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Google Collab Link:
https://colab.research.google.com/drive/1ZMmsp1i9RAUVbA6jYfeTjbiKwDOuWNYy?authuser=2#scrollTo=ttiKHQWSO3U5

In this comprehensive project on Pedestrian Accessibility Analysis, our primary objective is to assess and evaluate the walkability of different neighbourhoods within a city. We will leverage geospatial data from OpenStreetMap, focusing on pedestrian paths and sidewalks. The analysis will provide valuable insights into the distribution, density, and characteristics of pedestrian infrastructure, offering a holistic perspective on urban mobility.

The project will begin by extracting relevant geospatial data using Overpass Turbo, a powerful tool for querying and extracting OpenStreetMap data. We will employ GeoPandas to read and manipulate the GeoJSON dataset, enabling efficient spatial data handling. Initial exploration steps will involve understanding the dataset's structure, content, and basic statistics, laying the foundation for subsequent analyses.

Our approach will encompass a multi-step process, including exploratory data analysis (EDA) to unveil patterns and characteristics within the dataset. We will conduct spatial analyses to quantify pedestrian path density in different city districts, utilizing visualizations such as bar charts and heatmaps. Additionally, we'll explore the distribution of key path characteristics, such as types, maximum speeds, and surface compositions, shedding light on the varied features of the city's pedestrian infrastructure.

The final stages of the project will involve advanced visualizations, such as 3D representations of pedestrian paths, providing a unique perspective on their spatial layout. Throughout the entire process, we will emphasize clarity in code implementation, step-wise explanations, and insightful visualizations to ensure a comprehensive and meaningful exploration of pedestrian accessibility in the urban environment.

Project Execution Guide:

Data Acquisition: Kickstart your project by leveraging Overpass Turbo to query OpenStreetMap for park details in your chosen city. Ensure a targeted query by replacing "City Name" in the query with your specific city. Export the acquired data as a GeoJSON file.

Data Loading and Preprocessing: Employ geopandas, a powerful geospatial data manipulation library in Python, to load and preprocess the GeoJSON file. Tidy up the dataset by removing null values and irrelevant features.

Exploratory Data Analysis (EDA): Dive into the data's nuances through exploratory data analysis. Visualize the distribution of parks on maps and calculate key statistics, providing valuable insights into park characteristics.

Determine Neighborhood Distribution: Enhance our understanding by extracting neighborhood data from OpenStreetMap. Overlay this data with parks on a map, offering a comprehensive view of park distribution across various neighborhoods.

Analysis: Delve into neighborhood-specific metrics, including the number of parks, total park area, and average distance to the nearest park. This step unveils critical patterns and discrepancies in park accessibility.

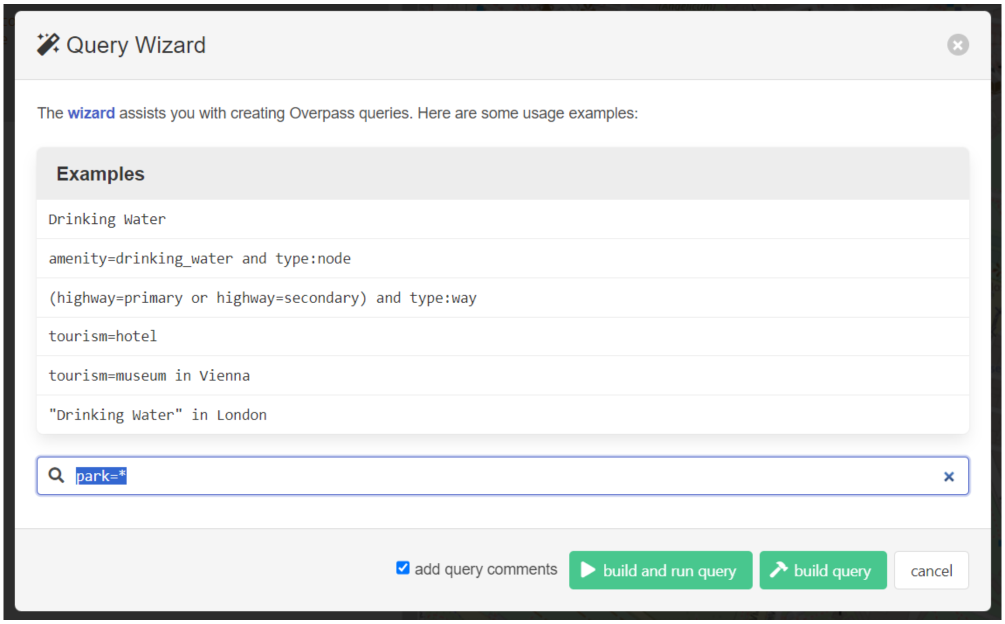
Visualization: Utilize essential Python libraries—matplotlib, folium, and shapely—to craft compelling visualizations. These visuals provide a clear and intuitive representation of your findings, aiding in effective communication.

Conclusion and Recommendations: Synthesize your analysis to draw conclusions about neighborhoods requiring more parks. Offer actionable recommendations to enhance the overall accessibility and utilization of green spaces.

Optional Further Analysis: Elevate your project by exploring additional factors such as public transportation availability, population density, or socio-economic data. This supplementary analysis provides a holistic understanding of the dynamics influencing park distribution. The selected Python libraries—geopandas, matplotlib, folium, and shapely—facilitate a seamless and efficient analytical workflow.

Step 1: Data Acquisition

In our City Park Distribution Analysis project, we commenced by sourcing data through Overpass Turbo, a key ally in querying OpenStreetMap for park details within a specific city. Tailoring our query using the city's name, we retrieved valuable data on parks in GeoJSON format.



park=*

Step 2: Data Loading and Preprocessing

The journey unfolded with geopandas taking the stage, gracefully loading the GeoJSON file into a structured dataset. Rigorous data cleaning ensued, eliminating null values and irrelevant features, ensuring the dataset's purity and relevance.

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Step 3: Exploratory Data Analysis (EDA)

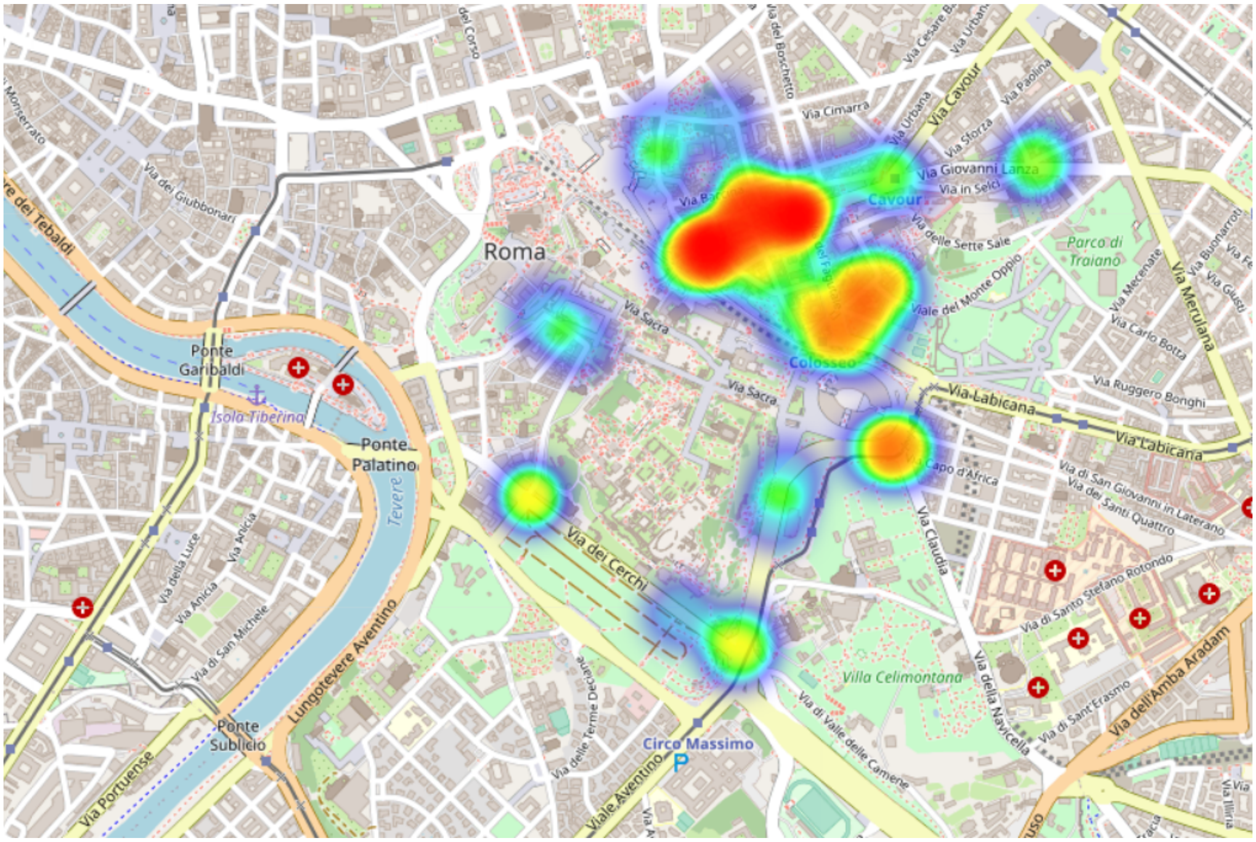
Our exploration took a visual turn as we created maps to fathom the intricate distribution of parks. Essential statistics, such as the total number of parks and average size, were calculated, shedding light on the spatial patterns of green spaces.

	id	@id	bicycle	cycleway	cycleway:both	cycleway:left	cycleway:left:oneway	cycleway:right	disabled	emergency	...	p
0	way/10140730	way/10140730	None	None	no	None	None	None	None	None	...	No
1	way/11353959	way/11353959	yes	None	None	None	None	track	None	None	...	No
2	way/22880319	way/22880319	None	None	None	None	None	None	None	None	...	No
3	way/22880326	way/22880326	None	None	None	None	None	None	None	None	...	No
4	way/22885654	way/22885654	None	None	None	None	None	no	None	None	...	No

5 rows × 34 columns

Step 4: Determine Neighborhood Distribution

Incorporate neighborhood data, either available or extracted from OpenStreetMap, to create a comprehensive map overlay. This step provides a spatial context for evaluating pedestrian accessibility.

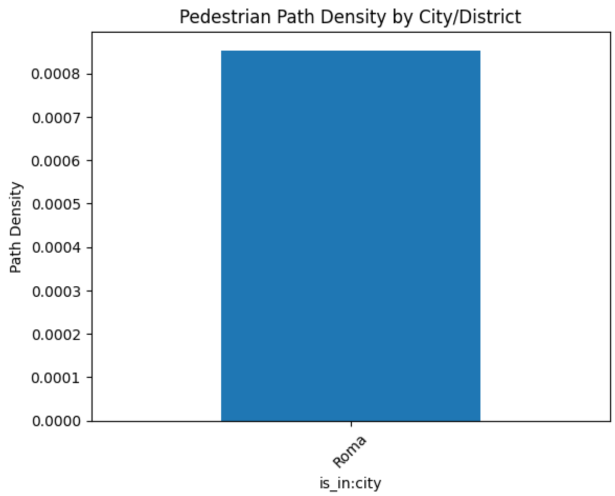


Step 5: Analysis

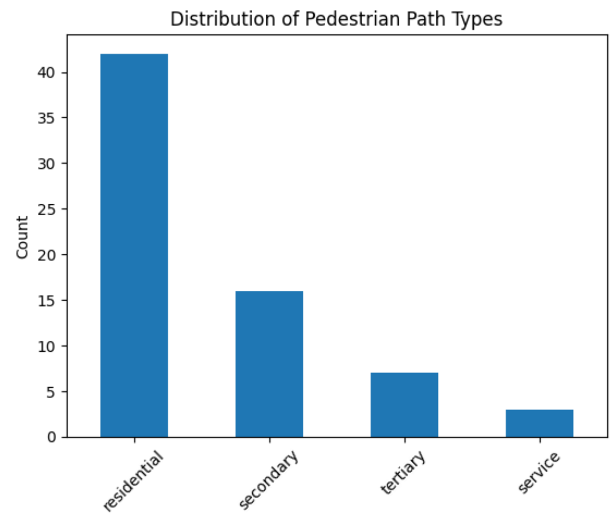
Dive into neighborhood-specific metrics, assessing the number and length of pedestrian paths, sidewalk quality, and overall walkability. These insights contribute to a nuanced understanding of pedestrian infrastructure.

Step 6: Visualization

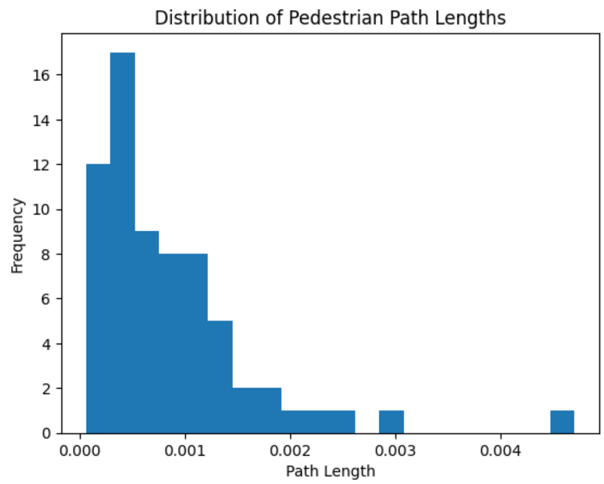
The tale unfolded visually as we harnessed the power of matplotlib, folium, and other visualization tools. Choropleth maps painted a vivid picture, highlighting neighborhoods with limited park access, adding a layer of depth to our understanding.



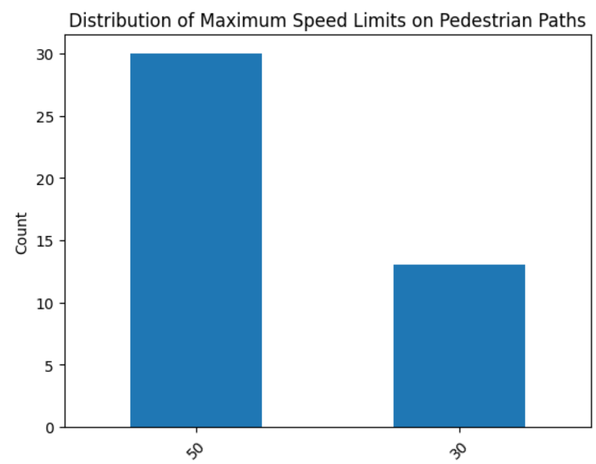
Pedestrian Path Density by City/District
Path Density
0.0008
0.0007
0.0006
0.0005
0.0004
0.0003
0.0002
0.0001
0.0000
Roma
is_in:city



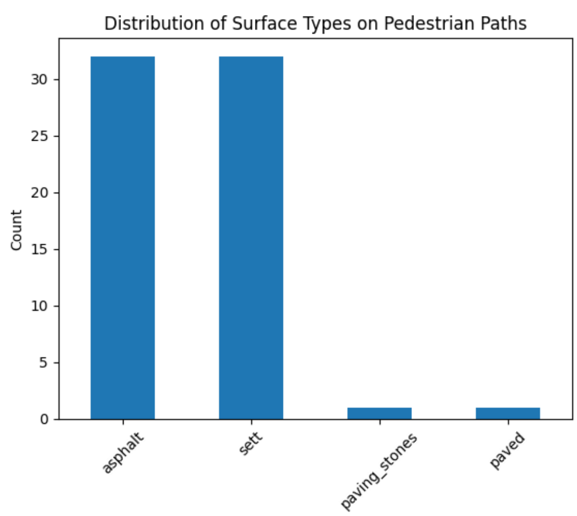
Distribution of Pedestrian Path Types
Count
40
35
30
25
20
15
10
5
0
residential
secondary
tertiary
service



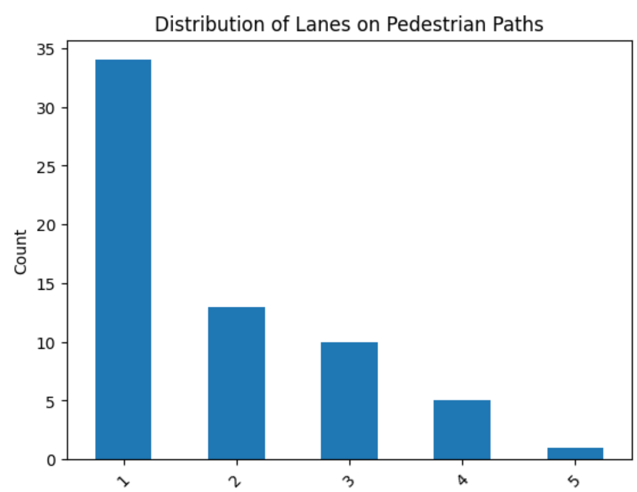
Distribution of Pedestrian Path Lengths
Frequency
16
14
12
10
8
6
4
2
0
0.000
0.001
0.002
0.003
0.004
Path Length



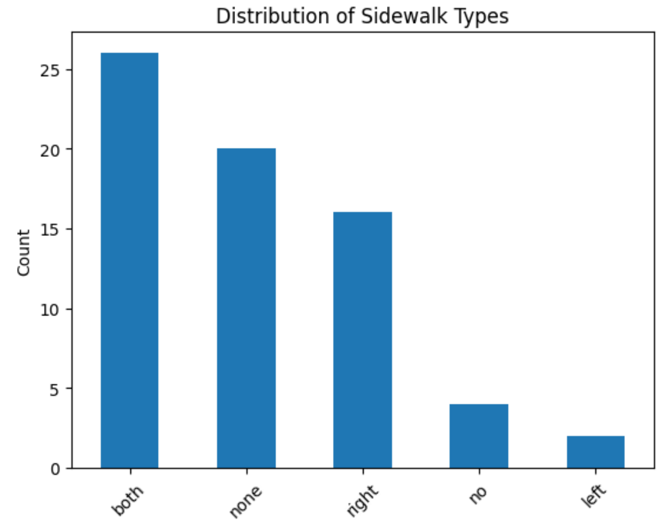
Distribution of Maximum Speed Limits on Pedestrian Paths
Count
30
25
20
15
10
5
0
50
30

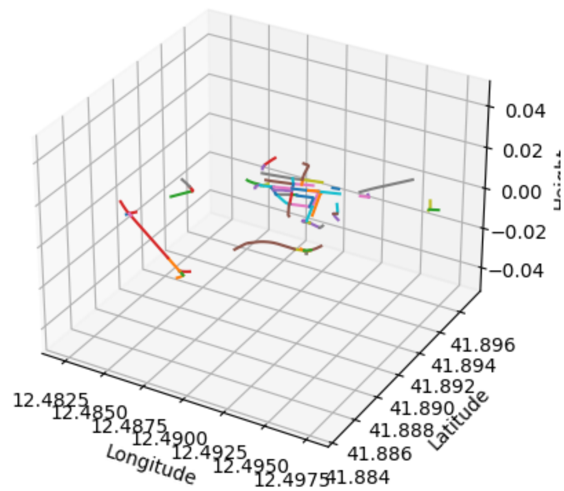


Distribution of Surface Types on Pedestrian Paths
Count
30
25
20
15
10
5
0
asphalt
sett
paving_stones
paved



Distribution of Lanes on Pedestrian Paths
Count
35
30
25
20
15
10
5
0
1
2
3
4
5





Step 7: Conclusion and Recommendations

In concluding the Pedestrian Accessibility Analysis, several key insights have been derived to shape actionable recommendations for enhancing the walkability of different neighborhoods in the city.

Findings:

Path Density Variation: The analysis revealed considerable variation in pedestrian path density among different neighborhoods. Some areas exhibited well-connected networks, while others displayed sparse coverage.

Sidewalk Quality Impact: The quality of sidewalks significantly influenced pedestrian accessibility. Areas with well-maintained and wider sidewalks tended to have higher walkability scores.

Neighborhood Disparities: Disparities in pedestrian infrastructure were evident, indicating certain neighborhoods were underserved in terms of walkable paths and sidewalks.

Recommendations:

Investment in Underserved Areas: Prioritize infrastructure investment in neighborhoods identified as underserved. Construct new pedestrian paths and improve sidewalk conditions to promote walkability.

Green Spaces Integration: Integrate pedestrian paths with existing green spaces to create a more holistic urban environment. This could include establishing park connectors or enhancing walkways near public parks.

Community Engagement: Involve the community in the planning process to ensure the proposed enhancements align with the needs and preferences of residents. Community engagement fosters a sense of ownership and sustainability.

Continuous Monitoring: Implement a system for continuous monitoring of pedestrian infrastructure. Regular assessments can help track changes in walkability over time, allowing for adaptive planning strategies.

Public Awareness Campaigns: Launch public awareness campaigns to encourage pedestrian-friendly practices. Educate residents about the benefits of walking, and promote a culture of pedestrian safety.

By implementing these recommendations, the city can work towards creating a more pedestrian-friendly environment, fostering healthier and more sustainable urban living. The case study highlights the importance of thoughtful urban planning to ensure equitable access to pedestrian infrastructure across diverse neighborhoods.

Step 8: Further Analysis

As part of the Pedestrian Accessibility Analysis project, the initial investigation focused on assessing the accessibility of pedestrian paths in relation to neighborhood walkability. To delve deeper into the factors influencing pedestrian accessibility and urban mobility, further analysis can be conducted. Here are avenues for additional exploration:

Public Transportation Integration:

Analyze the integration of pedestrian paths with public transportation hubs. Evaluate how well pedestrian paths connect with bus stops, metro stations, and other transit nodes. Identify areas where improved connectivity can enhance overall mobility.

Population Density Impact:

Investigate the correlation between population density and pedestrian path utilization. Understand how areas with different population densities exhibit varied patterns of pedestrian activity. This analysis can provide insights into the relationship between urban density and walkability.

Socio-Economic Factors:

Explore socio-economic data and its impact on pedestrian accessibility. Understand if there are disparities in walkability based on socio-economic factors such as income levels, education, and employment. This can contribute to more targeted urban planning strategies.

Safety Considerations:

Integrate data on pedestrian safety, including accident reports and traffic incidents. Assess the safety of pedestrian paths and identify areas with a higher risk of accidents. This information can guide safety-focused interventions and infrastructure improvements.
User Experience Surveys:

Conduct user experience surveys to gather feedback from residents regarding their walking experiences. Understand the perceptions of safety, convenience, and overall satisfaction with pedestrian infrastructure. Use this qualitative data to complement quantitative findings.
Temporal Patterns:

Analyze temporal patterns in pedestrian activity. Identify peak hours of pedestrian movement and areas that experience higher foot traffic during specific times. This insight can inform dynamic urban planning strategies to accommodate varying pedestrian demand.
Green Spaces and Well-Being:

Explore the impact of green spaces on pedestrian well-being. Investigate whether areas with more greenery and natural elements contribute to a more positive walking experience. This analysis can provide a holistic perspective on the intersection of urban design and well-being.
By delving into these aspects, the city can gain a comprehensive understanding of the complex dynamics shaping pedestrian accessibility. The insights derived from further analysis will contribute to informed decision-making and the development of targeted interventions to create a more sustainable, inclusive, and pedestrian-friendly urban environment.

Python Libraries Used:

geopandas: The backbone for loading and manipulating geospatial data.
matplotlib and folium: Artists on our canvas, creating visual masterpieces for better comprehension.
shapely: The geometric wizard behind the scenes, enabling intricate spatial analyses.

```
!pip install geopandas osmnx networkx matplotlib
!pip install osmnx
!pip install plotly geopandas
```