Neighboring State Analysis for Covid-19 Cases

Brandon Cossin (bcossin@kent.edu), Troy Toth (ttoth5@kent.edu)
Advisor: Dr. Xiang Lian (xlian@kent.edu)
Department of Computer Science, Kent State University

Introduction

Coronavirus has claimed millions of lives across the globe, since its widespread emergence in 2020. CDC COVID-19 Spatio-Temporal dataset for state cases was used to find correlations between states overtime. Can the analysis of COVID-19 trends and relations between neighboring states help predict the spread and prevent the loss of lives?

Rolling window of 3 was used on the time series to calculate the correlation over time.

Pearson Correlation Coefficient was used to measure the relation between states.

$$r_{xy} = \frac{\sum_{i=1}^{n}(x_i - \bar{x})(y_i - \bar{\bar{y}})}{\sqrt{\sum_{i=1}^{n}(x_i - \bar{x})^2}\sqrt{\sum_{i=1}^{n}(y_i - \bar{y})^2}}$$

Contributions

- Used Python to identify trends of cases per state
- Node network was created to visualize the states and connections to their neighbors.
- States visualized spatially with the percent change in cases displayed as a color
- Correlation value displayed as a colored node to display a positive or negative change.
- Correlation strength displayed as edge thickness
- Animated temporal graph created for different time frames

Ohio Case Study

- The correlations are much weaker in 2020. Why?
- June 2020 correlations includes the April, May and June case numbers.
- In 2020 each state had no idea how to combat Covid correctly and were all learning and had many different mandates.
- West Virginia and Pennsylvania are negative because their numbers peaked in April and decreased in May.
- Ohio, Indiana, Kentucky and Michigan all followed the same pattern of increasing from April through May.

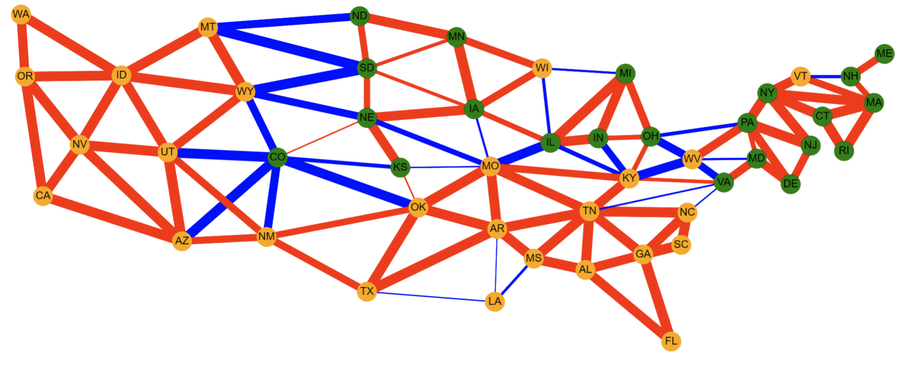

Figure 1: June 2020

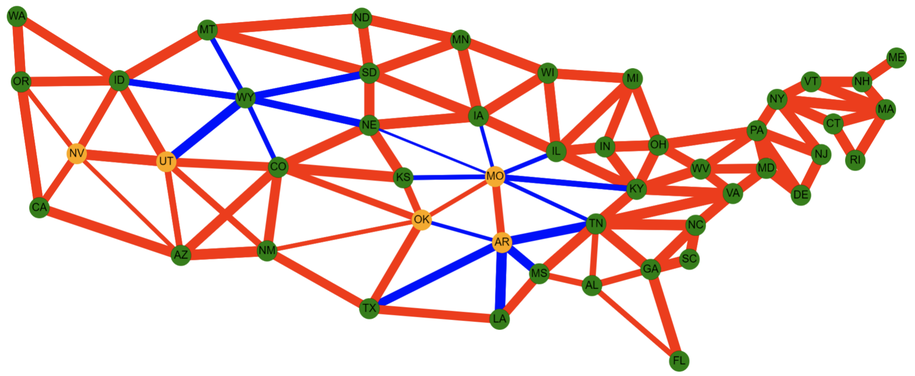

Figure 2: June 2021

States	June 2020 Corr.	June 2021 Corr.
Indiana	.421	.984
Michigan	.746	.966
Pennsylvania	-.314	.993
West Virginia	-.787	.965
Kentucky	.414	.989

Table 1: Ohio Case Study

Legend

New Case Change
- Increasing
- Decreasing
- No Change

Correlation Strength
- Positive
- Negative

Conclusions

- The overall investigation shows us that each state have a strong positive correlation.
- The more the time frame is shrunk the more the correlations differ from state to state.
- Expected a wave like pattern as one state goes up it causes its bordering states to increase and then so on throughout the country.
- In general, they seem to increase/decrease in unison.

Future Work

In the future we could investigate why these state outliers exist for each case. We could explore if these outliers are caused by the many differences in each state's different lockdowns, mask mandates etc..

References

- Centers for Disease Control and Prevention, COVID-19 Response. COVID-19 Case Surveillance Public Data Access, Summary, and Limitations
- Wikipedia contributors. (2022, March 24). Pearson correlation coefficient. In *Wikipedia, The Free Encyclopedia*. Retrieved 16:34, March 24, 2022, from https://en.wikipedia.org/w/index.php?title=Pearson_correlation_coefficient&oldid=1078965237

Acknowledgments

- This project was supported by Choose Ohio First Scholarship Program.
- Special thanks to Dr. Xiang Lian