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Digital Humanity 101

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Individual Project Topic

COVID-19 (previously known as 2019 Novel Coronavirus, or 2019-Nov), is a respiratory virus first identified in Wuhan, Hubei Province, China; however, the etiology still reminds unknown. A novel coronavirus is a coronavirus that has not been previously identified, which presumably originally emerged from an animal source but spreading from person-to-person. It’s important to note that person-to-person spread can happen on a continuum through the air. Some viruses are highly contagious, while other viruses are less so. Common signs and symptoms of Covid-19 infection include symptoms of acute respiratory disorders such as fever, coughing, and shortness of breath. In severe cases, Covid-19 can cause pneumonia, acute respiratory syndrome, kidney failure, and even death. The clinical signs and symptoms reported in the majority of cases are fever, with some cases having difficulty breathing, and X-rays show extensive pneumonia infiltrates in both lungs (Holshue et al., 2020; Perlman, 2020).

Most importantly, the average incubation period is 2-14 days with the longest incubation period of 27 days (Shen et al, 2020). Such a long incubation period and flu-like early-stage asymptomatic spread made Covid-19 extremely hard to be contained. It is true that almost every country has reported a few confirmed cases of Covid-19. However, while some countries have devastated by the increasing amount of illness and infection numbers, others have experienced relatively less breakout of the disease. For example, researchers have noted some neighborhood countries have had vastly different experiences. While the new coronavirus has caused 207,525 people infected in Iran, it’s neighbor country Iraq has reported 29,157 infected and 32,676 infected in Afganastan. Despite Iraq and Afghanistan’s population together is similar to the population in Iran, the confirmation number is only a third of Iraq’s infection population. Apparently there are numerous of reseason that could lead to such diverse outcomes such as government response, population density, culture distance, and elderly population. However, I found that the weather and humanity of a place could be potential factors that can largely affect the transmission of the disease. A warmer and more humid environment, harder the Covid-19 can transmit through the air.

Existing studies find that temperature and humidity have a significant influence on the number of confirmed cases for a certain location. On the other hand, indirect evidence shows the transmission of Covid-19 in the local community among tropical areas, which indicates that the impact of meteorological conditions on Covid-19 may not be as big as those on the flu and colds. Therefore, the accurate measurement of the influence of weather conditions on the transmissibility of Covid-19 is important for the knowledge of the general public. However, until now, there is no direct evidence demonstrating the influence of temperature and humidity on the transmissibility of Covid-19.

The goal of this project is to quantify the influences of temperature and humidity on the transmissibility of Covid-19, through analyzing Covid-19 data from the U.S.(https://github.com/CSSEGISandData/COVID-19/tree/master/csse\_covid\_19\_data, https://github.com/Yu-Group/covid19-severity-prediction/tree/master/data), and the climate data(https://www.nodc.noaa.gov/access/)with statistical analysis, data visualization, and machine learning to simulate the prediction on the future trend of the pandemic using last year’s climate data. Specifically, I will use a three-compartmental SIR model to simulate epidemiological data pairing with the meteorological data, which allows us to see the pandemic trend in an earlier stage.

I expect to find out a negative association between temperature/humidity and Covid-19 transmission using samples of the daily transmissibility of Covid-19, temperature, and humidity, and 1,005 U.S. counties, which should align with the result that high temperature and high humidity can reduce the transmission of influenza. During the process researching through the project, I expect learn more about how the virus and influenza become a pandemic through learning about the SIR model, and to learn more about the transmission of the virus especially its stability in various climate conditions