Whether the spread of disease is related to wildlife trade -- correlation analysis based on world wildlife trade data

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Abstract. The wild animal market is suspected to be the source of the current epidemic and the SARS epidemic in 2002, and the consumption of wild meat is considered to be a source of Ebola virus in Africa. In order to study whether the spread of disease is related to wildlife trade, this paper analyzes the wildlife trade volume in the year of SARS and COVID-19 outbreak from the perspective of time. The results show that the trade volume of scientific animals has increased significantly in the 2003 and 2020. From the biological point of view, we searched for some famous diseases and combined the annual epidemic data with the transaction volume of laboratory monkey. Through the analysis of the line chart, we concluded that the transaction volume of laboratory monkey has a certain correlation with the major epidemic, and then extended the conclusion that there is a certain relationship between the wildlife trade and the major infectious disease epidemic.

Keywords: Correlation Analysis, Epidemic Transmission, Wildlife Trade, Machine Learning.

1. Introduction

The wild animal market is suspected to be the source of the current epidemic and the SARS epidemic in 2002, while eating wild meat is considered to be a source of the Ebola virus in Africa. How to supervise wildlife trade in the long run has become a difficult problem. Excessive wildlife trade will accelerate the extinction of some species, while a comprehensive ban on wildlife trade will have a significant impact on the economy and science research.

At least 1/5 of vertebrates on the earth are traded in the wildlife market, and at least 8775 species may become extinct soon. This group of alarming figures comes from a research report published in Science on October 4. The researchers said that the global wildlife trade is more prosperous than previously thought[1]. Wildlife is traded as pets or animal products such as horns, ivory, medicine or meat. It is an industry worth billions of dollars, and therefore is widely regarded as one of the most serious threats to animals. In order to meet the rapidly growing global demand, billions of wild animals and plants are traded every year. This is an 'insatiable' demand. Globally, there are 8 billion to 21 billion dollars of illegal wildlife trade revenue every year, making it one of the largest illegal trade in the world[2]. We use CITES trade database as my data source. The database contains more than 20 million trade records, from which we select 5000 representative data and analyze them, hoping to be helpful for the analysis of the following problems.

2. Problems analysis and Conclusions

2.1. Purpose for the trade

Based on the comprehensive analysis of the database, we use a histogram to show the proportion of each item of animal trade. The results are shown in Figure 1[3].

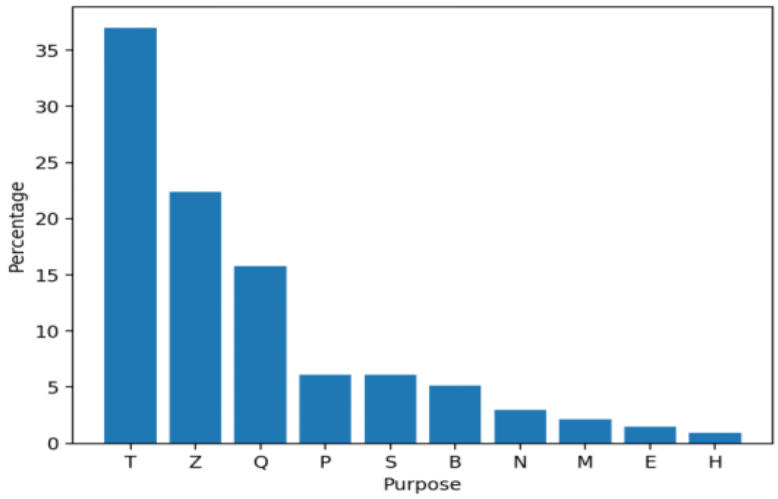

Figure 1. Proportion of purpose

Table 1. Meaning of each letter in Figure 1

Abbreviation	Meaning
T	Commercial
Z	Zoo
Q	Circus or travelling exhibition
P	Personal
S	Scientific
B	Breeding in captivity or artificial propagation
N	Reintroduction or introduction into the wild
M	Medical (including biomedical research)
E	Educational
H	Hunting trophy

Similarly, considering the correlation between the year span and the purpose of trade, we selected the top five purposes, used Python to draw a line chart for each purpose, and carried out a pearson correlation analysis. The results are shown in Figure 2-Figure 6 and Table 2-Table 6.

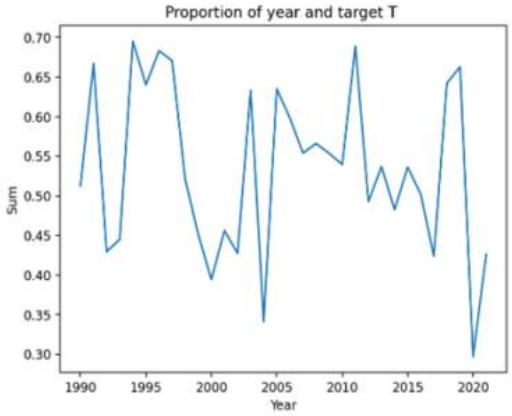

Figure 2. (a) Proportion of year and target T

Table 2. (a) Correlation of year and purpose T

	Year
Year	1.000
percentage	-0.182

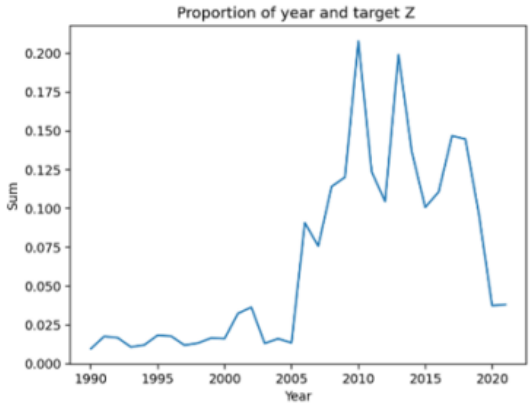

Figure 3. (b) Proportion of year and target Z

Table 3. (b) Correlation of year and purpose Z

	Year
Year	1.000
percentage	0.682

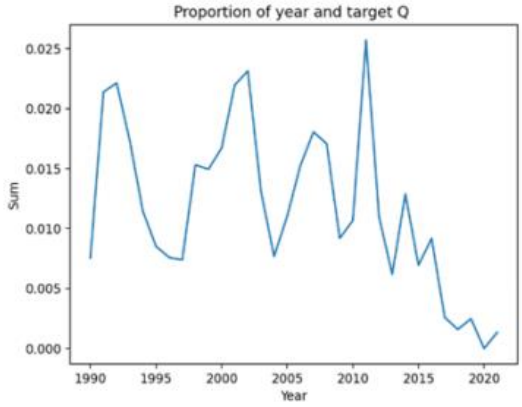

Figure 4. (c) Proportion of year and target O

Table 4. (c) Correlation of year and purpose O

	Year
Year	1.000
percentage	-0.521

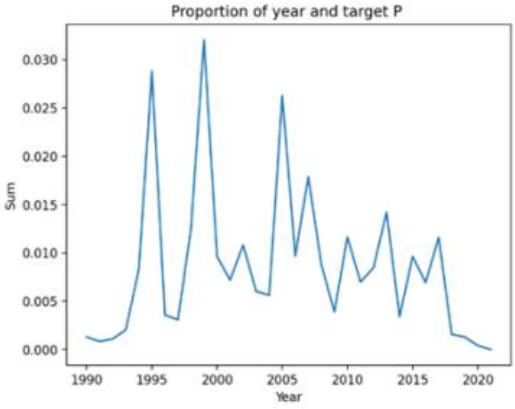

Figure 5. (d) Proportion of year and target P

Table 5. (d) Correlation of year and purpose P

	Year
Year	1.000
percentage	-0.129

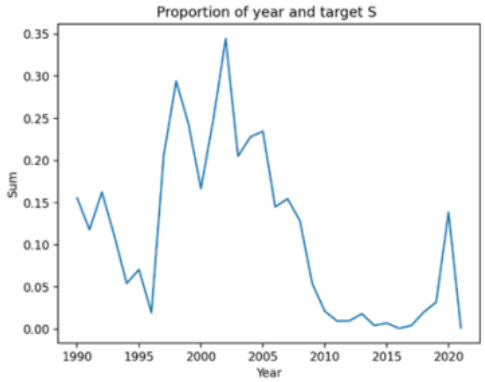

Figure 6. (e) Proportion of year and target S

Table 6. (e) Correlation of year and purpose S

	Year
Year	1.000
percentage	-0.516

From Figure 2, we can see that some purposes are not very correlated with the year, and some purposes have a more obvious positive or negative correlation with the year. The trade volume of animals used for science increased significantly in 2002 and 2020, which may be related to the outbreak of SARS and COVID-19. The Macaca fascicularis, an animal that has the largest trading volume, is an excellent experimental product, which can be used to assist human in biomedical research. Their trading volume declined in 1994 and 2004, which may be related to the laws promulgated by some countries. For example, China revised the Wildlife Protection Law of the People's Republic of China in 2004[4].

2.2. Analyze the changes in the world animal trade in the past 20 years.

We fit the animal trade volume over the past 30 years in the python Machine Learning in combination with the database. The images of linear fitting, quadratic fitting and cubic fitting are as Figure 7:

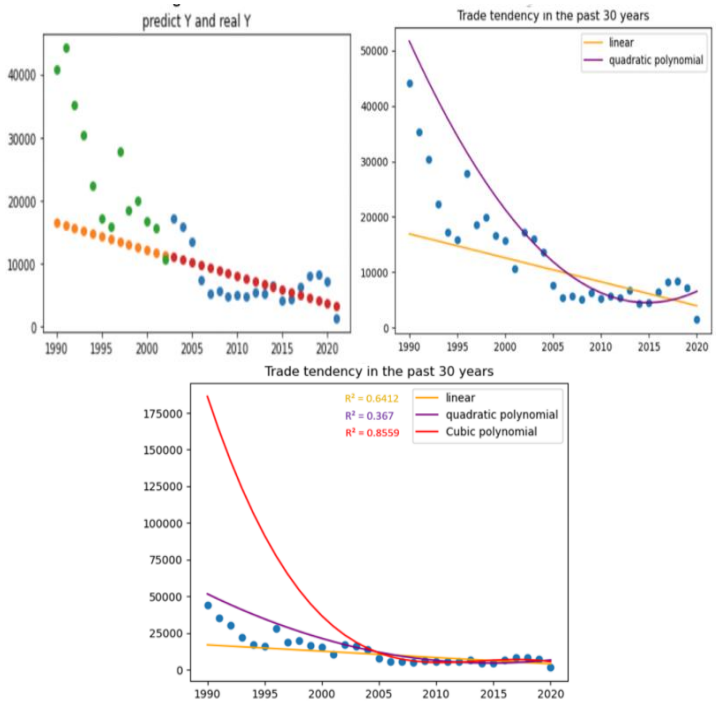

Figure 7. Fitting results

Combined with the image, it is found that there is a Runge phenomenon in the cubic fitting image. In the calculation method, polynomial is used to approximate a function and calculate the corresponding function value. In general, the more the degree of polynomial, the more data needed, and the more accurate the prediction. The higher the number of interpolations, the more the interpolation result deviates from the original function, which is called Runge phenomenon. So we eliminate the cubic fitting image, and then compare the linear fitting with the quadratic fitting .Comparing the fitting degree of two fitting methods, the fitting degree of linear fitting is 0.367, and the fitting degree of quadratic fitting is 0.6412, so the quadratic fitting image is more accurate[5].

The overall trend of trade is decreasing year by year, which may be due to theimpact of policies introduced by various countries, or the change in the number of species themselves. According to the data, although the volume of animal trade surged in some years, combined with the international background at that time, such as pneumonic plague in India in 1994, SARS in China in 2003, avian flu in China in 2006, and the increase in the number of animal trade species such as primates and rodents in these periods, experimental and scientific research increased. It is reasonable to assume that the increase in trade volume is not a coincidence but a necessity for the development of technology. It is hard to see an increase in the total trade of laboratory animals in the last decade, as countries have become more sophisticated in breeding and feeding them. Take the Macaca fascicularis as an example. This animal is a kind of good experiment. For a long time in the last century, this kind of monkey were traded in large quantities, resulting in a sharp decline in the number. In 2008, the Macaca fascicularis was included in the 2008 Red List of Endangered Species of the World Conservation Union. Nowadays, most of these animals are farmed. In the year of large-scale disease outbreak, the biological trading volume increased significantly and was used by scientists to research and fight against diseases [6].

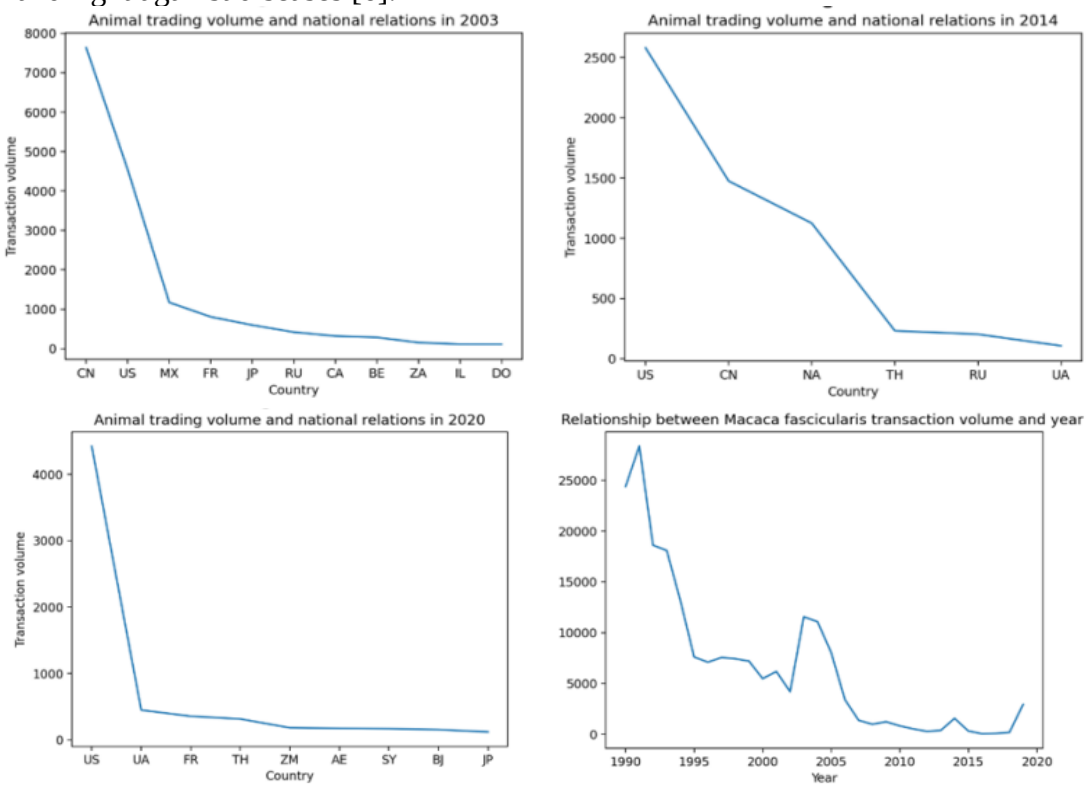

Figure 8. Schematic diagram of animal trade trend

Taking the trading volume of Macaca fascicularis as an example, we have drawn a line chart, Figure 8. We can see that the transaction volume of the Macaca fascicularis changes with the year, and the overall transaction volume shows a downward trend. However, it is not difficult to find that while the overall decline, the transaction volume of Macaca fascicularis in some years has increased. We checked the data and found that in these years, large-scale outbreaks occurred in the world to

varying degrees. As an experimental object, the Macaca fascicularis are usually used in biomedical research

We analyzed the countries where Macaca fasciculari transactions took place in 2002, 2014 and 2020, and obtained the results shown in the figure. It can be seen from the Figure 8 that most of the countries where the macaques trade broke out in these years. This shows that the transaction volume of Macaca fascicularis is related to the outbreak of large-scale epidemic[7].

2.3. Analyze whether wildlife trade is related to major disease outbreaks.

In 2017, Chinese biologists found that the SARS virus originated from a horseshoe bat population in Yunnan Province, China, but it first appeared in Guangdong, China, which can not help but associating with the relationship between wildlife trade and major infectious disease outbreaks.[8] In 2014, the Ebola virus broke out in West Africa. Experts believed that the outbreak was probably caused by the fact that Africans in Guinea ate the meat of bats with Ebola pathogens. This confirms our conjecture even more[9].

In this regard, we collected the number of people infected with large-scale infectious diseases in the past 30 years. For a class A infectious disease, such as plague, we add 2 to the year count for each historical outbreak, and for a class B infectious disease, such as gonorrhea, we add 1 to the year count for each historical outbreak.The simulation results are shown in Figure 9.

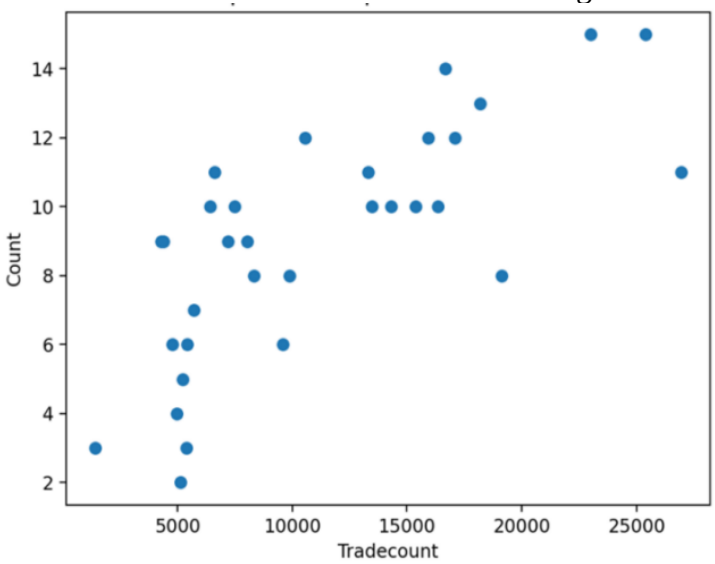

Figure 9. Relationship between epidemic outbreak and trade

Pearson coefficient was used for correlation analysis, and the correlation coefficient was 0.7332, indicating good correlation [10]. It can be inferred that there is a certain relationship between the volume of animal trade and the epidemic situation of major infectious diseases.

3. Conclusions

The large data prediction model for the user's electricity consumption is implemented in the Clementine software.

Considering the large year span of the data in the database, we use Pearson correlation coefficient to analyze the correlation between these components and the year, which is more comprehensive. We use python Machine Learning to fit the world wildlife trade in the past 20 years. After comparison, we find that there is no Runge phenomenon in the quadratic fitting, and the fitting degree is high. We choose the result of quadratic fitting as the final result. When analyzing whether the wildlife trade is related to the epidemic situation of major infectious diseases, we searched for some well-known diseases. Through the counting method established by our group, we combined the annual epidemic outbreak data with the transaction volume of the Macaca fascicularis, and through the analysis of the

line chart, we concluded that there was a certain correlation between the transaction volume of the laboratory monkey (take Macaca fasciculari as an example) and the major epidemic outbreak, and then extended to the conclusion that there was a certain relationship between the wildlife trade and the major epidemic disease outbreak.

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