food.get

Analyzing Chicago's food access and security

CAPP 30122
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Project Abstract

The project aims to analyze food access within the Chicago area. The scope of this work provides an updated food access metric for 2022 to understand communities' post-pandemic food access and shows how food access has changed in the city over time. The Atlas Food Access Research data from 2010, 2015, and 2019 is used as a historic food access metric. To recreate the 2022 metric, grocery store data from the City of Chicago are paired with household income information from the United States Census. For understanding and consumption, the project findings are presented in a Dash web application containing several interactive maps using Folium.

Structure of Software

This project is structured in the following sections:
- Data (/data)
  - Data Extraction
    i. Pulls grocery stores from City of Chicago and SNAP retailers (/extract_grocery.py)
    ii. Pulls in and combines historic USDA Food Atlas Research data (/extract_atlas.py)
    iii. Pulls in census tract boundaries (/extract_tracts.py)
    iv. Pulls in census tract income and population metrics (/extract_census.py)
  - Cleaning
    i. Cleaning grocery stores from City of Chicago and SNAP (cleanup_grocery.py)
    ii. Adds SNAP information to grocery store locations (match_groceries.py)
- Analysis (/analysis)
  - Recreate Food Atlas metric for 2022 (/generate_metric.py)
  - Generates DataFrames of the combined metrics and grocery stores for use in the map (/agg_metrics.py)
- UI (/ui)
  - Creates maps (/map.py)
  - Creates Dash application (/dash.py)

Data Submodule

The historical information and the insights needed to recreate the Atlas access food metric were gathered through various XLS and CSV downloads as well as APIs.

The data sourcing information:

Data Source	Collection Method	Data Year
Atlas Metrics	XLS downloads	2010, 2015, 2019
Census Data	API	2022
Census Tracts	CSV/GeoJson download	2010
Chicago Grocery Store Data	CSV download	2020
USDA SNAP	API	2023

Extract Files

The extract files load all data including USDA Food Atlas Research Data, census data, grocery store, and SNAP retailer data.

Cleaning Files

The cleaning files are responsible for cleaning the gathered data. The module ensures that latitude and longitudes are formatted consistently, that the data is isolated to Chicago, unnecessary columns are dropped, and membership grocery stores are filtered out. The module outputs are formatted for the map and metric modules. It also matches City of Chicago grocery stores to SNAP-eligible stores to include a flag column.

Analysis Submodule

The generate metric module is responsible for generating the new low-access and low-income metrics. To find the percent of a census tract that has access to a grocery store within a half mile, the module first creates ½ mile buffers around grocery stores in Chicago. These buffer boundaries are then overlaid with census tract boundaries to find the area that is **not** covered by the grocery store buffers (i.e., difference area). To find the ratio, or percent, of a tract that is serviced by a grocery store within a half-mile radius, we take one minus the difference area over the tract area. Once each tract has an associated ratio, we classify them as low-access if the ratio is less than 33%. For the low-income metric, we compare each tract's median household income to the county-wide (Cook County) median household income. If the tract's median household income is less than or equal to 80 percent of the county's median household income, then the tract is labeled as low-income.

The agg_metric file combines and formats the historic Atlas metric, the generated Atlas metric, and the grocery stores for use in the maps.

UI Submodule

Finally, the project_dash module creates a dashboard of findings using Dash and Folium. The module presents the results of the analysis in an interactive and user-friendly way, allowing users to easily explore the data and insights. When launched, the dash web application conveys information about the project and instructs the viewer on how to interpret and use the maps. The dash design is configured to allow a viewer to navigate through the story of food access in Chicago. The maps themselves were created in Folium allowing for interaction. Buttons on the map allow viewers to hone in on information most interesting to them.

Project Diagram

The diagram outlines at a high level the structure of the application. The key components and files are depicted to convey a deeper understanding of the software pieces.
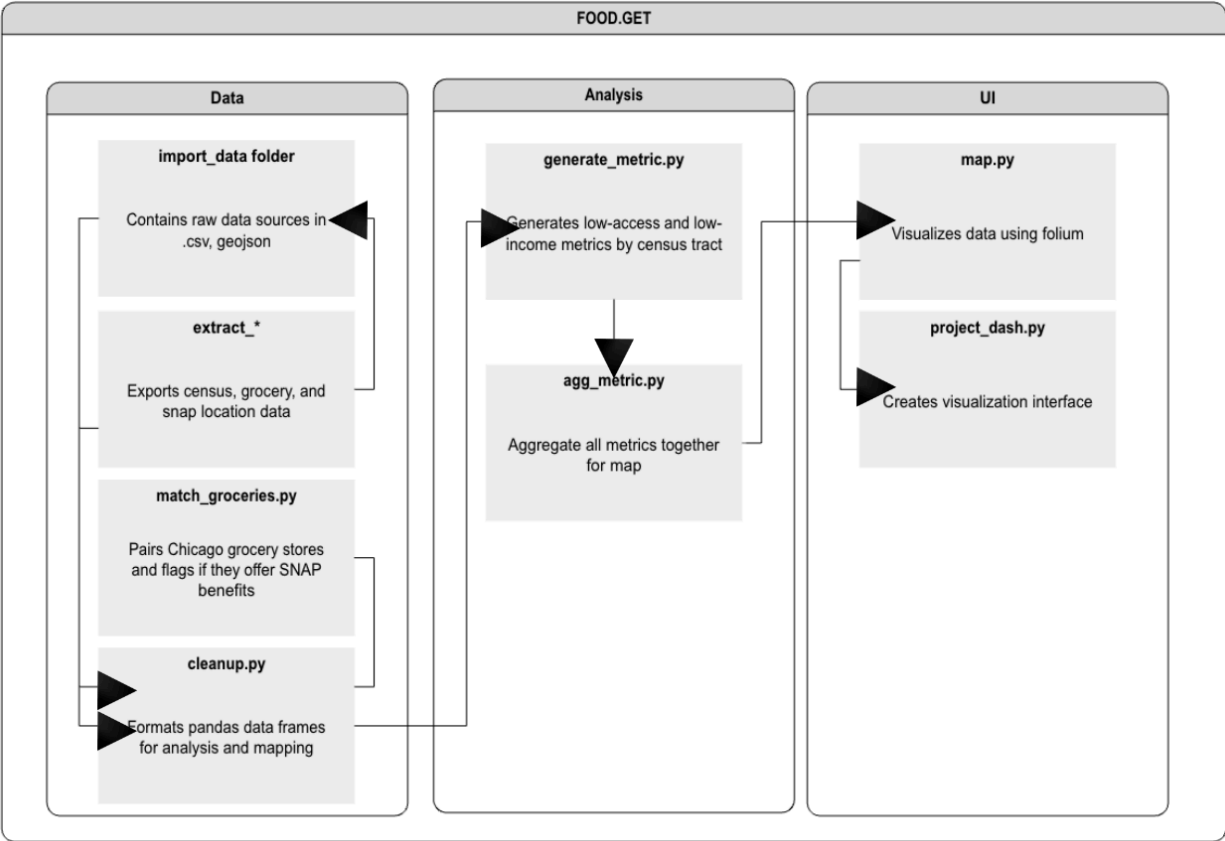
Code Responsibilities

Data (/data)
- Extraction (/data/)
    - Austin, Danielle, and Stacy uploaded .xlx,.csv, and .json files for the project
    - Danielle and Stacy worked on scraping web data sources
        i. Danielle coded functions to scrape and format US Census data
        ii. Stacy coded functions for grocery store and snap locations
- Cleaning (/data)
    - Austin, Danielle, and Stacy worked on the cleanup.py module
        i. Danielle coded functions related to compiling and standardizing Atlas data across years
        ii. Stacy coded functions for grocery store and snap locations
        iii. Austin coded the match groceries

Analysis (/analysis)
- Recreate metric
    - Livia coded everything in the generate_metric file
- Aggregate metrics
    - Austin coded everything in the agg_metrics file

UI (/ui)
- Visualizations (/map.py)
    - Austin coded everything in the map.py
- Web Application (/dash.py)
    - Stacy coded everything in the dash module

Honorable Mentions
- Livia set up poetry and the GitHub repository
- Livia wrote the README
- Austin set up __main__.py
- Danielle wrote all tests in the test file

User Guide

Installation

1. [Install Poetry to Local Machine](#)
2. Clone the Project Repository via SSH
   ```
   git@github.com:uchicago-capp122-spring24/food.get.git
   ```
3. Install Virtual Environment and Dependencies
   ```
   poetry install
   ```

Usage

Project must be run in the Poetry virtual environment. Upon completion of the above installation requirements within the project terminal, and on each subsequent rendering of the project, initialize the virtual environment by running:
```
poetry shell
```

Execute the project by running:
```
python -m food_get
```

This command may take a minute to load the project to the terminal.

You are then given an HTTP link, as seen below. Copy the link into your preferred browser to interact with the webpage.

```
Dash is running on http://127.0.0.1:8051/

      * Serving Flask app 'food_get.ui.project_dash'
      * Debug mode: off
      * Running on http://127.0.0.1:8051

Press CTRL+C to quit
```

Once on the Dash webpage each map page includes instructions on the left on how to best interact with the maps.

Goals and Findings

The goal of this project is to understand Chicago's historical food access and to construct an updated Atlas food metric with data post-pandemic to better understand the recent food access landscape in Chicago. This project functions as an exploratory tool to understand current and historic food access in the city. Initial analysis of the data shows that food access has significantly decreased after the pandemic and the divide between low-income tracts and not has increased across the last decade, especially since the pandemic. A deeper analysis of this information would answer questions such as: 1) What was the average decrease in food access? 2) What's the volatility of changes between the years visualized (i.e., are the trends always going up or down for a tract? 3) As communities continue to recover from the pandemic, has the city's access to food improved? 4) Have low-income tracks seen unique trends in changes in food access as compared to non-low-income tracks?

The project team completed all stated goals for data ingestion, cleaning, recreating, and visualizing within a user-friendly web-based application. However, the project ultimately serves more as an exploratory tool rather than providing deep insight using the data. We had hoped to provide more interpretation using the created metric but were not able to complete this additional analysis. Nevertheless, we believe the completed aspects of the project serve as a solid foundation to build upon this work.

Overall, this project provides valuable insights into Chicago's food accessibility. These insights have the potential to inform decision-makers on how to best resource the city and begin to narrate the impacts of pandemics on communities and their basic needs.

Considerations

1. For the recreated post-pandemic metric, ACS 5-year (2022) census data was used.
2. For ease of data collection and alignment with the Chicago data portal, grocery store data is from 2020. We assume that the number of grocery stores stays the same from 2020 to 2022.
3. For metric calculations, we exclude the area of census tracts that is in the lake or river. Folium map provides viewers with the option to toggle between the original census tracts with the waterways or without.
4. The project only determines metrics for census tracts that stayed the same from 2010 to 2020.
5. Constrained matching process of grocery stores to SNAP providers to within 1000 feet of each other and with shared address numbers.