Checkpoint 1: US Federal Spending

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Proposal Changes

oh no!

The majority of the initial proposal is intact, the only change we are making is how we will access the dataset. Due to an unforeseen change, the DB is not available on AWS RDS anymore, instead, to work with the dataset or access it, we are required to either download the database completely, which is roughly 40 GB, or search and download smaller datasets from the website. The current method in accessing the dataset will be discussed in the Dataset Management section.

this is fine.. just pick a subset either in time or place

Additionally, due to the size of the dataset, we are currently exploring trends in Colorado only and expanding our search for trends to different states (e.g., California, Colorado, Kansas) to compare how awards vary between each state and the reasons behind the variations given different traits and characteristics of these states.

The rest of our initial proposal is the same. We added and modified sections per the feedback we received about the types of trends we want to find, and it is highlighted in yellow.

Timeline

Week	Date	Complete Task by End of Week
Week 1	10/29 – 11/04	Complete Proposal, Access Datasets through AWS
Week 2	11/05 – 11/11	Narrow on datasets related to the problem only. Perform ETL
Week 3	11/12 – 11/18	Data Aggregation using Spark & EMR
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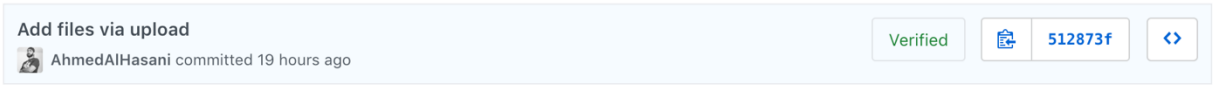
The colored texts include the weeks and tasks completed. The only tasks we did not achieve yet is using Spark and EMR to aggregate data because of the database and datasets issue we faced. We will discuss the work done by each member in the subsections below, but we did not include a GitHub screenshot, instead, we decided it is more efficient and effective to separate the tasks among ourselves and that each member will develop their own scripts and upload them separately to our GitHub page, so that it is clear what each of us completed so far.

1) Ahmed

Commits on Nov 15, 2018



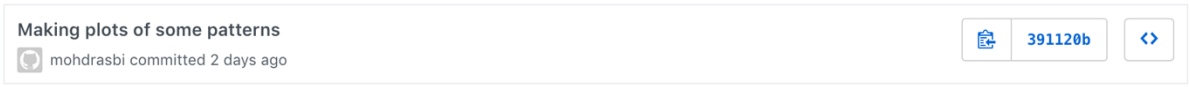
I extracted information from the original dataset and created new dataframes each with new information containing trends or patterns explored. The dataset I focused on is *All Agency Awards Colorado 2018*. The patterns I explored and printed in my notebook are:

1. Counted the top values in each category (according to how many times they received awards):
    a. Award Description.
    b. Counties and cities in Colorado.
    c. Business types in Colorado.
2. Most frequent awards given in Colorado and mapped them with their total obligations.
3. Counties and cities in Colorado that received the highest obligations.
4. The business types in Colorado with the highest obligations.

Future work and exploration include exploring the same patterns across multiple years, going back to 2010, categorizing awards (e.g. Education, Health), and comparing them with two other states that differ from Colorado.

2) Mohamed

Commits on Nov 14, 2018



Created two plots from which we can get an idea about the dataset and could be a start to finding other patterns: (1.png and 2.png in initial_findings directory)

1. The first plot shows the number of awards every fiscal year (2010-2018) that was granted by each agency. Each subplot shows the number of awards in a certain FY. After looking at this plot, we can get an idea of how many awards each agency granted to recipients throughout the years.
2. The second plot shows the total funding every fiscal year for each agency. We can use this plot with the first one to make a relationship between the number of awards and the total funding. The total funding attribute in the dataset is interesting because the values could be negative. We need to pay more attention to that in the future and make sure what exactly a negative value means in this context.

Future work will include creating plots for other states (for comparison), finding a relationship between total funding and the number of awards for each agency, and use some of the tools we used in class to help solve these problems.

3) Future Work

Per the timeline, by week 6, we will aggregate all these patterns and across all years and states we are interested each of us is exploring and summarize them.

Project Cost

We did not utilize AWS so far because we are able to download smaller datasets from USA Spending's website directly. We suspect that we will add all the downloaded datasets eventually to an S3 bucket and utilize AWS EMR to run Spark jobs on these datasets as they grow with time.

Dataset Management

As mentioned earlier, we were not able to use AWS RDS to access the dataset, so instead, we relied on the website to download datasets we need. The website is: https://www.usaspending.gov/#/download_center/custom_award_data.

In regards to data processing, the data are not noisy, because we restricted our work to datasets that are in .csv files only as opposed to .dat files which mainly contain long text paragraphs and indices and are not helpful for our project. Additionally, our datasets are very clean and easy to understand which minimized our ETL processes to data aggregation and pattern exploration mainly as explained in the Timeline section in more details and we did not have to clean our data.

keep pushing here… by limiting the size of the dataset, you may need to add something else to the project to make it a bit more technically interesting. come talk to me if you have some concerns.

CSCI 5323 Project Proposal: Understanding US Federal Spending

Ahmed Al Hasani, Mohamed Al-Rasbi

Problem Description

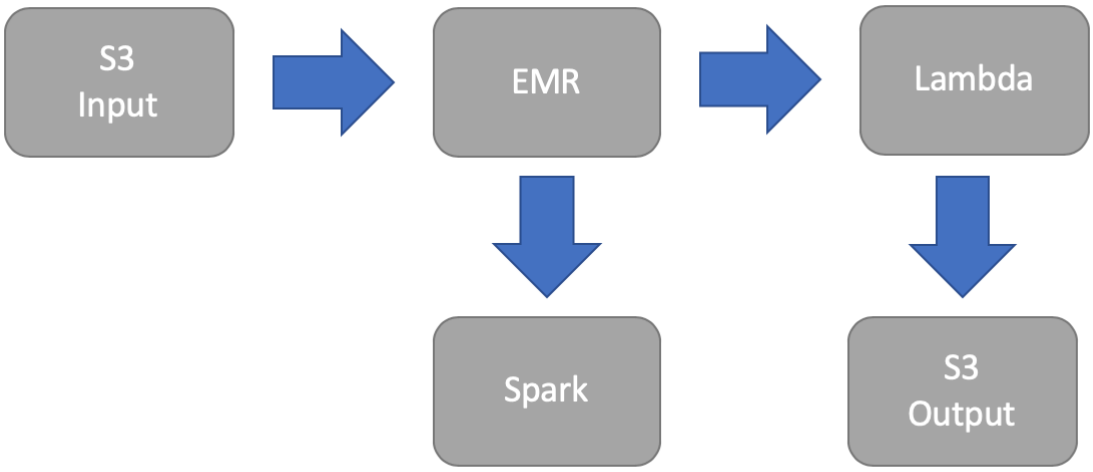
Since 2007, a government website launched to provide access to the federal spending data mandated by the Federal Funding Accountability and Transparency Act of 2006. The website, USAspending.gov provides information and data on all spending by the federal government. Politicians and news agencies make claims about spending behaviors and how it impacts US's debt and revenue. These claims change public opinion about different matters, and the change in public opinion leads to administration changes on many levels. As claims change public opinion, changes in public opinions also change policies and future spending. This change can be cyclic.

Our group wants to explore the data and extract information to communicate different spending trends along the years in accurate and simple manners. Additionally, the problem is very intriguing because there are numerous and various factors that impact spending. They include:

- Change of administration every 4-8 years
- World trends such as the Oil Crisis and the Financial Crisis in 2008
- Public opinions and reactions
- Debt

Therefore, we are extremely intrigued in understanding spending trends and trying to understand underlying reasons behind changes. Additionally, we want to communicate our findings through visualization the information in compact, simple, and interpretable manner with our peers and instructors.

High-Level Solution Architecture



1. S3 (input): We will use the s3 bucket that is publicly available to access the dataset. The data is stored in Amazon and can be accessed through Amazon Relational Database Service (RDS).
2. EMR cluster: Will be used to run spark and access the s3 input bucket easily.
    a. Spark - Three layers:
        i. Data extraction: The data will be extracted, processed and filtered by running computations in parallel so the execution becomes faster.
        ii. MapReduce: Might be used multiple times to count phrases to understand trends and patterns.
        iii. Data aggregation/analysis: once we compile different metrics and trends from MapReduce jobs, we will proceed to aggregate different results together to output in a spreadsheet and perform further analysis to visualize and communicate final results in our report.

3. Lambda function: After applying multiple spark functions on the data, we will apply lambda for row-individual-functions.
4. S3 (output): Finally, the output will be stored on an s3 bucket. Outputs can vary, they can be large text files, or a few CSV files. Text files might contain outputs from MapReduce jobs, whereas CSV files will include data rows with attributes of the final results we want to communicate and share with the class and in our final report.

Dataset

a) Dataset Used

There are various datasets provided through the website and hosted on AWS. Currently, we will rely two datasets provided by USAspending.gov which are:

1. Federal Accounts: Account Balances
2. Treasury Accounts: Account Balances

There are numerous and various datasets hosted and provided by USAspending.gov, however, we are still exploring datasets that we can use for our project and applicable with our tools. For instance, we accessed a dataset that contained two or three entries per line, which are

1. An index
2. A description of the transaction or account, written in a paragraph
3. A URL or special notes

This particular dataset is not applicable to aggregate, nor can we communicate information that is standardized among all accounts and data lines. One possible approach that we might consider is a word count, but rather than count all the words, we might count phrases and understand what kind of note is frequent among the dataset and communicate it if it is useful and applicable to our solutions for the proposed problem.

b) Data Description

Format

The website has many datasets that can be downloaded by specifying the following:

1. Award level
2. Award type
3. Agency
4. Time range
5. File format (csv, tsv, xml)

Preprocessing

The preprocessing of the data depends on what kind of trends and patterns we could extract. We want to analyze and collect information on how much each state spends, the description of that spending, the county/cities that receive the most awards, and to plot these trends over the years as far back as the data allows. Additionally, if we want to analyze what kind of budget function each federal account is spending on, we would preprocess the data such that these attributes would be used, and the rest would be excluded: federal_account_name, agency_name, budget_function.

Streaming/Static, Accessing and Storing Data

The data is available for download from 2001 until present and it is updated every day. We will access the data through the AWS S3 bucket/Amazon RDS that is publicly available and will store the final processed data on another AWS S3 bucket. The data is updated every night, while older data is static, there is a stream of new data at the beginning of each day.

Challenges

Communicating and visualizing spending habits of a huge country like the US can be very difficult. First, as computer science students, we lack the technical background to understand financial spreadsheets, and therefore, we anticipate learning how to read the available spreadsheets and the information the data is conveying. Secondly, as international students, we are unfamiliar with some of the institutions and their roles. We want to communicate interesting and unique spending habits and trends, hence, we will need to understand the different departments included in the datasets.

The challenges we are anticipating include:

1) There are thousands and thousands of listed accounts, aggregating spending data for each account and communicating how much each account spends can be time consuming, especially given the size of the data.
2) We need to understand each account and the background information related to the account and determine which accounts we need to focus on based on importance.
3) There are many attributes included in the data. We need to understand each dimension, and how it impacts our final results. For instance, the difference between 'budget authority unobligated balance brought forward' versus 'adjustments to unobligated balance brought forward'
4) The 40 GB and more size of the data provided offers various datasets. We will spend some time understanding each dataset and if we need to pair and combine various datasets together to communicate the information we gain and learn during the project.

Timeline

To ensure we stay on track to meet and completely fulfill the project's expectations, we aim to meet weekly milestones that we believe are ought to be met each week. Below, is a weekly timeline, the dates, and the task to be completed.

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