**Project Outline**

**Name –** Temporal and Spatial Trends in US Covid-19 Cases and Deaths

**Introduction**

Covid-19 is novel, highly contagious, acute respiratory virus that was first identified in December 2019 in Wuhan, China. Over the course of the following 14 months, this virus spread rapidly to every corner of the globe, becoming one of the deadliest pandemics in recorded history. In the United States, the first confirmed Covid-19 case was identified in January 2020 and by mid-March there were confirmed cases in every single state and North American territory. In the midst of this rapid pandemic spread, epidemiologists and modelers struggled to accurately forecast the spatial and temporal trends in cases and deaths. However, with regularly updated, publicly-available covid tracking data, a sufficient amount of data now exists to retroactively examine how cases and deaths evolved over the course of this 14 month period. This study utilizes the New York Times Covid Tracking Data to statistically analyze trends in the timeseries of Covid-19 cases and deaths as well as the spatial development of cases at the state level across the united states using cluster analysis.

Utilizing national and state aggregated covid case and death data this study stat

The **COVID-19 pandemic**, also known as the **coronavirus pandemic**, is an ongoing [pandemic](https://en.wikipedia.org/wiki/Pandemic) of [coronavirus disease 2019](https://en.wikipedia.org/wiki/Coronavirus_disease_2019) (COVID-19) caused by [severe acute respiratory syndrome coronavirus 2](https://en.wikipedia.org/wiki/Severe_acute_respiratory_syndrome_coronavirus_2) (SARS-CoV-2). It was first identified in December 2019 in [Wuhan](https://en.wikipedia.org/wiki/Wuhan), [China](https://en.wikipedia.org/wiki/China). The [World Health Organization](https://en.wikipedia.org/wiki/World_Health_Organization) declared the outbreak a [Public Health Emergency of International Concern](https://en.wikipedia.org/wiki/Public_Health_Emergency_of_International_Concern) in January 2020 and a pandemic in March 2020. As of 11 March 2021, more than [118 million cases](https://en.wikipedia.org/wiki/COVID-19_pandemic_cases) have been confirmed, with [more than 2.62 million deaths](https://en.wikipedia.org/wiki/COVID-19_pandemic_deaths) attributed to COVID-19, making it one of the [deadliest pandemics in history](https://en.wikipedia.org/wiki/List_of_epidemics#Top_epidemics_by_death_toll).

* **C**ovid 19 cases was a novel respitory virus that quickly spread across US in 2020
* Cases exponentially grew in different states at different times
  + Early spring peak for NY
  + Summer Rise for South (Florida, Texas, Arizona)
  + Fall Rise for West (Ca)
* New Death rate lagged behind cases by a few weeks
  + Incubation time for virus
  + Takes time for people to get sick, go to hospital, die
* ***Can we develop a model to predict future deaths based on current case numbers?***

**Methodology**

* **Exploratory Data Analysis - Micah**
  + Visualizing timeseries for average daily cases and deaths by state
  + Spatial trends
    - Box plots grouped by states
  + Visuals and statistics for monthly trends in cases by states
    - Box plot of average daily cases per month by state
    - Box plot of average daily deaths per month
  + Animated Map of cases across states
    - Shows when different regions were at their peak
* **Clutering analysis for heriartchy of states**
* **Timeseries lag anayslis**
  + Developing Lag-1 Autogressive model to predict daily deaths as a function of cases
  + What is the lag between the deaths and cases?
  + Is it consistent between states?

**Results**

* EDA
* Clustering Analysis
* Timeseries Analysis
  + How well does AR-1 Model Perform?

**Discussion**

* **Are there relationship between states? - Clustering**
  + What do they have common?
    - Location
    - Poltiics
    - Demographcs
* **Temporal Trends**
  + Does the lag between cases and deaths make sense
  + Can we predict with cases and/or deaths

**Conclusions**

* What are the implications for public policy?

**Appendix –**

* Figures, Tables, Codes