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Research Article

Impact of Atmospheric Pressure at Sea Level in the Cases of Covid-19 in Villa Clara Cuba

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Abstract

In this paper the total cases of covid-19 in Villa Clara Province, Cuba were modelled, the data begin in december 2020 until january 2022. The Regressive methodology called ROR was used with the help of the SPSS software. The modelling explain the 90 % of the total variance of data with an error of 127 cases. The model depends of the cases lagged in 105 days, this coincide with the nationals modelling for this diseases.The effects of vacination is litle but significative at 100 %, the cases of covid depends of the atmospherics pressure of the Yabu meteorological station, when the pressure increase, then increase the number of cases of covid, with an increase of 1000 hPa, the causes of covid increase in 184 cases, we know that the contagious is the main cause of spread this diseases, but we concluded that the atmospherics pressure can favor the incidence of the virus and so the quantity of persons with covid-19.

Keywords: Covid-19, Regressive Modelling Ror, Cuba, Impact, Atmospheric Pressure

1. Introduction

There are a large number of natural and even social phenomena in nature, whose occurrences, evolution and final result depend on several independent variables. Even though all these variables intervene in the phenomenon, some are more important than others and even the interrelation between them plays a very important role. The intervention of several independent variables makes the prediction of the occurrence of a natural phenomenon difficult to quantify. Predictive techniques have been developed both in the study of natural phenomena and in social phenomena, each with its scope and limitations.

Currently there are several methods to predict the occurrence of some phenomenon or result, which are included in the predictive analysis [1]. Predictive analytics is a subdiscipline of data analysis that uses statistical techniques, such as machine learning or data "mining," to develop models that predict future events or behaviors. These predictive models allow you to take advantage of behavior patterns found in current and historical data to identify risks. This type of analysis is based on the identification of relationships between variables in past events, in order to later exploit these relationships and predict possible results in future situations. Doing this is not easy since it must be taken into account that the precision of the results obtained depends a lot on how the data analysis has been carried out, as well as on the quality of the assumptions.

On the trivial level, it might seem that predictive analytics is the same as forecasting (which makes predictions at a macroscopic level), but no, it's something else entirely. In a crude example, while a forecast can predict how many hurricanes may form in a year, predictive analytics can indicate what intensity and what time of year they are most likely to form, and even where.

Therefore, to carry out predictive analysis it is essential to have a large amount of data, both current and past, in order to establish behavior patterns and thus induce knowledge. In the example above, there is more probability of prediction if you also consider variations in regional and global temperature, wind direction, changes and sources of change in pressures etc. This process is done thanks to computational learning. Computers can "learn" autonomously and thus develop new knowledge and capabilities, for this it is necessary to have large databases and predictive analysis tools.

There are currently several techniques applicable to predictive analysis; i) regression, which includes linear, non-linear, and multivariable adaptive regression; support vectors, ii) computational learning, which includes neural networks, Naïve Bayes and K-nearest neighbors. One of these tools is the Regressive Objective Regression method that we will explain briefly later. Various applications are included in the bibliography, and the idea is to extend this type of analysis to social and epidemiological phenomena such as the COVID-19 epidemic in Santa Clara, Cuba using atmospheric pressure as an exogenous variable.

2. Materials and methods

Some of the most important natural phenomena that we would like to be able to predict, in order to minimize their economic and health impact are, for example, earthquakes and hurricanes, the proliferation of infections caused by various viruses or diseases, among which is SARS- COV-2, and in certain regions of the planet the proliferation of viral diseases transmitted by mosquitoes, or bacteria transmitted by rodents, etc. Each of these natural and/or biological phenomena are caused by various factors that affect rapid or slow proliferation. Furthermore, each region of the planet is an extremely complex macrosystem, so variables that could play an important role in its prediction in one region may change in another. The present work is dedicated to the application of ROR for some of the phenomena mentioned above.

Regression analysis is the most widely used statistical technique to investigate or estimate the relationship between dependent variables and a set of independent explanatory variables. In our environment, the ROR methodology has allowed mathematical modeling a) the larval densities of mosquitoes b) the population dynamics of mollusks, c) the modeling of infectious entities of different etiologies, such as HIV/AIDS, Cholera, Influenza, Acute Respiratory Infections (ARI), Covid-19, Acute Bronchial Asthma Crisis (CAAB), Fasciolosis, Angiostrongylosis and even, d) in the estimation of the longitude and area of the universe, monthly forecast of precipitations and extreme temperatures, e) forecast of meteorological disturbances (cold fronts, and hurricanes, latitude prediction and length of earthquakes) search for information in white noises) modeling of the Equivalent Effective Temperature (TEE) and Atmospheric Pressure (PA) h) up to the electricity consumption of a municipality or province), and more recently in the COVID-19 pandemic [2-12].

3. Results

Next, a ROR model to predict the number of new cases of Covid-19 in Villa Clara Cuba by measuring the impact of vaccination at the country level and the impact of atmospheric pressure at sea level, we hope that this model can bring some clarity to the study of this disease.

The model explains 90% of the cases with an error of 127 cases, the Durbin Watson statistic is small, so the model admits new variables that could measure the impact, for now we will analyze vaccination and atmospheric pressure. Table 1.

Table 1: Summary of the modelc, d

Model o	R	R squared$_b$	Adjusted R squared	Standard error of the estimate	Durbin-Watson
1	,900a	,810	,807	127,484014811375660	,526

a. Predictors: PRE_2_mean, Unstandardized Predicted Value, DS, Lag105SP
b. For regression through the origin (the no-intercept model), R-squared measures the proportion of the variability in the dependent variable about the origin explained by the regression. This CANNOT be compared to the R-squared for models that include intercept.
c. Dependent variable: Sum Prov.
d. Linear regression through the origin

The Variance analysis shows a significant model with a Fisher's F of 262.173, so we are dealing with a valid model to predict. Table 2

Table 2: ANOVAa, b

Model	Sum of squares	df	root mean square	F	Sig.
Regression	17043497,188	4	4260874,297	262,173	,000$_c$
Residue	3998034,812	246	16252,174		
Total	21041532,000d	250			

a. Dependent variable: Sum Prov.
b. Linear regression through the origin
c. Predictors: Mean Atmospheric Pressure, Predicted Vaccination, DS, Lag105SP
d. This total sum of squares is uncorrected for the constant because the constant is zero for the regression through the origin.

This model depends on the number of cases returned in 105 days that corresponds to the National data for Cuba) [13]. The mathematical effect of vaccination is small but 100% significant, this may be due to the fact that the The vaccination data that we were able to obtain correspond to the nation and not to the province, despite this difficulty we decided to include them, the cases of Covid-19 depend on the Atmospheric Pressure in the Yabú station as it increases, the cases of Covid increase , with an increase of 1000 hPa the cases can increase by 184 cases, we know that the increase in cases depends on contagion, which does not mean that the virus may be affected by atmospheric pressure and favor or not its incidence in people. Table 3.

Table 3: Coefficients a, b

Model o		Unstandardized coefficients		Standardized coefficients		
		B	Standard error	Beta	t	Sig.
1	DS	-3,880	16,127	-,009	-,241	,810
	Lag105SP	-1,472	,077	-,812	-19,191	,000
	predicted vaccination	6,259E-5	,000	,871	20,662	,000
	mean atmospheric pressure	,184	,012	,644	15,057	,000

a. Dependent variable: Sum Prov.
b. Linear regression through the origin

Finally, a plot of the predicted cases against the real ones is made and the forecast is displayed until February 24, 2022, apparently there may be an increase in cases, reaching 1000 cases, which would bring a new pandemic outbreak, it is because of This means that strict measures must be taken at airports and continue with the mouth mask and avoiding crowds. Figure 1.

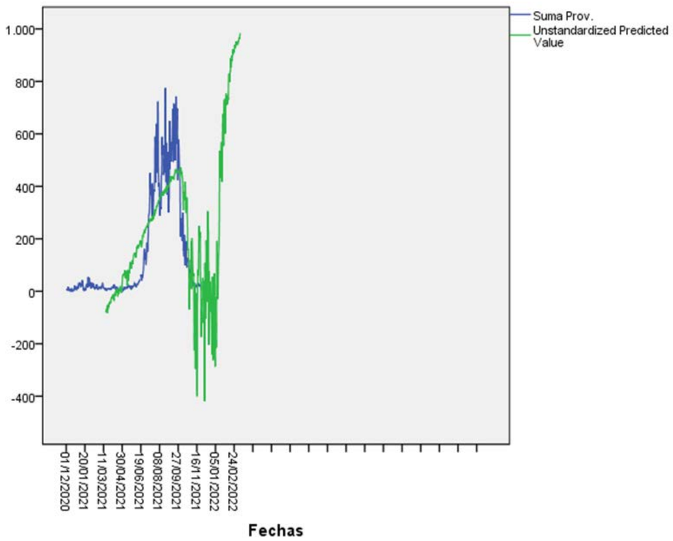

Figure 1: Cases of Covid -19 and long-term forecast for Villa Clara Cuba

4. Conclusions

- The model explains 90% of the cases with an error of 127 cases.
- This model depends on the number of cases returned in 105 days.
- The mathematical effect of vaccination is small but 100% significant.
- The cases of Covid-19 depend on the Atmospheric Pressure in the Yabú station as it increases, the cases of Covid increase.
- With an increase of 1000 hPa the cases can increase by 184 cases.
- There may be an increase in cases, reaching 1000 cases, which would bring a new pandemic outbreak, which is why strict measures must be taken at airports and continue with the use of masks and avoiding crowds

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