DATA VISUALIZATION (CSE3020)

SLOT: B2/ L11+L12

J COMPONENT REVIEW 3

ANALYSIS OF COVID-19 AND ITS EFFECT ON THE ECONOMY

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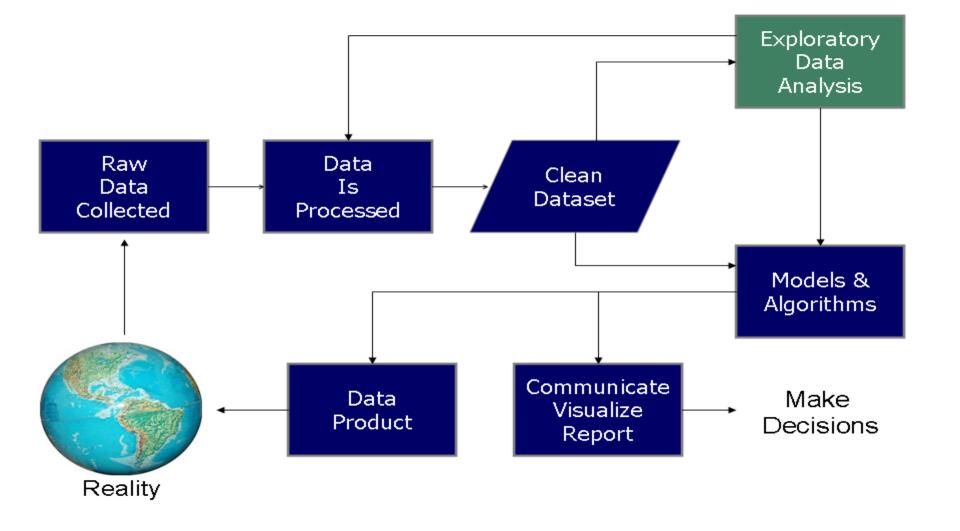KULDEEP PATEL (18BCE0079)

DOMAIN LEVEL

PROBLEM STATEMENT

The economic impact of the 2020 coronavirus pandemic in India has been largely disruptive. India's growth in the fourth quarter of the fiscal year 2020 went down to 3.1% according to the Ministry of Statistics.

It becomes very important to analyse the effect of covid 19 on economy and then understand the pattern to find it solution with the help of data visualization tools.

WHY OUR SOLUTION IS REQUIRED?

There were some common gaps that we identified between our project and the proposed researches in our literature survey. Some of them are as follows:

- None of the research taken in the survey related the corona virus cases in a structured format with the effect of this pandemic on the stock market and economy of the world
- We used data visualization tool instead of algorithmic research to show it to the common man like investors and office workers.
- Our algorithmic calculation take place in backend and hence it make the process easier for the common man to relate with our project and research.
- We related the cases of Covid 19 in all phases with the stock price corresponding to that phase unlike other researches. This will not only help present investors but will also help the future investors in case of similar pandemic situation. They can recreate the stock market rates using our software analysis.
- We also used the KNN model to predict the future stock values in our research work.

WHAT TO SHOW?

Our main focus is to analyse and display the covid 19 data in animated and graphical form so that user can easily grab the pattern. We will also relate the covid 19 data with effects on economy with the help of data visualization tools. We aim to cover following objectives through our project:-

➢ **Geographical Visualization:**

● The main and the most compelling reason for this visualization is so that we can visualize the spread of the virus for China to the rest of the world
● This graph shows the sudden rise in the number of cases in countries like the US, Italy, Iran.

➢ **Epidemiology curve**
● An "epidemic curve" shows the frequency of new cases over time based on the date of onset of disease.
● The shape of the curve in relation to the incubation period for a particular disease can give clues about the source.

➢ **Logistic Graph**
● We will be plotting a line graph of confirmed cases Vs. confirmed cases per day of CoViD19 across the world to visualize whether we are actually winning or losing from this disease.
● This graph shows all countries travelling along the trajectory of exponential growth and it makes it easy to depict which countries have managed to stop the exponential spread of the disease.

➢ **Spread Plots of Covid**
● The Covid19 data needs to be efficiently conveyed to people, since in the event of a pandemic like this, intuition cannot substitute for facts to understand how the spread is advancing.
● Visualizing collected data can make its interpretation easy, and can help others understand quickly what has taken others so long to collect and analyze. After all, a picture is worth a thousand words.

➢ **Line, Spread, Ratio and Color bar plot of Stock Market**
● The damage caused by COVID-19 is not confined to only select pockets of businesses but it is a widespread malady that is expected to keep the economy sick for a longer time
● With these visualizations we can have the magnitude of impact on each sector and which sector have suffered the most and continue to suffer.

PROPOSED WORK

We can divide our project into three distinct modules, that is Data Abstraction, Data Preprocessing and Data Visualization.

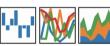| Data Abstraction	Data Preprocessing	Data Visualization
This section we will be focusing on the importing relevant data and datasets	This will mainly include processing the data so it can be used to create various plots and graphs	This module will be focused on using relevant API's to plot the required graphs

Tools Used:-

ENCODING AND INTERACTION LEVEL

HOW TO SHOW?

CHLOROPLETH VISUALIZATION

ANALYTICS:

The main and the most compelling reason for this visualization is so that we can visualize the spread of the virus for China to the rest of the world

This graph shows the sudden rise in the number of cases in countries like the US, Italy, Iran.

This also shows how countries are dealing with the pandemic in comparison to other countries by giving us a direct contrast in the number of cases and in each country.

By showing a visualization in time, it also shows which countries are improving and which in countries the situation is deteriorating.

This also helps us get a peek into the healthcare facilities by showing us the number of fatalities and recoveries of a given country.

This graph also shows where India stands globally in being able to manage the pandemic
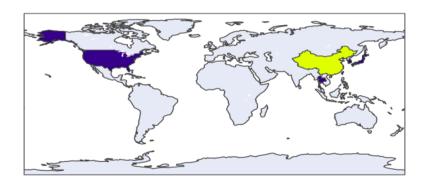
COVID19 Visualization Timeline

Press the play button to see an animation of the spread of COVID19 globally. You can zoom in and out and move around the map as well.
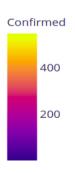
Select Type of Display :

Confirmed ✕ ▾

Countries with Confirmed Cases

Confirmed

400

200

DateStr=2020-01-22

▶ ■

2020-01-22 2020-02-11 2020-03-02 2020-03-22 2020-04-11 2020-05-01 2020-05-21 2020-06-10 2020-06-30
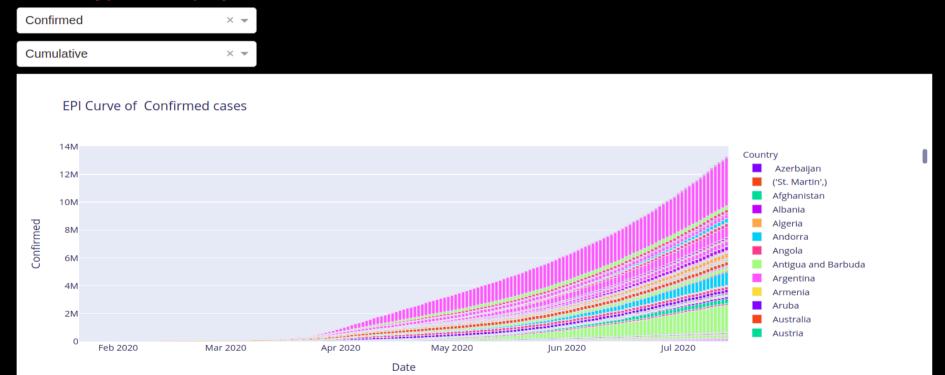
EPIDEMIOLOGY CURVE ANALYTICS:

- An "epidemic curve" shows the frequency of new cases over time based on the date of onset of disease.
- The shape of the curve in relation to the incubation period for a particular disease can give clues about the source.
- There are three basic types of epidemic curve :

  ○ Point source outbreaks (epidemics)

  ○ Continuous common source epidemics

  ○ Propagated (or progressive source) epidemic.

- In our case we are plotting Continuous common source epidemics.

  ○ These types of curves may also rise to a peak and then fall, but the cases do not all occur within the span of a single incubation period.

  ○ This implies that there is an ongoing source of contamination.

  ○ The down slope of the curve may be very sharp if the common source is removed or gradual if the outbreak is allowed to exhaust itself.

- Each country is assigned a different color which makes it clear to visualize which country is suffering more from covid19.
- We can also visualize for an individual country by selecting that country.

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Customizable

The following graph is an EPI Curve, it can be customized using the dropdowns below and on clicking a country to view the country specifics.

Select Type of Display :

Confirmed   ✕   ▾

Cumulative   ✕   ▾

EPI Curve of Confirmed cases

Country
- Azerbaijan
- ('St. Martin',)
- Afghanistan
- Albania
- Algeria
- Andorra
- Angola
- Antigua and Barbuda
- Argentina
- Armenia
- Aruba
- Australia
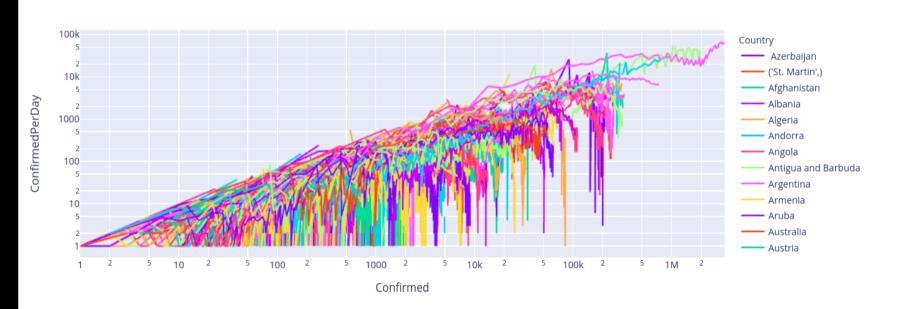- Austria

Logistic Graph
ANALYTICS:

- We are plotting a line graph of confirmed cases Vs confirmed cases per day of CoViD19 across the world to visualize whether we are actually winning or losing from this disease.
- This graph shows all countries travelling along the trajectory of exponential growth and it makes it easy to depict which countries have managed to stop the exponential spread of the disease.

- The general trend in this graph is crystal clear as all countries follow the path of exponential growth. This is clearly seen in countries like the US, India, Iran, etc.
- The countries that have managed to control this pandemic are clearly visualized as breaking off from this trend and falling downwards. This behaviour is seen in countries like South Korea, Hong Kong, Luxemburg.
- This graph also makes it clear even if a country doesn't have a lot of cases right now, covid19 is probably going to follow the same trajectory there and end up spreading.

Logistic

The following graph is a logarithmic plot of the timeline of COVID19. You can double-click on the countries on the right to view their inidividual timeline

- ***Spread Plots ANALYTICS:***

- The Covid19 data needs to be efficiently conveyed to people, since in the event of a pandemic like this, intuition cannot substitute for facts to understand how the spread is advancing.

- Visualizing collected data can make its interpretation easy, and can help others understand quickly what has taken others so long to collect and analyze. After all, a picture is worth a thousand words.
- With these plots We can visualize the number of Active , Recovered and Death cases in a particular country.
- We have also plotted a spread between the Confirmed and recovered cases which will help us to predict whether we are actually winning or losing from this disease.

Country-Specific

Select a Country and view its COVID timeline. You can select a section of the graph to zoom in as well.

Select Country :

India ✕ ▾

Spread plot of Cumulative cases in India

- Confirmed
- Deaths
- Recovered

Spread plot of Daily cases in India

- ConfirmedPerDay
- DeathsPerDay
- RecoveredPerDay
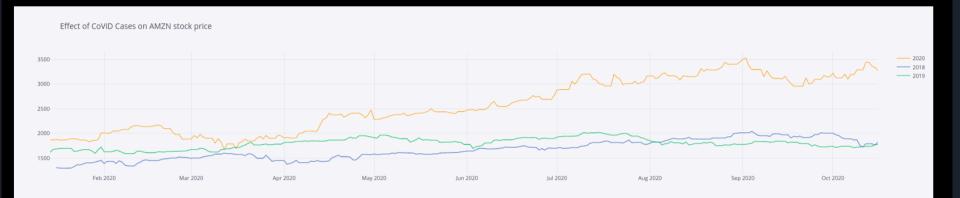
Stock Market Plot ANALYTICS:

- The damage caused by COVID-19 is not confined to only select pockets of businesses but it is a widespread malady that is expected to keep the economy sick for a longer time

- With these visualizations we can have the magnitude of impact on each sector and which sector have suffered the most and continue to suffer. According people can invest in stocks.
- Decision making in stock investment is often made based on current events in the market and the analysis of historical data on specific stocks. So these visualizations can help stock investors in putting their money in the right place.
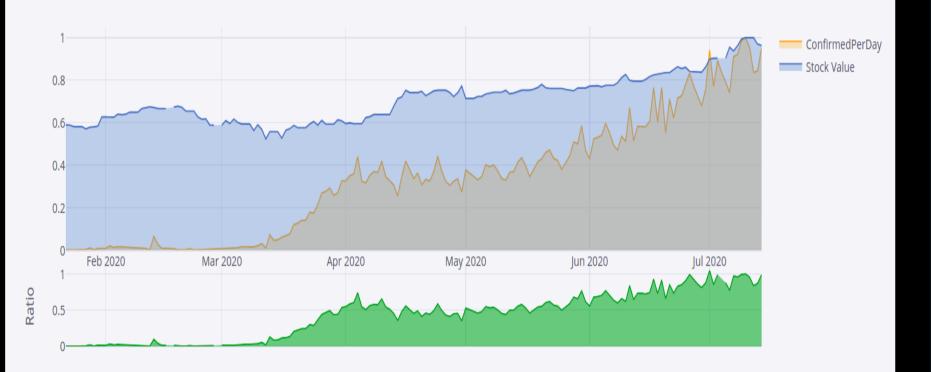
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Financial Hit

COVID19 has hit the market! It has affected the companies and a lot of people have lost their jobs as well. The below graphs are a Spread Plot of the stock prices of the company and how COVID has affected the company over time.
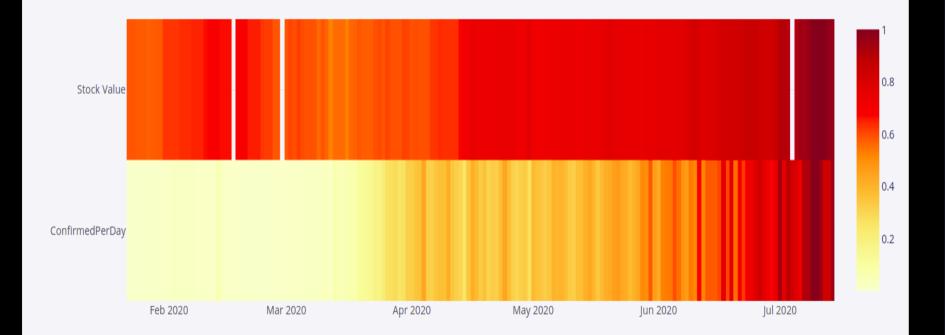
AMZN - Amazon.com, Inc.   ✕ ▾

US Market

Effect of CoVID Cases on AMZN stock price

— 2020
— 2018
— 2019

Spread Plot

— ConfirmedPerDay
— Stock Value

Area and Ratio Graph

Variation shown through Colour Shades

Prediction Model Analytics

● Our goal in this project is to use ETFs to predict the value of one composite stock. The premise for this is that, we can think of an ETF as a representative for the entire industry. Banking and financial firms are all pretty much correlated to each other as even a minor policy change could potentially affect all of them. Thus, by using the performance of the ETF to train our Machine Learning models, we can arrive at a healthy and reasonable prediction for target stock : JP Morgan(JPM)

● One way we can go about doing this is differencing the data. But since this is financial data, the quantmod package has a lot technical indicator functions which we can use to generate indicator data that more or less gets rid of seasonality.

● Some of the indicators, we have used are:

Visualization of Price History:

The highcharter library is a brilliant tool for generating visually appeasing and interactive charts. Although it's free for non-commercial/academic use, it requires a license for commercial use though. This is the first time we are playing with this library and we got to say, it's really neat. The following chart was generated using highcharter.

ALGORITHMIC LEVEL

• Stock Comparision

```python
def stockCompare(company, attr='Close'):
    start_date = '-01-15'
    end_date = '-10-16'

    stocks20 = data.DataReader(company, 'yahoo', f'2020{start_date}', f'2020{end_date}')
    stocks19 = data.DataReader(company, 'yahoo', f'2019{start_date}', f'2019{end_date}')
    stocks18 = data.DataReader(company, 'yahoo', f'2018{start_date}', f'2018{end_date}')

    stocks18 = pd.DataFrame(stocks18[attr])
    stocks18.columns = ['2018']
    stocks18['DDMM'] = pd.Series(stocks18.index.values).apply(lambda x: '2020-'+str(x).split(' ')[0][5:]).values

    stocks19 = pd.DataFrame(stocks19[attr])
    stocks19.columns = ['2019']
    stocks19['DDMM'] = pd.Series(stocks19.index.values).apply(lambda x: '2020-'+str(x).split(' ')[0][5:]).values

    stocks20 = pd.DataFrame(stocks20[attr])
    stocks20.columns = ['2020']
    stocks20['DDMM'] = pd.Series(stocks20.index.values).apply(lambda x: '2020-'+str(x).split(' ')[0][5:]).values

    compare = pd.merge(left=stocks18, right=stocks19, on='DDMM', how='outer')
    compare = pd.merge(left=compare, right=stocks20, on='DDMM', how='outer')
    compare.set_index('DDMM', inplace=True)
    compare.sort_index(inplace=True)
    compare.fillna(method='ffill', inplace=True)
    return compare
```

• Covid Data Frame Creation

```python
def sort_by_country(country):
    temp_df = df[df['Country/Region'] == country]
    temp_df = temp_df.drop('Province/State', axis=1).drop('SNo', axis=1)
    temp_df = temp_df.groupby(['Country/Region', 'ObservationDate'], as_index=False).aggregate(['sum'], )
    temp_df.columns = df.columns[4:]
    temp_df= temp_df[temp_df['Confirmed'] != 0]
    temp_df['ConfirmedPerDay'] = non_cumulative(temp_df['Confirmed'].copy())
    temp_df['DeathsPerDay'] = non_cumulative(temp_df['Deaths'].copy())
    temp_df['RecoveredPerDay'] = non_cumulative(temp_df['Recovered'].copy())
    temp_df['Country'] = [country]*temp_df.shape[0]
    return temp_df
```

- Graph Function

```python
def make_spread_plot(country):
    spread_data = df_country[df_country['Country']==country]
    spread_data.set_index('Date', inplace=True)

    spread_plot = spread_data[['Confirmed', 'Deaths', 'Recovered']].iplot(
        kind='spread',
        asFigure=True,
        title= f'Spread plot of Cumulative cases in {country}'
    )

    spread_plot_daily = spread_data[['ConfirmedPerDay', 'DeathsPerDay', 'RecoveredPerDay']].iplot(
        kind='spread',
        asFigure=True,
        title= f'Spread plot of Daily cases in {country}'
    )

    return spread_plot, spread_plot_daily

@app.callback(
    Output("barPlot", "figure"),
    [Input('barDispType', 'value'),
    Input('barDispSum', 'value')]
)
def make_bar_plot(dispType, dispSum):
    return px.bar(
        df_country,
        x='Date',
        y=f'{dispType}{dispSum}',
        color='Country',
        title=f'EPI Curve of {dispSum} {dispType} cases'
    )
```

- # Stock Plot Functions

```python
def make_stock_spread_plot(company, company_other):
    if(company=='OTHER'):
        company = company_other
    company_stocks = stockCompare(company)

    company_stocks_graph = company_stocks[['2020', '2018', '2019']].iplot(
        asFigure=True,
        title=f'Effect of CoViD Cases on {company} stock price'
    )

    stocks_affect = total_cases.join(company_stocks)
    stocks_affect['ConfirmedPerDay'] = stocks_affect['ConfirmedPerDay']/max(stocks_affect['ConfirmedPerDay'])
    stocks_affect['2020'] = stocks_affect['2020']/max(stocks_affect['2020'])
    stocks_affect.columns.values[-1] = 'Stock Value'

    stocks_affect_graph = stocks_affect[['ConfirmedPerDay', '2020']].iplot(
        kind='spread',
        asFigure=True,
        title=f'Spread Plot'
    )

    fig = stocks_affect[['ConfirmedPerDay', '2020']].iplot(
        kind="ratio",
        fill=True,
        asFigure=True,
        title=f'Area and Ratio Graph'
    )
    fig2= stocks_affect[['ConfirmedPerDay', '2020']].iplot(
        kind="heatmap",
        colorscale='ylorrd',
        asFigure=True,
        title=f'Variation shown through Colour Shades'
```

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THANK YOU