What the Project Does:

This project focuses on **optimizing the locations of social facilities** — specifically drugstores (drogeries) — in Salzburg, following the **15-minute city concept** to improve accessibility and urban quality of life.

Background and Motivation

- The **15-minute city** concept promotes access to essential services within a 15-minute walk or bike ride.
- Salzburg's unique geography — including its historic center, mountains, and the Salzach River — creates barriers that complicate equal access to services.
- There are significant inequalities between densely populated central districts and peripheral neighborhoods regarding access to facilities like drugstores.

Main Research Question

How can social infrastructure be optimally distributed to meet Salzburg's evolving demographic and geographic needs, ensuring maximum accessibility and efficiency?

Methodology and Technical Implementation

- The project uses a rich set of **spatial and demographic data** from sources like **OpenStreetMap**, municipal statistics, and detailed **GIS analyses**.
- These data are processed and analyzed using **Python**.
- Specifically, the project employs **GeoPandas** for handling geospatial vector data (district boundaries, facility locations, centroids), and **Matplotlib/Seaborn** for visualizations.
- Complex spatial queries (e.g., calculating distances between residents' locations and drugstores) with QGIS and data manipulations are automated with Python scripts .
- Optimization is conducted using **Mixed Integer Programming (MIP)** techniques, allowing the model to consider multiple constraints like geographic barriers and population distribution.
- **QGIS** complements Python by providing a visual platform for exploring, editing, and validating spatial data.

- The workflow involves:
    - Importing and preprocessing data in QGIS,
    - Exporting processed geospatial files (GeoPackages),
    - Performing advanced spatial computations, grouping, filtering, and optimization in Python,
    - Visualizing the results in both Python and QGIS for easy interpretation by urban planners.

Key Findings and Contributions

- The analysis reveals **areas with poor drugstore access**, especially in peripheral districts where many residents travel over 1500 meters.
- Using the MIP optimization, the project proposes **optimal new locations for drugstores**, minimizing travel distances and increasing accessibility.
- Visualization maps created in Python and QGIS illustrate disparities before and after optimization, highlighting improvements.
- The project bridges **data science and urban planning** by delivering practical recommendations backed by rigorous spatial analysis and optimization.

Summary

This project leverages **Python programming and GIS tools** to analyze, optimize, and visualize the spatial distribution of social facilities in Salzburg. By integrating advanced data processing, spatial analysis, and mathematical optimization, it supports the vision of a more equitable, sustainable, and accessible urban environment aligned with the 15-minute city concept.