Project: Nautral Disaster Aid and Demographics

Team: (la)Monty Python

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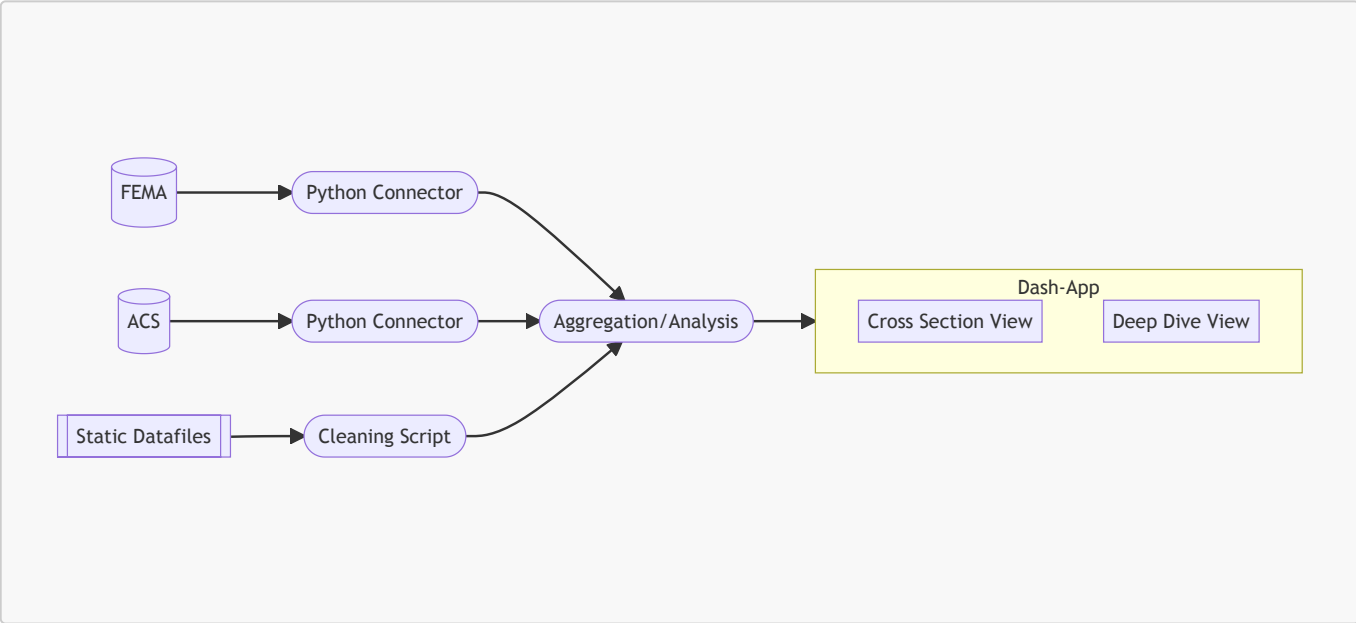
Project Overview

Our project enables exploration of various demographic, economic, and political features on federal government aid to counties after natural disasters in the U.S. We collect data from several government sources, including the Census Bureau and FEMA, to capture demographic, economic, and natural disaster measures. Our project includes a Plotly Dash interface where users can interact with the data to explore the relationship between various demographic variables and FEMA aid provided to counties affected by natural disasters.

Software Structure



The software consists of two abstract class connections to two separate APIs (and several downloaded static datasources) on the backend, a data integration and analysis middle layer, and a Plotly Dash frontend. The backend of our project connects to the following APIs and static datasources:

- American Community Survey from the U.S. Census Bureau
- OpenFEMA Datasets
- MIT Election Lab Federal Elections Data
- NOAA National Hurrican Center Data

The middle layer combines the data by aggregating and joining ACS data with FEMA aid data. The middle layer also performs pre-processing on presidential voting and hurricane path static datafiles. After the data has been processed, the middle layer also performs several regressions on a subset of three specific hurricanes: Irma, Michael, and Harvey. Our Regression and API Data Pull classes are designed in a scalable manner so additional disasters can be added with little effort.

The front end of our application renders data across multiple views and data visualizations in a Plotly Dash interface. The interface allows the user to explore the realtionship between various demographic variables and FEMA aid in counties affected by natural diasters from 2010-2019. The frontend consists of two views:

- Cross Section: user can explore the relationship between demographics and FEMA aid provided at the county-disaster level, exploring how different county demographic factors are related with aid levels for a given disaster or disasters.
- Deep Dive: user can view specific statistical relationships between demographics and aid, as well as geographic data, of three specific hurricanes.

Code Responsibilities

- Everyone: code reviews; collaborative code troubleshooting
- Aditya: project management; Dash frontend, deep dive view
- Ali: FEMA API; ACS & FEMA blending; shell script
- Wesley: ACS API; data cleaning & statistical models
- Zander: frontend wireframing & styling; Dash frontend, cross-sectional view

App Interaction (Setup)

To launch the user interface from the UChicago Virtual Desktop (locally, skip to step 2):

1. Follow the guide for accessing the virtual desktop here
2. After cloning the code, open a terminal and navigate to ./lamontypython/ within the root directory.
3. Run the shell script "install_and_run.sh" from this directory to setup a virtual environment and then run the code (this may take a few minutes).
4. Once the script is running you should see a URL to the dash app in the terminal like this:
   `Dash is running on http://127.0.0.1:8050/`
   Copy the url into Google Chrome (not Firefox, not all visuals will work) and you're in!

Goals & Accomplishments

In our project, we generally sought to create an application that enabled users to explore and understand the relationship between demographic characteristics and aid received by counties affected by natural disasters that was easily scalable. We accomplished our goal of creating a piece of functional software that allows users to explore most natural disasters in the time period 2010-2019 since our application connects directly to FEMA and ACS data APIs. We also built a suit of statistical models that focus on several natural disasters, but can also be easily scaled to incorporate more natural disasters because of the modular design of our data connection and regression models.

If we were to improve further on our project, we would work to get a deeper understanding of the FEMA data beyond what could be gleaned from the FEMA documentation and we would make our regression models more robust by increasing data granularity and cleanliness. The FEMA documentation was vague around some key variables, such as specific types of aid and their significance, that we used in our analysis and would require clarification from a data SME. The regression analysis suffers from data gaps seen in both the ACS and FEMA datasets. For example, there is no data for Puerto Rico. The lack of significance seen in our regressions can very likely be an attribute of this. In future versions of this project, expanded efforts to root out the true effect of neighborhood characteristics on FEMA aid could be undertaken.