Travel Volume Modelling for Infectious Disease Transmission Risks Assessment

**Summary**

This proposal will introduce how to use travel volume modelling to evaluate the risks of infectious disease transmission. In today's environment of economic and transportation globalization, the risk of transmission of a series of infectious diseases will also become higher. Therefore, it is necessary to use traffic information for risk assessment. The main problems this project wants to solve include: 1. taking other key factors into account, such as the susceptibility of different regions; 2. visualizing the results for ease of use by passengers. In order to implement this topic, some data mining technics will be used, such as page rank and risk rank.

**Background**

Airborne, foodborne, and zoonotic infectious diseases transmitted ruing air travel are an important public health concern as air travel becomes more accessible and affordable. Currently, because of international travel, the spread of COVID-19 has become the norm and this is not a precedent. The SARS outbreak in 2002 showed that air travel can play and important role in the rapid spread of new infections and may even lead to epidemics. Therefore, it is necessary to estimate the future infection risk through the flight volume.

In response to this situation, various countries and institutions have also developed corresponding risk assessment mechanisms. Since 2007, the European Center for Disease Control and Prevention has launched the Risk assessment guidelines for infectious diseases transmitted on aircraft(RAGIDA). There is a series of algorithms behind the RAGIDA to support this project to be able to predict and prevent a range of infectious diseases such as anthrax and SRAS(Karl Schendel et al, 2009). Similarly, in China, some researchers have also developed a data-driven practical method for predicting the evolution of the new coronavirus pneumonia epidemic. Based on moving average prediction limit(MAPL), this project uses the previous SARS epidemic data to verify the practicability of the MAPL method for epidemic trend and risk prediction. The official data of COVID-19from January 16, 2020 was tracked to establish the corresponding MAPL for timely epidemic prediction and risk assessment(Hao et al., 202).

**Problem identification**

Although several projects have now investigated this issue, there are still some issues that need to be addressed. The first problem is that some models only consider the effect of connectivity between regions on infection risk. However, the spread of the epidemic also depends on the susceptibility of countries and regions with different latitudes and longitudes, and the sensitivity of local people to certain infectious diseases. Moreover, when implementing the actual infectious disease risk prediction method, it is also necessary to evaluate the situation in different regions to predict the risk. Therefore, more factors need to be taken into our consideration. The second problem is that currently, there is a lack of visual implementation of these models. This is very necessary because infectious diseases affect every passenger. Especially in today’s convenient transportation environment, it is necessary to make it easy for everyone to obtain epidemic risks information.

To solve these issues, I propose some objectives for the project.

**Objectives**

To implement this method, I will build a system that enable to do the following things:

* based on international air-travel volume, design and develop models for predicting the transmission of new infectious pathogens to and from different countries.
* build a user interface dashboard, which enable to update the travel data by the users.
* built an interactive visualization system that will use different data structures and graphic designs to help the users to explore the relationships, which would influent the transmission risks.

**Proposed solution**

This project will be implemented by two parts. The first one is the risks assessment model. In this part, each region of the world is regarded as a node, and each node is connected by the air-travelling. In this way, the whole world can be seen as a network. Thus, the page rank algorithm can be used to evaluate the risks. The reason for using this algorithm is that it takes into account the influence that neighboring countries have on a country. The second part is the visualized dashboard. This would help user to explore the current data by various types of graphs, which could assist to discover insightful results. Moreover, it could also be a real-time epidemic risks map for users as a reference.

In order to implement this project, I will take following steps:

* collecting relevant data, including demographic, healthcare, public health, disease dynamics, political domestic, political international and economic(Cadavid et al, 2021).
* use the data as the evaluation criteria to evaluate the risks of different countries.
* apply page rank algorithm to the graph network, and make iterations to build the model.
* writing and testing the user interface dashboard.

In conclusion, this system will give corresponding risk prediction information based on the data of different infectious diseases given by the user and perform it to the user in a visual way.

**Reference**

Cadavid Restrepo A, Furuya-Kanamori L, Mayfield H, et al. Implications of a travel connectivity-based approach for infectious disease transmission risks in Oceania. BMJ Open 2021;11:e046206. doi: 10.1136/bmjopen-2020-046206

HE Hao, HE Yun-ting, ZHAI Jing, WANG Xiao-jin, WANG Bing-shun. Predicting the trend of the COVID-19 outbreak and timely grading the current risk level of epidemic based on moving average prediction limits[J]. , 2020, 40(4): 422-.

Karl Schendel et al. (2009). Risk assessment guidelines for infectious diseases transmitted on aircraft. European Centre for Disease Prevention and Control.