Data Science COVID-19 Group Project: Final Report

Effect Analysis of Movement Restrictions in the U.S. Major Cities

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Project Background and Abstract

Global spread of COVID-19 has infected over 3.5 million people and killed 247,000 people in the world as of May 4th. The United States of America is one of the most affected countries by this disease, which has over 1.18 million people infected and 68,000 deaths according to the latest information. In order to reduce the infection rate, the federal government and state governments have taken many countermeasures. The movement restriction is one and the most basic measure against the virus, but how effective is it actually?

In this project, we visualized and analized how mobility and number of daily COVID-19 cases/deaths are related in some U.S. major cities. The result shows that restricting movement of people has a significant effect, especially in New York City. Reducing the amount of physical contact decreases the risk of aerial and droplet infections; therefore, the movement restriction is undoubtedly effective.

Dataset and Data Source

1. **applemobilitytrends-2020-04-24.csv** https://www.apple.com/covid19/mobility
2. **daily-cases-covid-19.csv** https://ourworldindata.org/coronavirus#confirmed-cases
3. **daily-deaths-covid-19.csv** https://ourworldindata.org/coronavirus#confirmed-deaths
4. **Baltimore daily cases/deaths** https://coronavirus.baltimorecity.gov/
5. **Boston daily cases/deaths** https://www.mass.gov/info-details/covid-19-response-reporting
6. **New York City daily cases/deaths** https://www1.nyc.gov/site/doh/covid/covid-19-data.page
7. **Los Angeles daily cases/deaths** http://dashboard.publichealth.lacounty.gov/covid19

Project Procedure

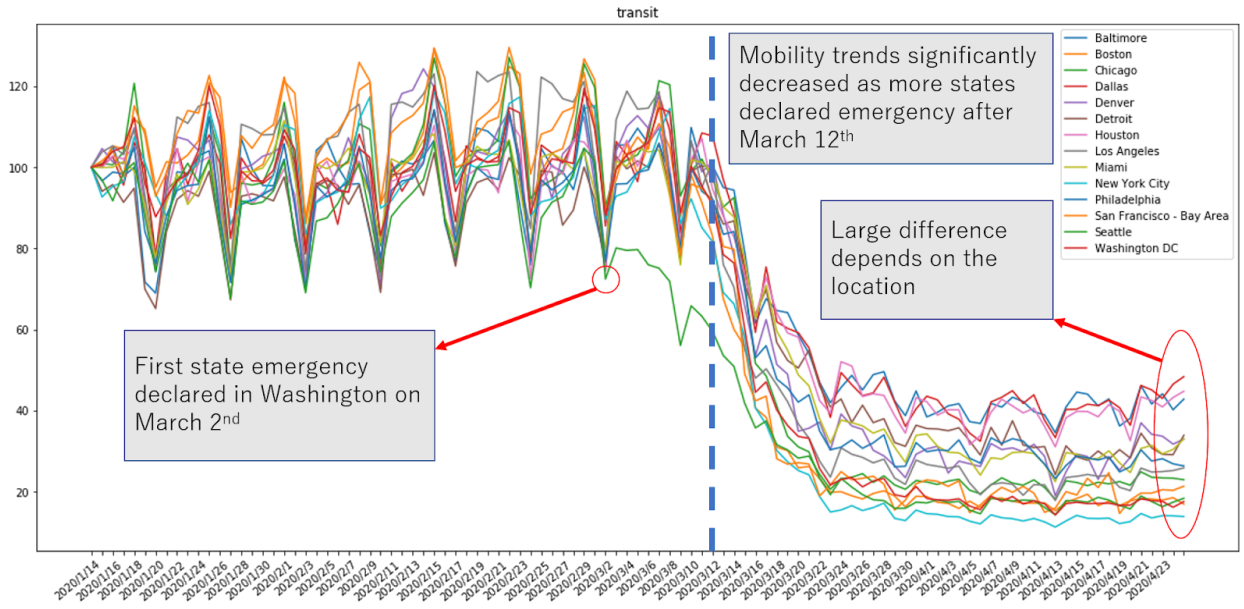
Week 3:

1. Select the topic for the project. We decided to find out how effective the movement restriction is in the U.S. cities (the combination of topic 6 and 7).
2. Gather appropriate dataset (1 - 3 on the list above). Some dataset required data extraction and cleaning for the project.
3. Visualize data on Jupyter Notebook. The plots are available on the GitHub repository: https://github.com/SPACE0724/DataScience-Project

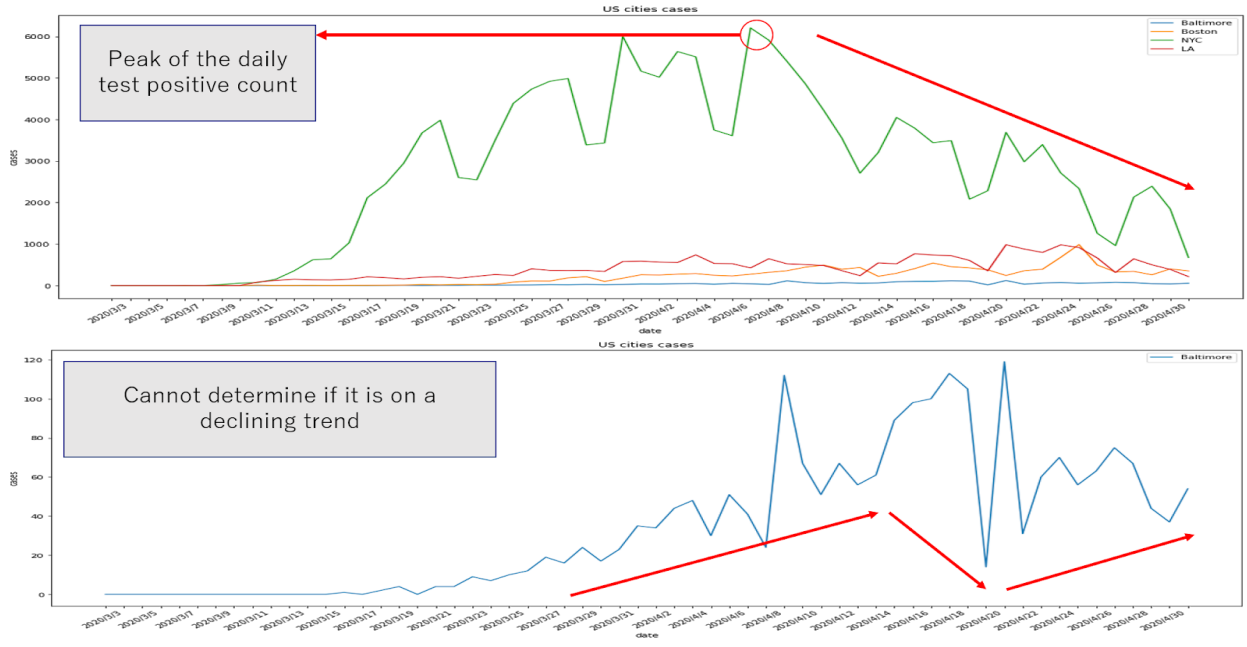
Week 4:

4. Create a dataset of daily cases/death of 4 U.S. major cities (4 - 7 on the list above) manually since the dataset is not available online.
5. Visualize data and combined with the result from the previous week.
6. Analyze the result and evaluate the effect of the movement restriction.

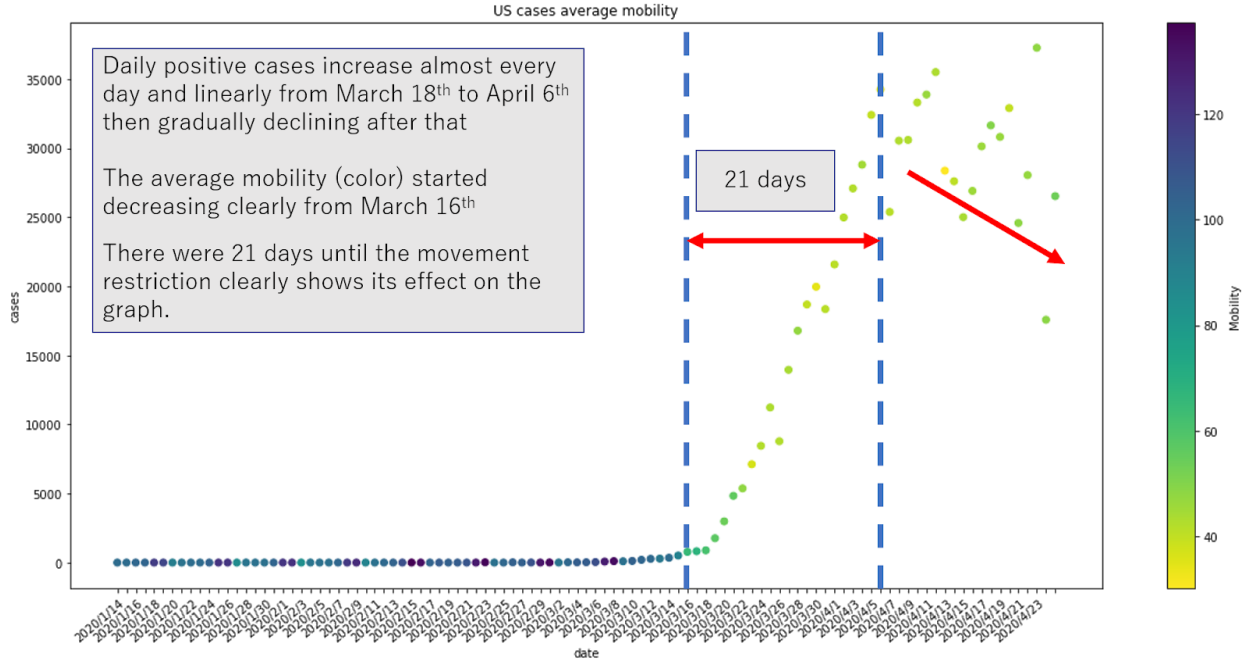
Results



This graph shows the daily transit (public transportation) mobility trends of 14 U.S. major cities. The first state emergency in the U.S. was declared on March 2nd in Washington and many other states also followed shortly after. The mobility trends started dropping significantly after March 12th since many states also declared emergency and announced the stay home order. However, the amount of decrement was limited in some locations. For example, Baltimore had about 43% mobility (compared to a baseline volume on January 13th) on April 24th while New York City only had about 14%, which is the ratio of 3.31 : 1. How does this difference affect the spread of COVID-19? Answering this question might help to support the effectiveness of the movement restriction.



We selected 4 U.S. major cities as samples and the figure above compares daily cases of 4 U.S. major cities (Baltimore, Boston, New York City, and Los Angeles). We cannot make an easy comparison because the number of cases in New York City is surpassing others, but the trend is undoubtedly declining in NYC while it is still unstable in Baltimore. Reminding the rapid spread of COVID-19 in March, even a small number of virus carriers who are not isolated can cause outbreak; therefore, those cities with lower movement restrictions might have the higher risk of pandemic later. On the other hand, the daily cases in NYC on April 30th was about 600, which is almost one-tenth of the peak on April 6th. Therefore, although there are more factors we should consider, the movement restriction significantly contributed to reducing new cases. Other cities like Boston and Los Angeles, which have relatively low mobility rates, also show the stable or declining trend so the movement restriction most likely has significant effect on the infection rate.



The plot shows the number of U.S. daily cases and the colors representing the average mobility (mean of walking, transit, and driving). The color of mobility clearly started changing on March 16th. From this day until April 6th, the daily positive cases continued to increase almost every day and linearly, then gradually declining after that. It took about 21 days for the movement restriction to show its effect on the graph. Even the countrywide data is indicating that the movement restriction is effective; however, it does require staying at home and avoiding physical contact with other people for more than 3 weeks patiently.

Hours Spent

Jack Edwin Tilley : 7 hours (Week 3) + 9 hours (Week 4) = 16 hours

Shunsuke Omura : 7 hours (Week 3) + 8 hours (Week 4) = 15 hours