

Determination of a Possible Origin for Influenza and Pneumonia for a Season

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ABSTRACT

In this study, from the data concerning the number of people who get influenza and pneumonia separately for each state in the USA, the known correlation between Flu and Pneumonia is proved with a correlation coefficient of 0.826805 and the possible starting points of these two diseases in the USA are determined via cross-spectral density function as Arizona, Minnesota and Montana.

INTRODUCTION

Influenza (flu) is a potentially life-threatening, contagious disease that is caused by a virus. The tissues temporarily become swollen and inflamed but usually heal within two or more weeks. When someone who has influenza sneezes, coughs, or even talks, the influenza virus is expelled into the air and may be inhaled by anyone close by. Viral pneumonia, which is a serious infection/inflammation of the lungs, is the most common serious complication of influenza.

In medicine it is very important to find what symptoms trigger a particular disease and to know which diseases are correlated with each other. In this study, it is aimed to prove the known correlation between influenza and pneumonia in order to suggest a new approach. In addition, in order to take precautions for an epidemic or pandemic disease, it is crucial to determine the starting point of the disease. In this study, a new methodology is suggested to help the determination of possible starting points of influenza and pneumonia.

METHODOLOGY

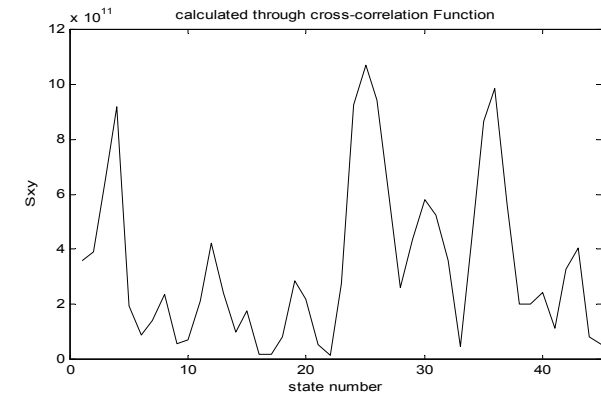
The number of people who get influenza and pneumonia state by state is obtained. An origin among 48 states is chosen and the distances of the other states with respect to the origin are calculated. This procedure is repeated for every state. By this way, \mathbf{r} matrix (48x48) is obtained. The correlation coefficients of influenza (ρ_{xr}) and pneumonia (ρ_{yr}) with respect to \mathbf{r} are calculated. In addition, the correlation coefficient between influenza and pneumonia is determined. The correlation coefficient being close to ± 1 implies a high correlation in direct or reverse proportionality. The cross-spectral density function through correlation-function is

calculated and plotted. The highest peak is expected to be the candidate for the starting point of diseases.

RESULTS and DISCUSSION

When the data is investigated, it is clear that flu cases are more widespread than pneumonia cases. The number of people who gets ill is expected to decrease with increasing distance(r). However, for some centers, there are ρ_{xr} and ρ_{yr} values being positive. This may be explained with the fact that, while the circular waves are going away from one center, for another center the spreading waves are coming closer.

The same ρ_{xy} value for every center is obtained as 0.826805, which is very close to unity implying influenza and pneumonia are highly correlated. This result is consistent with the general view. When S_{xy} is plotted with respect to states the highest peaks are obtained in Arizona, Minnesota and Montana respectively.



These locations, as the starting points of diseases, seem reasonable because of Minnesota and Montana being in the border of Canada with a cold and tough climate and Arizona being in the border of Mexico which may be a source of many diseases.

CONCLUSION

The correlation coefficient between flu and pneumonia is found to be 0.826805, which implies the known high correlation between them. The highest peaks on S_{xy} plot demonstrate the origins of the diseases. In this study, it is seen that the infections are multi-centered. Arizona, Minnesota and Montana are the possible starting points of diseases.

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