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Artificial Neural Network for Predicting COVID 19 Using JNN

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Abstract: The emergence of the novel coronavirus (COVID-19) in 2019 has presented the world with an unprecedented global health crisis. The rapid and widespread transmission of the virus has strained healthcare systems, disrupted economies, and challenged societies. In response to this monumental challenge, the intersection of technology and healthcare has become a focal point for innovation. This research endeavors to leverage the capabilities of Artificial Neural Networks (ANNs) to develop an advanced predictive model for forecasting the spread of COVID-19. It involves the collection, analysis, and integration of diverse datasets encompassing epidemiological, clinical, and social factors that influence the virus's dissemination.

Keywords: Prediction, COVID-19, Artificial Neural Networks, JNN.

INTRODUCTION

The world has witnessed rapid and transformative events since the beginning of 2019, with the outbreak of the novel coronavirus (COVID-19) that has impacted every aspect of our lives. Cases of the virus spread rapidly, and the pandemic evolved into an unprecedented global challenge that caught us all by surprise. To confront this colossal challenge, many countries and institutions turned to technology and data in search of an effective solution. We discovered that artificial intelligence, specifically Artificial Neural Networks (ANNs), could play a crucial role in understanding and combating the virus's spread and managing its consequences. This study aims to utilize Artificial Neural Networks as a powerful tool to develop an advanced model for predicting the spread of COVID-19. It transcends the boundaries between medicine, data science, and artificial intelligence, offering a blend of scientific research and modern technology. The goal of this research is to collect and analyze available epidemiological, clinical, and social data, and then use Artificial Neural Networks to develop a model capable of accurately forecasting the spread of COVID-19. This model will be a valuable tool for public health authorities and policymakers to respond to the pandemic and take necessary actions to control the virus's spread and protect public health. In the following sections of this research, we will focus on how to design and train this model, the data used, the expected results, and how this research can contribute to improving the response to the COVID-19 pandemic. This study represents an important journey in the field of science and technology to understand and confront a global epidemic, guiding our efforts toward a safer and healthier world.

Introduction

Specific types of artificial neural networks include:

- Feed-forward neural networks
- Recurrent neural networks
- Convolutional neural networks
- De-convolutional neural networks
- Modular neural networks

Feed-forward neural networks are one of the simplest variants of neural networks. They pass information in one direction, through various input nodes, until it makes it to the output node. The network may or may not have hidden node layers, making their functioning more interpretable. It is prepared to process large amounts of noise. This type of ANN computational model is used in technologies such as facial recognition and computer vision [21-22].

Recurrent neural networks (RNN) are more complex [23]. They save the output of processing nodes and feed the result back into the model. This is how the model is said to learn to predict the outcome of a layer. Each node in the RNN model acts as a memory cell, continuing the computation and implementation of operations. This neural network starts with the same front propagation as a feed-forward network, but then goes on to remember all processed information in order to reuse it in the future. If the network's prediction is incorrect, then the system self-learns and continues working towards the correct prediction during backpropagation. This type of ANN is frequently used in text-to-speech conversions [24].

Convolutional neural networks (CNN) are one of the most popular models used today. This neural network computational model uses a variation of multilayer perceptron's and contains one or more convolutional layers that can be either entirely connected or pooled .These convolutional layers create feature maps that record a region of image which is ultimately broken into rectangles and sent out for nonlinear processing [48]. The CNN model is particularly popular in the realm of image recognition; it has been used in many of the most advanced applications of AI, including facial recognition, text digitization and natural language processing. Other uses include paraphrase detection, signal processing and image classification [25].

De-convolutional neural networks utilize a reversed CNN model process. They aim to find lost features or signals that may have originally been considered unimportant to the CNN system's task. This network model can be used in image synthesis and analysis [25]. Modular neural networks contain multiple neural networks working separately from one another [12-13]. The networks do not communicate or interfere with each other's activities during the computation process. Consequently, complex or big computational processes can be performed more efficiently [14].

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Advantages of artificial neural networks include [15]:

- Parallel processing abilities mean the network can perform more than one job at a time.
- Information is stored on an entire network, not just a database.
- The ability to learn and model nonlinear, complex relationships helps model the real life relationships between input and output.
- Fault tolerance means the corruption of one or more cells of the ANN will not stop the generation of output.
- Gradual corruption means the network will slowly degrade over time, instead of a problem destroying the network instantly.
- The ability to produce output with incomplete knowledge with the loss of performance being based on how important the missing information is.
- No restrictions are placed on the input variables, such as how they should be distributed
- Machine learning means the ANN can learn from events and make decisions based on the observations.
- The ability to learn hidden relationships in the data without commanding any fixed relationship means an ANN can better model highly volatile data and non-constant variance.
- The ability to generalize and infer unseen relationships on unseen data means ANNs can predict the output of unseen data.

Methodology

By looking intensely through literature and soliciting the experience of human experts on pathological conditions, a number of factors have been recognized that have an impact on determining patients' cases in the subsequent period. These factors were prudently studied and coordinated with an appropriate number for coding the computer within the modeling environment ANN. These factors were categorized as input variables and output variables that reflect some possible levels of disease status in terms of the assessment system. The data were entered into the JNN tool environment, determined the value of each of the variables using JNN (the most influential factor on COVID 19), then the data were trained, validated, and tested.

Input variables

The specified input variables are those that can be obtained simply from the file system and the registry of diseases. Input variables are:

NO.	Attribute Name	Attribute Meaning
1	Age Distribution	represents the age groups within a population
2	Testing Capacity	Relates to the ability to conduct widespread testing for COVID-19. It's vital for early detection, contact tracing, and isolation of cases

3	Vaccination Rate	Rate represents the percentage of the population that has received COVID-19 vaccines.
4	Public Health Measures	measures include policies and actions like mask-wearing, social distancing, quarantine, and lockdowns
5	Variant Strains	Variant strains of the virus refer to genetic mutations of SARS-CoV-2. The presence and prevalence of variants can impact the severity and transmissibility of COVID-19.
6	Population Density	refers to the number of people living in a given area

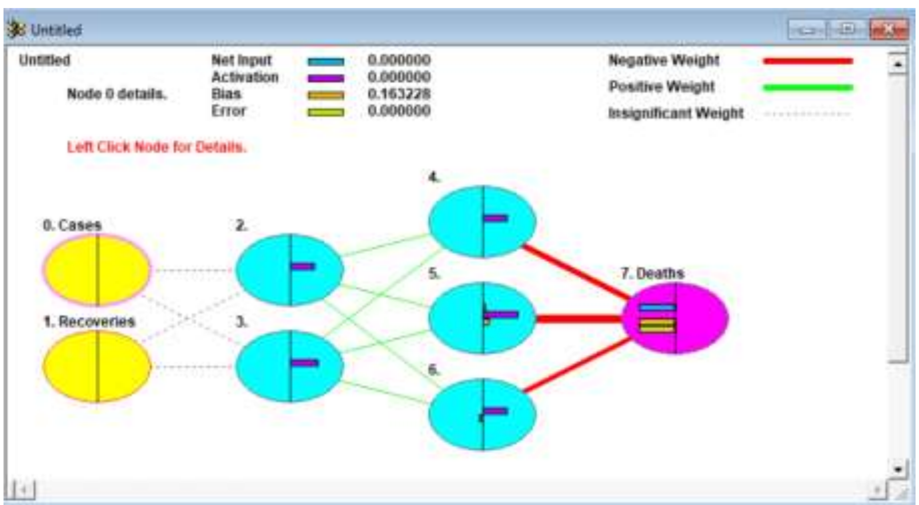
The Output Variable

The output variable represents whether a person has COVID 19 or not (Injured, Healthy)

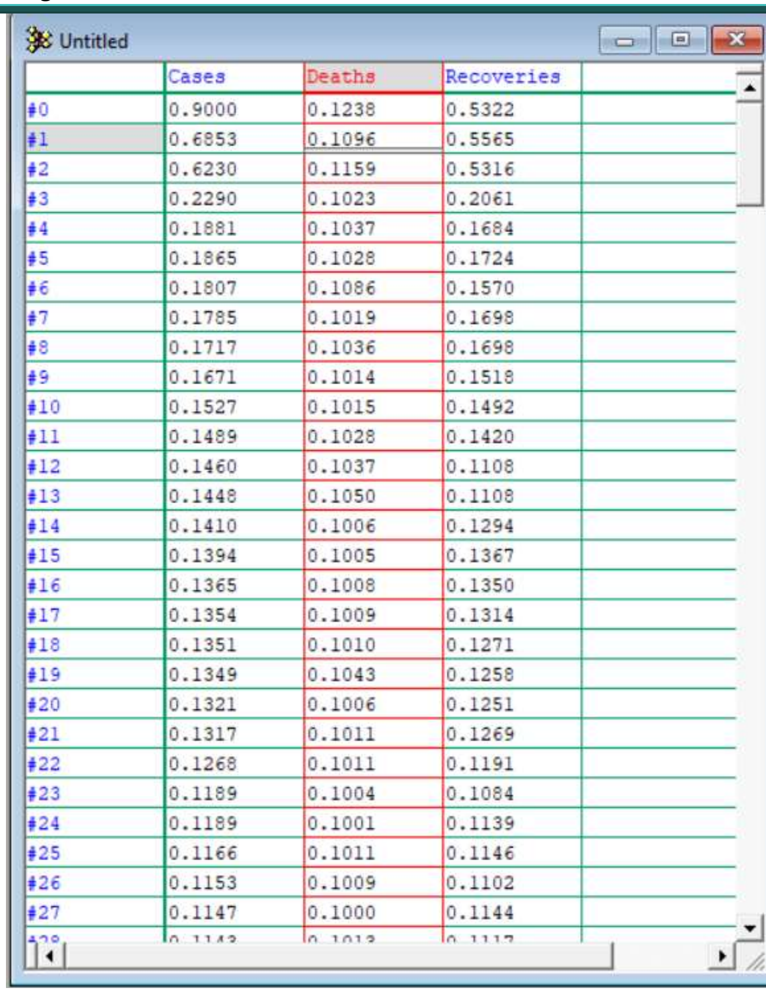
#	Output Variable	COVID 19
1	Healthy "1 "	A person not infected with coronavirus
2	Injured "0 "	A person infected with coronavirus.

Neural Network

A neural network is a computational model inspired by the structure and functioning of the human brain. It is a type of machine learning model that is used for various tasks, including pattern recognition, classification, regression, and more. Neural networks are composed of interconnected artificial neurons (also called nodes or units) organized into layers. These neurons work collectively to process and learn from data.

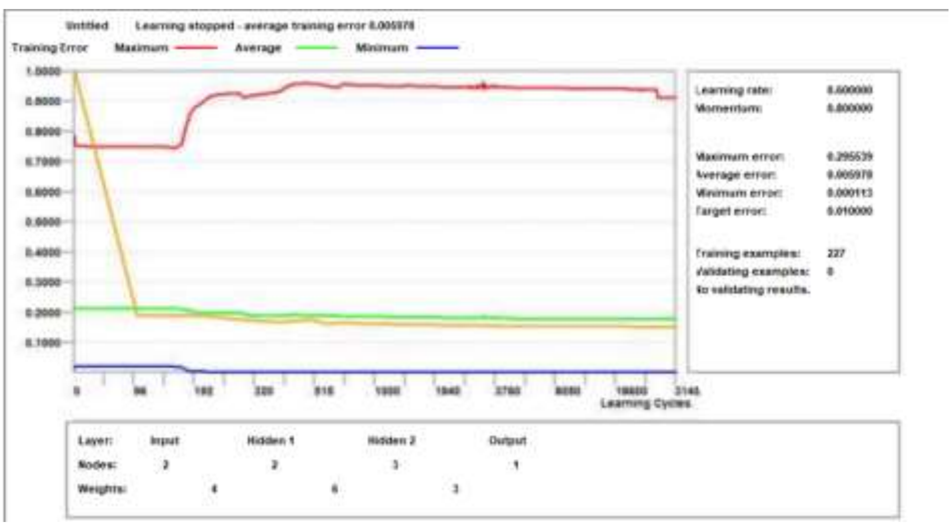


Structure of the proposed ANN mode

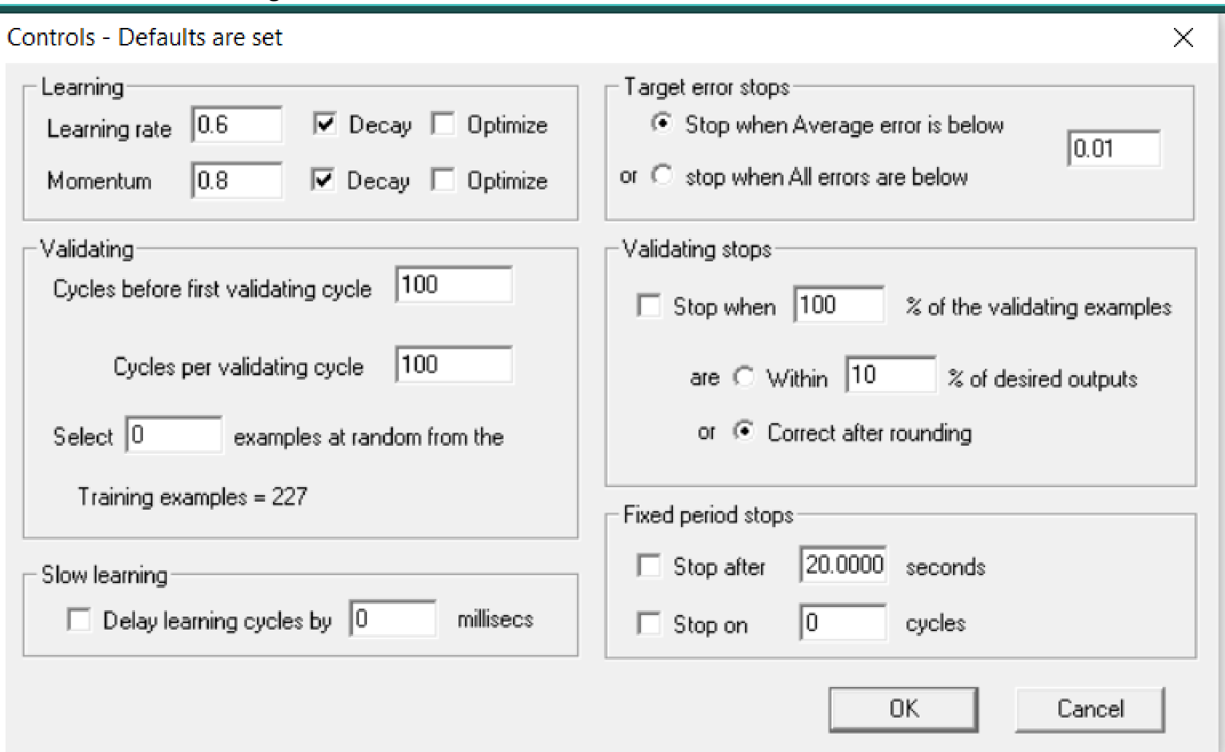


	Cases	Deaths	Recoveries
#0	0.9000	0.1238	0.5322
#1	0.6853	0.1096	0.5565
#2	0.6230	0.1159	0.5316
#3	0.2290	0.1023	0.2061
#4	0.1881	0.1037	0.1684
#5	0.1865	0.1028	0.1724
#6	0.1807	0.1086	0.1570
#7	0.1785	0.1019	0.1698
#8	0.1717	0.1036	0.1698
#9	0.1671	0.1014	0.1518
#10	0.1527	0.1015	0.1492
#11	0.1489	0.1028	0.1420
#12	0.1460	0.1037	0.1108
#13	0.1448	0.1050	0.1108
#14	0.1410	0.1006	0.1294
#15	0.1394	0.1005	0.1367
#16	0.1365	0.1008	0.1350
#17	0.1354	0.1009	0.1314
#18	0.1351	0.1010	0.1271
#19	0.1349	0.1043	0.1258
#20	0.1321	0.1006	0.1251
#21	0.1317	0.1011	0.1269
#22	0.1268	0.1011	0.1191
#23	0.1189	0.1004	0.1084
#24	0.1189	0.1001	0.1139
#25	0.1166	0.1011	0.1146
#26	0.1153	0.1009	0.1102
#27	0.1147	0.1000	0.1144

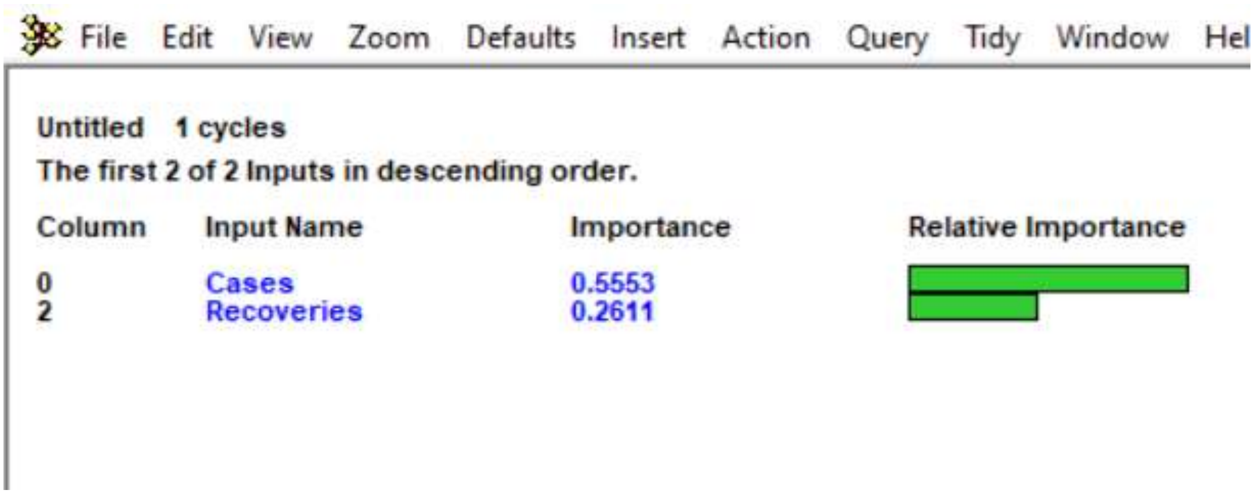
Imported dataset in JNN environment



Training and validating the ANN model



Parameters of the proposed ANN model



Most influential features in the dataset

Details of the proposed ANN model

Conclusion

In conclusion, this scientific research demonstrates the importance of predicting the coronavirus as a crucial matter for understanding and combating this global pandemic. The challenges posed by this virus encompass health, economic, and social dimensions, and the study has shown that early forecasting and planning can mitigate its negative impact. By employing predictive models and precise data analysis, the research identified key factors influencing the virus's spread and transmission. Understanding these factors and their interactions can contribute to improving our responses to such pandemics in the future. The recommendations arising from this research include the necessity of enhancing public awareness regarding preventive behaviors and the importance of taking appropriate measures in the event of new cases emerging. Sustainable preparedness and international cooperation are also essential for tackling pandemics and preparing for future challenges. We believe that science and research will remain fundamental in our efforts to control these health crises, and we hope that this study inspires further research and efforts to safeguard the health and well-being of human societies. Ultimately, our global cooperation and solidarity will be the key to overcoming challenges like the coronavirus and ensuring a better future for humanity.

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