Data Visualization of COVID-19 Impact on US Labor Market

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Abstract. The labor markets all over the world are doomed to experience some degrees of turmoil since the patient zero of coronavirus appeared in 2019 December 1st. We have heard people complaining about the inconvenience this pandemic has brought us, and the stress caused by the job losses. COVID-19 has changed lives around the world and affected the labor market in the US. By visualizing the COVID-19 cases which includes data of employment state wise, job loss, COVID cases, etc, we visually how COVID-19 has affected the job losses on the current market between the states in the US.

Keywords: Information Visualization · D3.js · COVID-19 · State unemployment · COVID-19.

1 Introduction

The motivation behind this project is to geographically show the various parameters associated with COVID-19 data sets such as unemployment, unemployment rate by state, etc. As we all are aware of the fact that, unemployment is a major concern across the globe and this project aims to visualize different metrics and trends which will help improve the unemployment rate using visualization.

Our Visualization is about the confirmed cases of COVID-19, the unemployment rate, the number of job openings, the number of unemployment claims over the pandemic months. Our project aims to provide an overview of how the COVID-19 affected the U.S. labor market, and whether or not it is recovering from the impact of COVID-19. The data visualization technology can help researchers to identify how the COVID-19 pandemic impacted the unemployment rate with more ease. Otherwise, it can be difficult to recognize latent information like what potentially impacted the unemployment rate in a particular state.

The unique part of our project is that we not only focus on the trend of the unemployment rate over the pandemic months but also try to answer the question: "Are lost jobs coming back?". To achieve this purpose, we visualized the below information together in our project:

- The confirmed cases of COVID-19

- The unemployment rate
- The number of job openings
- The number of unemployment claims

In section 2 we have visited various websites which were related to COVID-19 and have done research on how they were related to job loss state wise. In section 3, we will introduce what data we have used and how we pre-processed them. In section 4, we will introduce our simple and clean layout with well-designed pages having a good story flow. In section 5, we will present how we designed the main charts in details.

2   Related Work

We found a line chart that visualizes the U.S. unemployment rate history since year 1929 with important events on the timeline, and we used a similar approach in the overview session in our website. Additionally, we also found how John Hopkins have visualized the data for COVID-19. Our works fit with other's work as we have answered the questions such as is there a significant relationship between COVID-19 confirmed cases and the unemployment rate? How this COVID-19 break out had its impact on the US labor market? Which states are recovering from the impact of the COVID-19 and which states are still struggling? And we visualized how the employment situation of each state acting differently from January-August 2020.

3   Data

We used the COVID-19 data sources from CSSEGISandData/COVID-19, JHU[1] and unemployment rate by state from US Local Area Unemployment Statistics[2]. COVID-19 data sets describe the confirmed and probable cases for COVID in the United states based on every states. Unemployment Data is the data which describes the trend of the unemployment rate acting in each state.

In US Local Area Unemployment Statistics, there are columns in the file and the data started from 2010 [2,3]. For the main purpose of our project, we mainly focused on the unemployment, year and month columns. We only focus on the data that was after 2019. Regarding COVID-19 data set, there are columns representing the confirmed, deaths and recovered. We have concentrated on the confirmed cases. Besides, we filtered the data for US. For both data sets, the files are separated by the state or by date. As we plan to draw the time series chart and compare the data between months, we grouped the data into a file for each data set or at least by state or by month. We also refer to the latest news release [4] from the US Department of Labor to give an overview of the current situation of the labor market as of October 2020. And the number of unemployment claims also come from the US Department of Labor database[5].

4   Approach

We used a simple and clean layout with well-designed pages to have a good story flow based on these references [1, 3] and course materials. We made use of commonly used interactive, responsive charts. This was in order to make the information more accessible who are new to this domain and to grab their attention. For example, we made use of lollipop charts and maps together to show the multilevel, multidimensional visualization of information using D3.js [6, 7]. Users can easily explore Data Exploration tab, and find the relationship between unemployment rate change and increased confirmed cases among states and the number of confirmed cases sorted by Unemployment Rate change with a single click and find patterns and relationships between these entities. All our interactive charts are put in this tab to let users better understand the relationship between COVID-19 confirmed cases and the unemployment rate change. We also draw maps and lollipop chart which are interactive and aligned with each other. Additionally, we have also shown how it changes when we select the stick of lollipop which region has number of confirmed cases sorted by unemployment change rate. We also have built a graph which gives the relation between pandemic and labor market. By showing different views at once, it is more informative and exploratory in nature to users. These kinds of visualizations are very useful to political scientists or people who want to delve more into this subject. Additionally, under Unemployment Claims tab, we further explored the number of unemployment claims in each state and try to answer the question: "Is the labor market recovering from the impact of the COVID-19?"

5   System

In this section, main technical parts of drawing charts will be explained. This explanation will help users understand how the D3.js codes in each chart work.
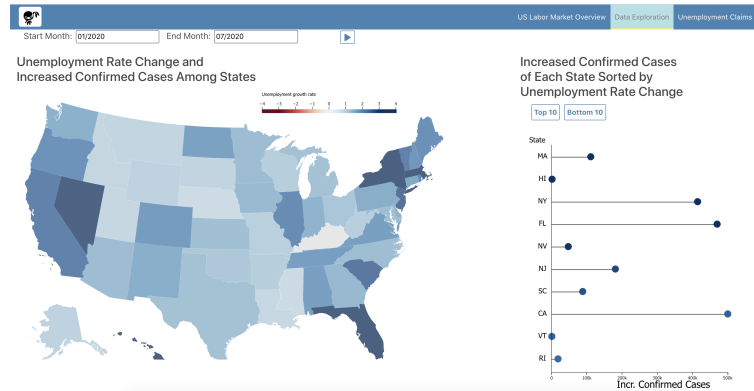

Fig. 1. D3 Map and Lollipop chart

5.1   Implementation of map

As shown in Fig. 1, the map aims to provide the general situation among all the states in US. We have used d3 map with "counties-albers-10m.json" to visualize the map. We first read the data from two csv files, and then aggregate the data using custom function[4]. Finally, we used the d3 path to color each state. The color of each state represents the unemployment change rate, and when hovering over the state, the name of state and the number of COVID case will show up.

5.2   Implementation of lollipop chart

This chart, shown as Fig. 1, can read parameters based on start date, end date, filter mode, read data from csv files, cleaning and aggregating them according to parameters. By using unemployment data to create state axis and candy color and have used COVID data to create COVID axis and length of lollipop. Then we wrote a function to make the chart interactive to filter buttons and month selectors and wrote a function to make the chart responsive to window size.

5.3   Implementation of line chart

The line chart provides the trend of COVID confirmed cases, unemployment rate and nationwide hiring rate from 2019 to 2020. Users can select state they want to explore by choosing the region in the combo box. To achieve such interaction and transition, we have utilized the "state" and "componentDidUpdate" in React. We first define a global variable and when user select a different state, the value of that global variable will be changed. Then, "componentDidUpdate" will be triggered and the chart will be updated. Moreover, we use transition function of d3 library so that the change looks consistently. The chart is shown as Fig. 2.
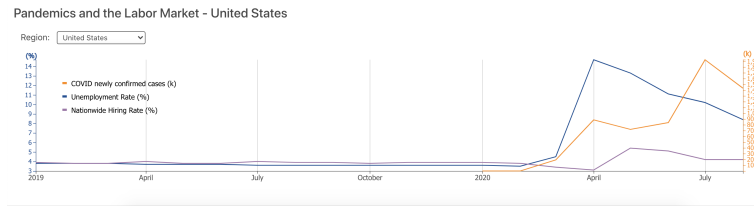

Fig. 2. D3 Line chart

5.4   Implementation of Mapbox

We have used mapboxgl library in react to build the chart and the radius of circle indicates the number of claim. To combine data information with the mapbox, we first transform data into geojson format and add layer with the transformed data into the mapbox[5]. Later, we have used "circle-radius" to specify the radius of the circle and the function is sqrt(number of claims)/15, shown as Fig. 3.
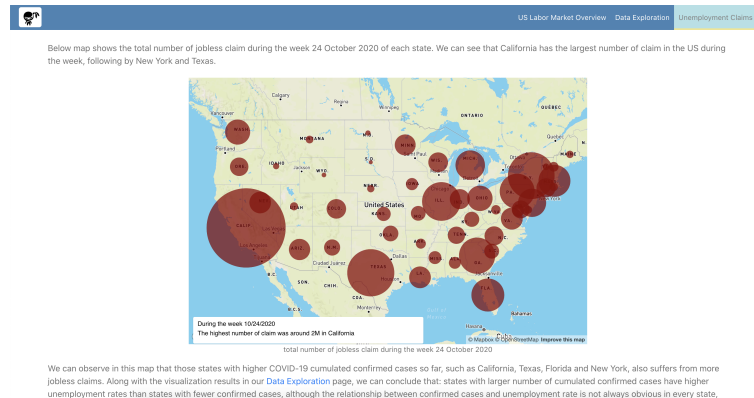
Fig. 3. Mapbox chart

6   Conclusion

The main contribution of our project is that it enables job seekers to figure out the relationship between the unemployment rate and the number of COVID cases. By viewing our website, users can get a clear insight of how the market is impacted and how it is recovering.

If we could have more time, we would have collected COVID related policies and announcements of each state, because we found out that policy also influences the unemployment rate. Additionally, we would add time series analysis to analyze the relationship between confirmed cases and the unemployment rate, because we think that the influence of the COVID to the unemployment rate is not instant, there might exist some time delay. We would also showed a 3-D maps since it might provide more insights.

References

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