
COVID-19: Review of Research and Data Analysis



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Submission at HEALTHINFO

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COVID-19: Review of Data Analysis

🦠 Short resume of the presenter

- **Anthony Dias**

- Has a degree in Computer Engineering at the organization Polytechnic Institute of Castelo Branco.
- Works as a software developer in Ritain.io.

INTRODUCTION

- The first infection caused by Covid-19 appeared in December 2019 and has infected about 250 million people. In pandemics, it is essential to model propagation so that it is possible to know how to act to avoid a significant public health problem.
- Since its appearance, mathematicians, scientists, physicians, and engineers have cooperated in data analysis. This study aims to understand which mathematical models are more relevant and used in this context.
- Based on PRISMA methodology, we will analyze Covid-19 related articles, meeting the results in predicting this pandemic in Portugal and worldwide.
- All the articles chosen use models or algorithms to perform prediction, and we conclude that the SIR (Susceptible-Infected-Recovered) model was the most appropriate. Whereas that, all the articles have been published up to April 2021.

Keywords - PRISMA; literature review; Covid-19; prediction; SIR.

STATE OF ART

- The review is reported according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement. It includes the following topics:



STATE OF ART

Research questions

Question 1:

- What are the existing models/algorithms for the Covid-19 forecast?

Question 2:

- How to make a prediction in an application (web or mobile) for Covid-19?

Question 3:

- What parameters are used for the creation of a Covid-19 forecasting model?

Question 4:

- What advantages do these algorithms bring to the health area and the population?

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Inclusion criteria

Condition 1:

- Studies where algorithms applied to data related to Covid-19 are present.

Condition 2:

- Studies that have calculated formulations applied to data resulting from studies on the theme Covid-19.

Condition 3:

- Studies seeking to predict the evolution of the pandemic.

Condition 4:

- Studies showing assertiveness results of prediction algorithms related to the theme Covid-19.

Condition 5:

- Studies that consider the country Portugal.

Condition 6:

- Studies between 2019 and 2021.



STATE OF ART

Search strategy

- Through research and survey of scientific articles in PubMed, ScienceDirect and MedRvix databases, a study was conducted on Covid-19 and the corresponding aspects of this disease.
- The articles included were published between 2019 - 2021.
- The research terms used to perform this systematic review were: "Covid", "Algorithm", "Forecast", "Portugal".
- This survey was conducted on April 23, 2021.

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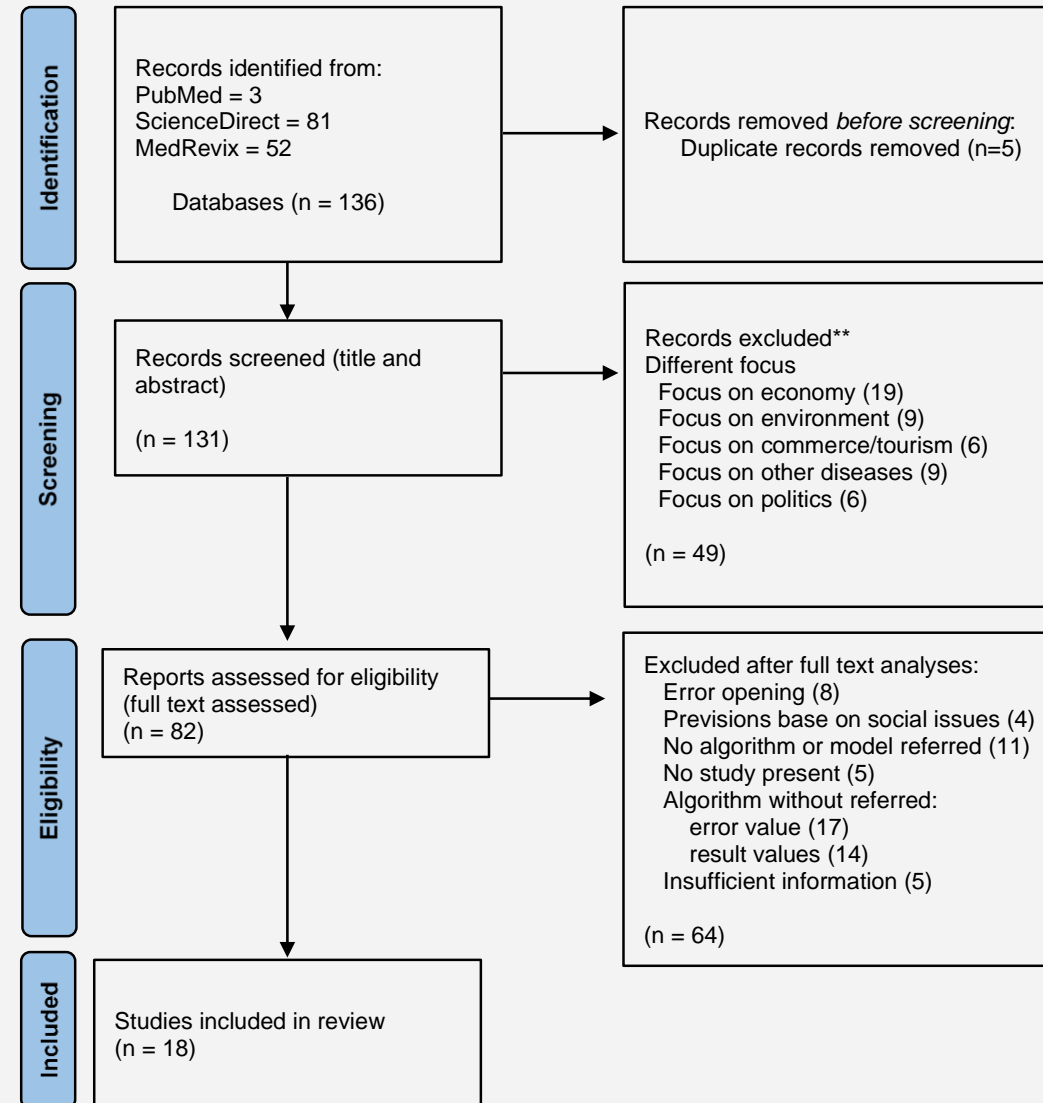
Results

In an initial phase were chosen:

- 3 articles of PubMed
- 82 of ScienceDirect
- 53 of MedRvix

The final phase featured:

- 8 articles of ScienceDirect
- 10 of MedRvix.



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Data Extraction and Data Analysis

Article Name	Method/Algorithm	Programming Language
Tracking R of COVID-19: A New Real-Time Estimation Using the Kalman Filter [7]	SIR	R
A Novel Smart City Based Framework on Perspectives for application of Machine Learning in combatting Covid-19 [8]	SIR Random Forest	NA
Extension of a SIR modelling the propagation of Covid-19 in several countries [9]	SIR	R
COVID 19 in Portugal: predictability of hospitalization, ICU and respiratory-assistance needs [10]	Random Forest Decision Tree	Python
Estimation of COVID-19 spread curves integrating global data and borrowing information [7]	SEIR	NA
Data-driven inference of the reproduction number for COVID-19 before and after interventions for 51 European countries [8]	SIR	Python C++
...

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Data Extraction and Data Analysis

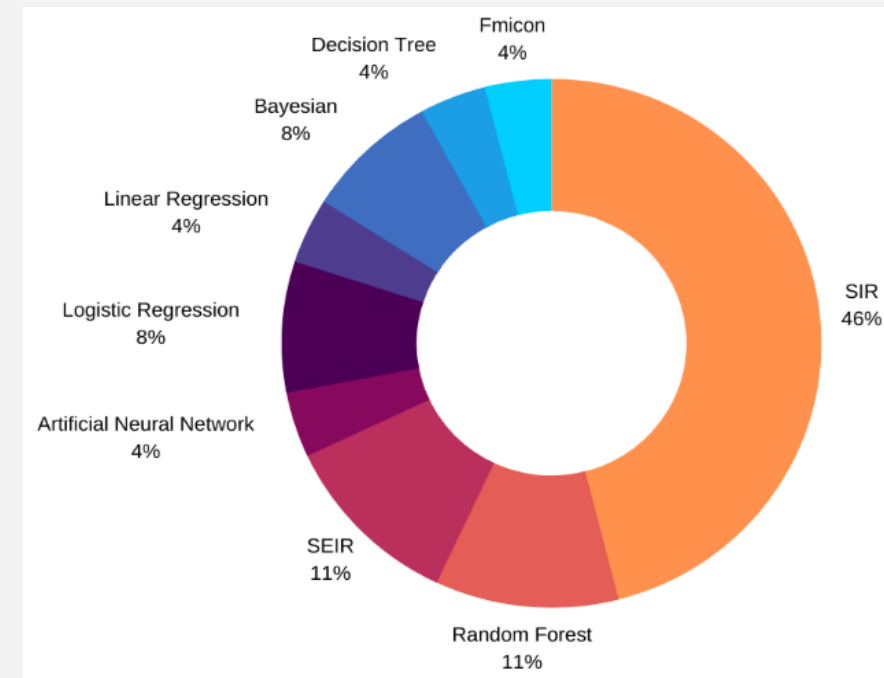
	SIR	Random Forest	Decision Tree	SEIR	Logistic Regression	Baysien	Fmicon	Linear Regression	Artificial Neural Network
R	6	1			1	1		1	1
Phyton	2	1	1						1
MatLab	3			2			1		
IHR				1					
C++	2			1					

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Discussion

Question 1:

- What are the existing models/algorithms for the Covid-19 forecast?
 - SIR model
 - Random Forest algorithm
 - Decision Tree algorithm
 - SEIR model
 - Regression Logistic
 - Linear Regression
 - Artificial Neural Network
 - Fmincon



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STATE OF ART

Discussion

Question 2:

- How to make a prediction in an application (web or mobile) for Covid-19?
 - R
 - MatLab
 - Phyton
 - C++
 - IHR

	SIR	Random Forest	Decision Tree	SEIR	Logistic Regression	Bayesian	FmiCon	Linear Regression	Artificial Neural Network
R	6	1			1	1		1	1
Phyton	2	1	1						
MATLAB	3			2			1		1
C++	2			1					
Total	13	2	1	3	1	1	1	1	2

STATE OF ART

Discussion

Question 3:

- What parameters are used for the creation of a Covid-19 forecasting model?
 - Usually generalised, differentiating between the content with which the treatment is carried out.
 - Susceptible
 - Infected
 - Recovered

STATE OF ART

Discussion

Question 4:

- What advantages do these algorithms bring to the health area and the population?
 - Health area
 - Collecting more accurate data
 - Means for future analysis of a new eventual pandemic
 - Population
 - Access to information

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STATE OF ART

Discussion



Susceptible

The individual is subject to contracting the disease.

Infected

The individual can transmit the disease to a susceptible individual.

Recovered

The individual is no longer infectious, but neither is he susceptible.

STATE OF ART

Discussion

Pros:

- It is a simple model; It is compartment-based; It is based on a dataset during a time window; It is a deterministic model; You do not need many iterations to achieve the desired accuracy

Cons:

- When using the standard SIR model, the "N" corresponds to the total population, being a fixed and global value; Age groups are not distinguished.

CONCLUSIONS

- Research is one of the most critical phases of this work.
- To obtain the results of the realized studies, it should be considered that Covid-19 is recent.
- In general, the analyzed models can be accurate and have a minimum error rate. However, they cannot accurately predict what will happen in each situation, as it is theoretically impossible to determine how individuals will adapt their behavior in the community.
- Using modelling, it is possible to simulate the propagation, in this case of Covid-19, in each population to estimate the total number of affected individuals.



CONCLUSIONS

- Transmission and contagion period, these two characteristics being modelled through their rates, and the values of these characteristics being decisive in the analysis of the outbreak's evolution, corresponding these characteristics to the SIR model, which was the most preferred used by the authors.
- For future work, it will be interesting to model the SIR method, introducing relevant parameters, to make the model as realistic as possible. As an example, vaccination parameters should also be incorporated into the model.

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