing entries for these years. Each point on the line represents the total acres burned (in millions, or 10610^6106) for the specific year shown.

A closer look at data from 1960 onwards highlights more consistent fire records, providing a clearer view of fluctuations and trends within this timeframe. The data used to create this plot was sourced directly from the combined fires dataset, focusing on fire sizes. Fires occurring within 0 to 650 miles of Charleston were identified, and their areas were summed annually to generate the visual representation above.



Fire Smoke and AQI Estimates Over Time



This graph showcases the time series trends of my smoke estimate (calculated as fire area divided by log(distance) *1000 from Charleston) alongside the average AQI recorded by stations in Charleston. The x-axis spans the years from 1961 to 2021, with the smoke estimates plotted on the left y-axis in orange and AQI values on the right y-axis in blue. Using contrasting colors helps to differentiate between the two metrics clearly.

AQI data, available only from 1999 onward, is absent before this period, hence no blue line appears prior to 1999. The correlation between the smoke estimate and AQI is 0.35, indicating a moderate but not strong relationship. However, both metrics display an upward trend, suggesting that as AQI values rise, so do smoke estimates, implying a relationship between increased fire activity and worsening air quality. Although the peaks of the two lines don't align perfectly by year, they follow a generally similar trend, highlighting that periods of high smoke estimates often coincide with elevated AQI levels, reflecting poorer air quality.

For AQI calculations, only particulate matter (PM2.5) was considered, as it significantly contributes to air quality deterioration. The AQI values represent the average across all available stations in Charleston, providing a comprehensive view of the city's air quality for the plot above.

Collaborative Reflection

Although I didn't borrow much code directly (with the exception of a small snippet to extract dates from strings, which I've clearly highlighted in my notebook), the collaborative opportunities in this project significantly impacted how I approached and understood the assignment. Discussing with classmates exposed me to alternative methods, tools, and strategies, broadening my perspective on how to manage and analyze the dataset effectively. For instance, some classmates who were more experienced with GIS tools shared insights about using ArcGIS and the Haversine formula for geospatial calculations. This motivated me to consider more efficient ways of calculating distances in my own work, refining my approach for accuracy and efficiency.

A major point of discussion revolved around optimizing data extraction, particularly for cities like Charleston, where over 30 monitoring stations capture both gaseous and particulate pollutants. In our collaborative conversations, we collectively recognized that PM2.5 was a primary contributor to wildfire smoke's impact on air quality. This insight was pivotal, as it allowed us to streamline the dataset by focusing solely on PM2.5 for our analysis. When we brought this idea to the professor, it further validated our approach, significantly reducing both the time and complexity of data extraction and processing. This streamlined focus ultimately simplified my workflow and helped make my analysis more targeted and relevant.

Additionally, observing the variety of approaches others were taking for estimating smoke impact motivated me to try a unique calculation method. While many were applying cumulative or distance-weighted methods, I decided to explore a logarithmic estimate, which allowed me to incorporate both fire size and proximity in a nuanced way. Collaborating with others also provided a valuable opportunity to compare results, where we found a general positive correlation between AQI values and smoke estimates across various cities. This trend held true in my analysis as well, reinforcing the broader relationship between wildfire smoke and deteriorating air quality, as seen through AQI.

Overall, collaboration greatly enriched my approach to the project. It not only changed how I handled specific technical challenges but also encouraged a more thorough exploration of the dataset, allowing me to see different perspectives on data processing and interpretation. The chance to share ideas, test methods, and refine our techniques collectively helped me make more informed decisions in my analysis, making the process more efficient and insightful. The opportunity to collaborate fostered a deeper understanding of the problem, inspiring me to consider alternative approaches that I might not have explored independently.