Abstract:

The rapid spread of Coronavirus has affected the whole world from different aspects. The United States, with the most infected cases in all the countries at now time, is experiencing significant economic and social challenges due to the decreased domestic mobility. Some researches have analyzed potential risk factors that may influence the transmission of COVID-19 and some researches have found correlations between Americans’ traveling behavior and some factors. However, there is a lack of research on identifying what factors of a region are correlated with people’s level of responses to mobility interventions, such as the national emergency declaration on March 13, and what factor is correlated with the change of mobility. Our work is intended to investigate regional factors that influence the change of mobility in response of the Coronavirus outbreak. We utilized Geographically Weighted Regression Model and data from Apple Mobility to analyze the impact of increasing cases at all counties within the United States on people’s mobility in nearby counties. Meanwhile, we used the same model to acquire characteristics of a region that are more influential in the change of local mobility. Also, we utilized data from Google Trends to represent the panic level of American people and analyzed its relationship with social mobility. Our study indicates that

Introduction:

The COVID-19 pandemic is an ongoing pandemic caused by SARS-CoV-2, which stands for severe acute respiratory syndrome coronavirus 2. The pandemic was first reported in Wuhan, China in December 2019 and quickly spread throughout the world. As for the United States, the Trump administration announced a national emergency on March 13th and attempted to slow down the transmission of the virus by issuing social distancing guidelines, which has a great impact on social mobility. According to the data from Apple COVID-19 Mobility Trends Reports, after the declaration of national emergency, the number of driving and walking flow has decreased over 50 percent at most compare to the traffic flow on January 13th. Moreover, the public transportation flow has diminished over 80 percent at most and shows a sign of sluggish recovery.

The rapid spread of Coronavirus has affected the whole world from different aspects. The United States, with the most infected cases in all the countries at now time, is experiencing significant economic and social challenges due to the decreased domestic mobility. Due to the practice of social distancing and mobility interventions, traffic flow has decreased dramatically, which is correlated with a large extent economic recession that could lead to social crisis such as high unemployment rate, closure of businesses, and supplies shortages, etc. Therefore, the cost caused by this pandemic is unmeasurable. According to predictions from Congressional Budget Office, this pandemic will inflict long-term damage on the U.S. economy, causing a shrinkage of 7.9 trillion dollar in the next decade. Besides the economic cost, the social cost brought by this outbreak is also nonnegligible. Epidemics like COVID-19 can weaken social institutions and decrease social trust because the destruction brought by this pandemic will not be distributed equally among the entire population. Therefore, families and communities will take the worst damage. In long-term, social structure will be uprooted as more and more social problems emerge due to this crisis. The society could not afford even one more day operating in such circumstance. More study on the relationship between social mobility and the spread of the pandemic is needed to help stop the spread of this pandemic. With a nationwide reopening attempt, decision makers and professionals need research basics to make better plans and adjust measures according to local social and economic features in order to avoid further spread of the pandemic and save the economy from collapse at the same time.

Some studies have analyzed potential risk factors that may influence the transmission of COVID-19 and some studies have found correlations of Americans’ traveling behavior with various factors. However, there is a shortage of research on identifying what factors of a region are correlated with people’s level of responses to mobility interventions, such as the national emergency declaration on March 13, and what factors are correlated with the change of mobility. Our work is intended to investigate how the change of mobility in a region can be affected by the development of the pandemic in other regions within this country. Meanwhile, we want to find out regional factors that influence the change of mobility in response of the Coronavirus outbreak and also analyze the correlation between the spread of the pandemic and these regional factors. We believe such study can give us an intuition on what cause people to reduce their social mobility and people from regions with what characteristics are more likely to reduce their mobility. We utilized Geographically Weighted Regression model and data from Apple Mobility to analyze the impact of increasing cases at all counties within the United States on people’s mobility in nearby counties. Meanwhile, we used the same model to acquire characteristics of a region that are more influential in the change of local mobility. Also, we utilized data from Google Trend to represent the panic level of American people and analyzed its relationship with social mobility.

Related Work:

COVID-19 has imposed great challenge to the whole society and many researches have been done to discover how and to what extend the virus affect our society. Earlier studies investigated the linkage between the change of mobility due to COVID-19 and demographic features at community level. Specifically focusing on the difference of mobility changes of younger communities and senior communities, a study conducted by Kabiri et al. from University of Maryland found that both younger and senior communities performed social distancing after the declaration of national emergency and both communities do not maintain the level of social distancing as time goes by, which is a phenomenon called social distancing inertia, according to the work of Ghader et al. Their work also indicates that senior communities responded to the social distancing guidelines faster than the younger communities and reduced their social mobility on a greater level. \cite{hu2020impacts} realized that the reopen of the society after the first wave of the pandemic will change the pattern and mode of transportation since people would have new preference over locations, so they used a Bureau of Public Road model to detect such mode transformation. \cite{Engle2020} used a simple linear regression model with self-defined variables to evaluate how local infection rate would result in the reduction of mobility. Askitas et al. analyze the impact of lockdown policies on COVID-19 transmission and population mobility in 135 different countries in order to understand the effectiveness of implemented policies and seek better solutions to fight against COVID-19.

There are also studies that focus on people’s attitude over COVID-19. For example, Gozzi et al. find the correlation of public attention with news media coverage and the progression of COVID-19 using data from COVID-19 related YouTube videos, relative discussion from Reddit users, and Wikipedia pages related to several countries where the virus broke out.

Our research is intended to investigate the mutually influence of mobility changes due to COVID-19 incidence among counties. Most of the former studies focus on mobility changes of different social-demographic characteristics, such as ages, income, and so on.

Data:

Model:

Results:

地图上哪些county对我这个county的影响

In \cite{huang2020quantifying} the author use two indexes, New Venues Created and Volumes of Visits to Venues, to estimate the impact of COVID-19 on the economy in different areas of China. And in \cite{martin2020socioeconomic} they set up a micro-economic model to get a insight of the impact of COVID-19 on the dynamics of household. \cite{gozzi2020collective} also finds the correlation of public attention with news media coverage and the progression of COVID-19 using data from COVID-19 related YouTube videos, relative discussion from Reddit users, and Wikipedia pages related to several countries where the virus broke out. In \cite{myers2020quantifying} the author explored how the pandemic influenced the research community based on a survey of approximately 4,500 Principal Investigators at U.S. and Europe-based research institutions. Since COVID-19 are highly contagious, less contact with people is critical to reducing the danger of being infected. Therefore, decrees were issued by the government and as the situation gets more severe people also consciously avoid traveling as possible. Thus, understanding how different social factors affect people's traveling decisions in such a special period is important. Academia has put much effort into exploring such topic. \cite{hu2020impacts} realized that the reopen of the society after the first wave of the pandemic will change the pattern and mode of transportation since people would have new preference over locations, so they used a Bureau of Public Road model to detect such mode transformation. \cite{Engle2020} used a simple linear regression model with self-defined variables to evaluate how local infection rate would result in the reduction of mobility. From this paper we could tell initially a small increase in infection rate would cause a great reduction of traveling. \cite{aless2020human} \cite{dahlberg2020effects} examines such impact in different areas in Europe under different policies. \cite{askitas2020lockdown} even did that work in a world wide range. Further more, the change of mobility itself also affect people's lives in many ways \cite{ong2020covid19} found that the reduction of mobility actually affect people's physical activity and sleep patterns.

In this paper, we will present a detailed analysis of different social factors that would affect people's mobility under the pandemics period. We used geographically weighted regression (GWR) model to estimate how 20 factors affect mobility in California. We use the mobility data from Google map which provides the relative flow change based on the average flow before the pandemic broke out. We also investigate how these relationships depend on demographic characteristics.