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Short Communication

A New Graph to Display the Epidemic Outbreaks of Covid-19 in the World

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Abstract

The paper proposes a new visualization scheme for the registry of Covid-19 cases by calculating the mantissa of the registered ones, so there is no need of performing complicated mathematical calculations. As an example, six countries are randomly selected: Australia, Brazil, China, Colombia, Portugal and Venezuela. The results show that China is the only country that keeps the epidemic under control, while Australia begins a new outbreak after having previously controlled the epidemic. Colombia and Portugal show a very similar behavior of registered cases and, finally, we can see that Venezuela, Brazil, Portugal, and Colombia present a growth of cases that may trigger new outbreaks in the future. Results are obtained from data registered at Johns Hopkins University until July 18th, 2020.

Keywords:
Covid-19; Outbreak; Mathematics; 2019-nCoV; Epidemic

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Introduction

The World Health Organization declared a new pandemic due to Covid-19 on March 11th, 2020, and until July 25th, 2020, there have been more than 13 million infections in the world with more than six hundred thousand deaths according to the daily records made by the Johns Hopkins University. For this reason, it is necessary to design new computational methodologies that allow monitoring of cases by Covid-19 in real time, and to help design public policies that allow controlling the epidemic.

As can be seen in the scientific literature, multiple mathematical models are being carried out to monitor the Covid-19 epidemic [1-4], but they must be recalculated on a daily basis. For this reason, a simple mathematical operation is proposed to determine whether or not the epidemic is being overcome, and to visualize how severe the epidemic is in real time.

Computational Methodology

The daily case records for Covid-19 were obtained from the Johns Hopkins University database until July 18th, 2020, where six countries were randomly selected, *i.e.,* Australia, Brazil, China, Colombia, Portugal and Venezuela.

The mantissa is calculated according to the following equation:

$$\text{Mantissa (Cases)} = \text{Log}_{10}(\text{Cases}) - \text{Integer}[\ (\text{Log}_{10}(\text{Cases}))\ ]$$

Where Log_{10}(Cases) is the base 10 logarithm of the cases recorded daily, and 'Integer' is the integer part of the value obtained. So this value is plotted based on daily records. This calculation was recently mentioned in the scientific literature [3], but without discussing its advantages.

The advantage of using the mantissa calculation is that it is more sensitive to changes in recorded cases as opposed to a linear or logarithmic scale, since the results show how severe an epidemic outbreak can be depending on the shape of the peak of the graph instead of using a linear or logarithmic scale.

Results

Figure 1 shows the results obtained in the six selected countries. This figure shows that Australia begins to show a progressive growth of cases due to Covid-19 after managing to control the epidemic, where three epidemic rebounds, i.e. number of peaks depicted in the graph, are observed after the start of the cases registered in that country.

On the other hand, Colombia and Portugal show a similar behavior of the cases registered by Covid-19, where three maximums are observed after the initial outbreak, and it is also seen that the cases continue to rise along the time. China, after its initial outbreak, manages to control the epidemic. Brazil has several spikes in cases due to Covid-19, while Venezuela is starting a new epidemic rebound after showing less growth compared to its countries (Brazil and Colombia).

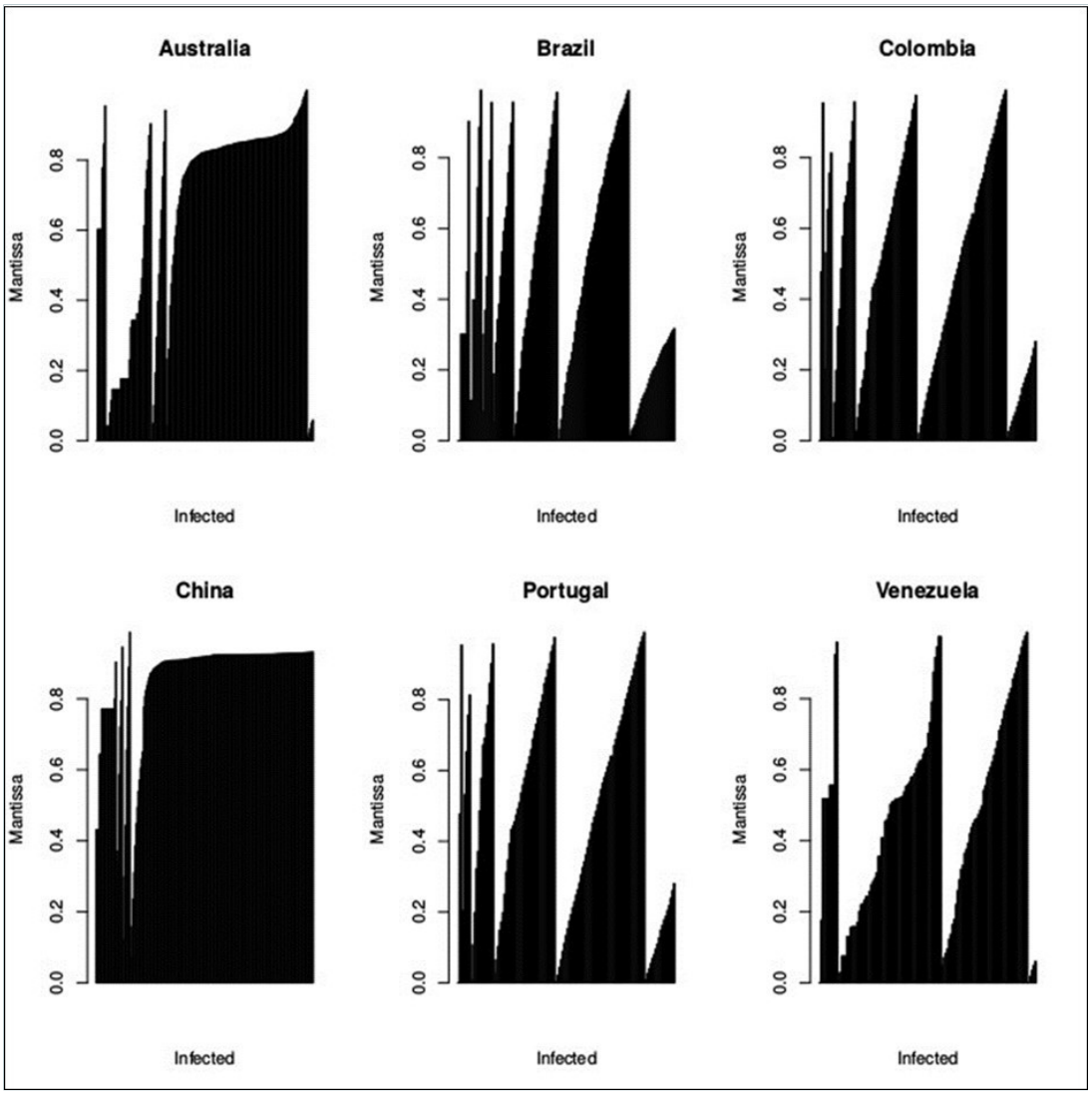

Figure 1. The results of the mantissa values in the following countries: Australia, Brazil, Colombia, China, Portugal and Venezuela.

Conclusions

The work presents a new computational methodology capable of monitoring the Covid-19 epidemic outbreaks in the world in real time, without the need for complicated mathematical calculations. Only is necessary to calculate the mantissa of the cases registered. The advantage of this calculation is that these results show how severe an epidemic outbreak can be depending on the shape of the peak of the graph, as well as monitoring the continuous epidemic rebounds in each country, revealing, for example, the slow growth of cases registered in Venezuela unlike their neighboring countries Brazil and Colombia. Therefore, it is recommended to use the calculation of the mantissa to detect how severe an epidemic is, instead of using a linear or logarithmic scale.

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