

CORONAVIRUS DISEASE (COVID-19) CASES ANALYSIS USING MACHINE LEARNING

Submitted in partial fulfillment of the requirements
for the award of
Bachelor of Engineering Degree in Computer Science and
Engineering

by

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BONAFIDE CERTIFICATE

This is to certify that this Professional Training Report is the bonafide work of **KONDA SAI RAHUL (38110257) and GANDAREDDY AKHIL KUMAR REDDY(38110150)** who carried out project entitled “**CORONAVIRUS DISEASE (COVID-19) CASES ANALYSIS USING MACHINE LEARNING**” under my supervision from NOVEMBER 2021 to MARCH 2022

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Abstract

The outbreak of the Novel Coronavirus or the COVID-19 in various parts of the world has affected the world as a whole and caused millions of deaths. This remains an ominous warning to public health and will be marked as one of the greatest pandemics in world history. This aims to provide a better understanding of how various Machine Learning models can be implemented in real-world situations. Apart from the analysis done on the world figures, this paper also analyzes the current trend or pattern of Covid-19 transmission in India. With the help of datasets from the Ministry of Health and Family Welfare of India, this study puts forward various trends and patterns experienced in different parts of the world. The data to be studied has been obtained for 154 days i.e. from January 22, 2020, till June 24, 2020. For future references, the data can be further analyzed, and more results can be obtained.

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CHAPTER 1

INTRODUCTION

MACHINE learning (ML) has proved itself as a prominent field of study over the last decade by solving many very complex and sophisticated real-world problems. The application areas included almost all the real-world domains such as healthcare, autonomous vehicle (AV), business applications, natural language processing (NLP), intelligent robots, gaming, climate modeling, voice, and image processing. ML algorithms' learning is typically based on trial and error method quite opposite of conventional algorithms, which follows the programming instructions based on decision statements like if-else. One of the most significant areas of ML is forecasting, numerous standard ML algorithms have been used in this area to guide the future course of actions needed in many application areas including weather forecasting, disease forecasting, stock market forecasting as well as disease prognosis. Various regression and neural network models have wide applicability in predicting the conditions of patients in the future with a specific disease. There are lots of studies performed for the prediction of different diseases using machine learning techniques such as coronary artery disease, cardiovascular disease prediction, and breast cancer prediction. In particular, the study is focused on live forecasting of COVID-19 confirmed cases and study is also focused on the forecast of COVID-19 outbreak and early response. These prediction systems can be very helpful in decision making to handle the present scenario to guide early interventions to manage these diseases very effectively. The most challenging aspect of its spread is that a person can possess the virus for many days without showing symptoms. The causes of its spread and considering its danger, almost all the countries have declared either partial or strict lockdowns throughout the affected regions and cities. Medical researchers throughout the globe are currently involved to discover an appropriate vaccine and medications for the disease. Since there is no approved medication till now for killing the virus so the governments of all countries are focusing on the precautions which can stop the spread. Out of all precautions, "be informed" about all the aspects of COVID-19 is considered extremely important. To

contribute to this aspect of information, numerous researchers are studying the different dimensions of the pandemic and produce the results to help humanity.

1.1 MACHINE LEARNING

Machine learning could be a subfield of computer science (AI). The goal of machine learning typically is to know the structure information of knowledge of information and match that data into models which will be understood and used by folks. Although machine learning could be a field inside technology, it differs from ancient process approaches.

In ancient computing, algorithms are sets of expressly programmed directions employed by computers to calculate or downside solve. Machine learning algorithms instead give computers to coach on knowledge inputs and use applied math analysis so as to output values that fall inside a particular vary. thanks to this, machine learning facilitates computers in building models from sample knowledge so as to modify decision-making processes supported knowledge inputs.

1.2 Machine Learning Strategies

In machine learning, tasks square measure typically classified into broad classes. These classes square measure supported however learning is received or however feedback on the educational is given to the system developed. Two of the foremost wide adopted machine learning strategies square measure supervised learning that trains algorithms supported example input and output information that's tagged by humans, and unattended learning that provides the algorithmic program with no tagged information so as to permit it to search out structure at intervals its computer file.

1.2.1 Supervised Learning

In supervised learning, the pc is given example inputs that square measure labelled with their desired outputs. The aim of this technique is for the algorithmic program to be ready to “learn” by comparison its actual output with the “taught” outputs to search out errors, and modify the model consequently. Supervised learning thus uses patterns to predict label values on extra unlabelled information. For example, with supervised learning, an algorithm may be fed data with images of sharks labelled as fish and images of oceans labelled as water. By being trained on this data, the supervised learning algorithm should be able to later identify unlabelled shark images as fish and unlabelled ocean images as water.

A common use case of supervised learning is to use historical information to predict statistically probably future events. It's going to use historical stock exchange info to anticipate approaching fluctuations, or be used to filter spam

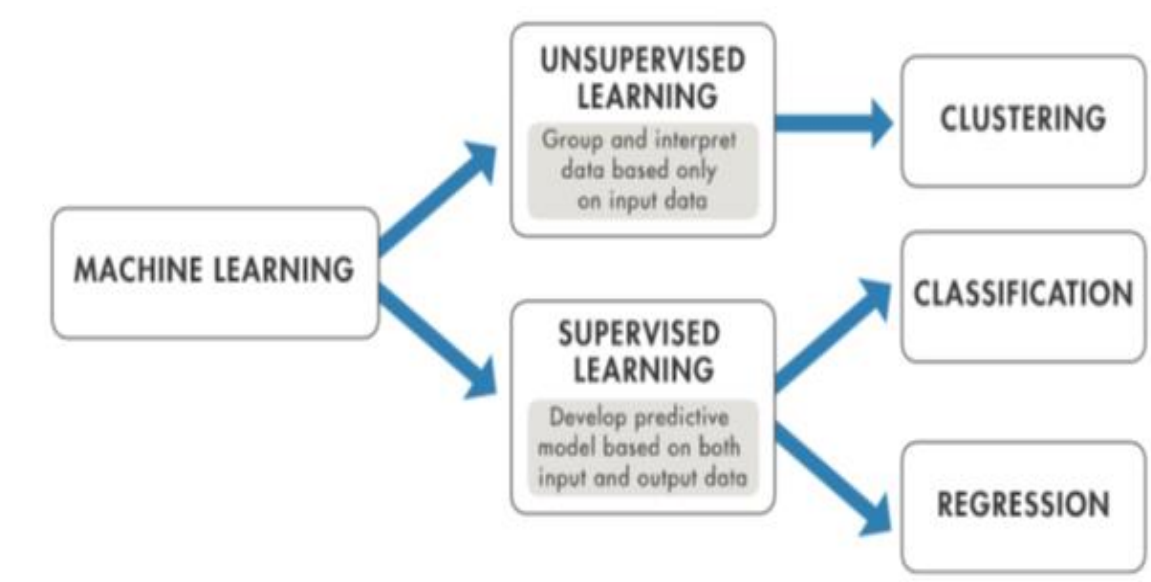
emails. In supervised learning, labeled photos of dogs are often used as input file to classify unlabeled photos of dogs.

1.2.2 UnSupervised Learning

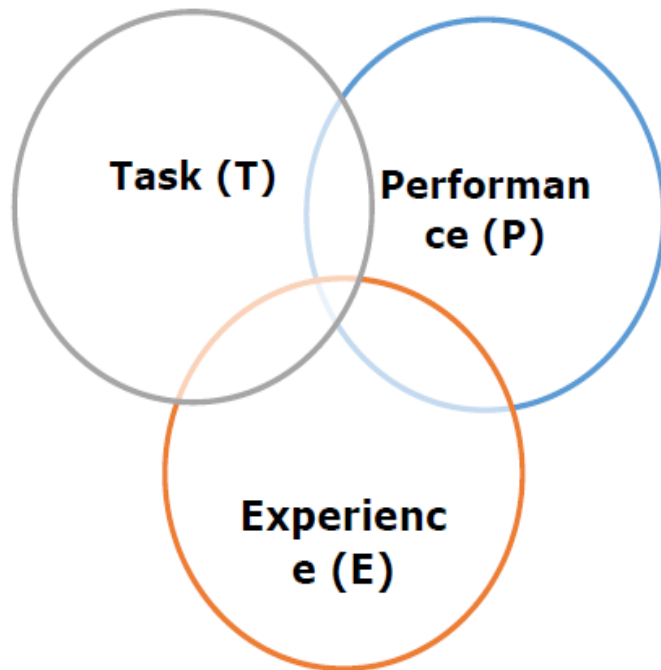
In unattended learning, information is unlabeled, that the learning rule is left to seek out commonalities among its input file. The goal of unattended learning is also as easy as discovering hidden patterns at intervals a dataset, however it should even have a goal of feature learning, that permits the procedure machine to mechanically discover the representations that square measure required to classify data.

Unsupervised learning is usually used for transactional information. You will have an oversized dataset of consumers and their purchases, however as a person's you'll probably not be able to add up of what similar attributes will be drawn from client profiles and their styles of purchases.

With this information fed into Associate in Nursing unattended learning rule, it should be determined that ladies of a definite age vary UN agency obtain unscented soaps square measure probably to be pregnant, and so a promoting campaign associated with physiological condition and baby will be merchandised.



1.1 MACHINE LEARNING



CLASSIFICATION

1.2 MACHINE LEARNING

CHAPTER 2

LITERATURE REVIEW

Literature survey is the most important step in software development process. Before developing the tool it is necessary to determine the time factor, economy and company strength. Once these things are satisfied, then the next step is to determine which operating system and language can be used for developing the tool. Once the programmers start building the tool the programmers need lot of external support. This support can be obtained from senior programmers, from book or from websites. Before building the system the above consideration are taken into account for developing the proposed system.

The major part of the project development sector considers and fully survey all the required needs for developing the project. For every project Literature survey is the most important sector in software development process. Before developing the tools and the associated designing it is necessary to determine and survey the time factor, resource requirement, man power, economy, and company strength. Once these things are satisfied and fully surveyed, then the next step is to determine about the software specifications in the respective system such as what type of operating system the project would require, and what are all the necessary software are needed to proceed with the next step such as developing the tools, and the associated operations.

2.1 RELATED WORK

COVID-19 Epidemic Analysis using Machine Learning and Deep Learning Algorithms

The catastrophic outbreak of Severe Acute Respiratory Syndrome - Coronavirus (SARS-CoV-2) also known as COVID-2019 has brought the worldwide threat to the living society. The whole world is putting incredible efforts to fight against the spread of this deadly disease in terms of infrastructure, finance, data sources, protective gears, life-risk treatments and several other resources. The artificial intelligence

researchers are focusing their expertise knowledge to develop mathematical models for analyzing this epidemic situation using nationwide shared data. To contribute towards the well-being of living society, this article proposes to utilize the machine learning and deep learning models with the aim for understanding its everyday exponential behaviour along with the prediction of future reachability of the COVID-2019 across the nations by utilizing the real-time information from the Johns Hopkins dashboard.

COVID-19 in India: State-wise Analysis and Prediction

The highly infectious coronavirus disease (COVID-19) was first detected in Wuhan, China in December 2019 and subsequently spread to 212 countries and territories around the world, infecting millions of people. In India, a large country of about 1.3 billion people, the disease was first detected on January 30, 2020, in a student returning from Wuhan. The total number of confirmed infections in India as of May 3, 2020, is more than 37,000 and is currently growing fast.

COVID-19 Outbreak Prediction with Machine Learning

Several outbreak prediction models for COVID-19 are being used by officials around the world to make informed-decisions and enforce relevant control measures. Among the standard models for COVID-19 global pandemic prediction, simple epidemiological and statistical models have received more attention by authorities, and they are popular in the media. Due to a high level of uncertainty and lack of essential data, standard models have shown low accuracy for long-term prediction. Although the literature includes several attempts to address this issue, the essential generalization and robustness abilities of existing models needs to be improved. This paper presents a comparative analysis of machine learning and soft computing models to predict the COVID-19 outbreak. Among a wide range of machine learning

models investigated, two models showed promising results (i.e., multi-layered perceptron, MLP, and adaptive network-based fuzzy inference system, ANFIS). Based on the results reported here, and due to the highly complex nature of the COVID-19 outbreak and variation in its behavior from nation-to-nation, this study suggests machine learning as an effective tool to model the outbreak.

Forecasting the novel coronavirus COVID-19

What will be the global impact of the novel coronavirus (COVID-19)? Answering this question requires accurate forecasting the spread of confirmed cases as well as analysis of the number of deaths and recoveries. Forecasting, however, requires ample historical data. At the same time, no prediction is certain as the future rarely repeats itself in the same way as the past. Moreover, forecasts are influenced by the reliability of the data, vested interests, and what variables are being predicted. Also, psychological factors play a significant role in how people perceive and react to the danger from the disease and the fear that it may affect them personally. This paper introduces an objective approach to predicting the continuation of the COVID-19 using a simple, but powerful method to do so. Assuming that the data used is reliable and that the future will continue to follow the past pattern of the disease, our forecasts suggest a continuing increase in the confirmed COVID-19 cases with sizable associated uncertainty. The risks are far from symmetric as underestimating its spread like a pandemic and not doing enough to contain it is much more severe than overspending and being over careful when it will not be needed. This paper describes the timeline of a live forecasting exercise with massive potential implications for planning and decision making and provides objective forecasts for the confirmed cases of COVID-19.

Prediction of Spreads of COVID-19 in India from Current Trend

The article describe modelling efforts for evaluating the current level of COVID-19 infections in India, using exponential model. The Data from 15 march 2020 to 30 April 2020 are used for validating the model, where intrinsic rise rate is kept constant. It is observed that some states of India, like MAharastra, Gujarat and Delhi

have a much higher daily infection cases. This is modelled by assuming an initial higher infections, keeping rise rate same. The sudden outbursts are captured using offset of values for these three states. Data from other states like Madhya Pradesh, Uttar Pradesh and Rajasthan are also analysed and they are found to be following the same constants as India is following. Worldwide, many attempts are made to predict outburst of COVID-19 and in the model, described in this paper, turning point is not predicted, as cases in India are still rising. The developed model is based on daily confirmed infections and not on cumulative infections and rationalization is carried out for the population of various regions, while predicting infections for various states. Assigning a decay constant at this stage will be a premature exercise and keeping that in mind, exponential model predicts that India will attain 1 lakh case by 15 May 2020. The figure of 2 lakh and 3 lakh will be attained on 22 May 2020 and 26 May 2020, respectively.

An interpretable mortality prediction model for COVID-19 patients

The sudden increase in COVID-19 cases is putting high pressure on healthcare services worldwide. At this stage, fast, accurate and early clinical assessment of the disease severity is vital. To support decision making and logistical planning in healthcare systems, this study leverages a database of blood samples from 485 infected patients in the region of Wuhan, China, to identify crucial predictive biomarkers of disease mortality. For this purpose, machine learning tools selected three biomarkers that predict the mortality of individual patients more than 10 days in advance with more than 90% accuracy: lactic dehydrogenase (LDH), lymphocyte and high-sensitivity C-reactive protein (hs-CRP). In particular, relatively high levels of LDH alone seem to play a crucial role in distinguishing the vast majority of cases that require immediate medical attention. This finding is consistent with current medical knowledge that high LDH levels are associated with tissue breakdown occurring in various diseases, including pulmonary disorders such as pneumonia.

CHAPTER 3

METHODOLOGY

3.1 EXISTING SYSTEM

- Information from news articles played an important role in empowering citizens during an epidemic.
- However, our analysis found more negative articles than positive articles which is a concern (2548 vs. 561).
- The word clouds corresponding to the negative and positive statements displayed similar words.
- A content analysis of text mined Ebola on news articles and scientific publications showed similar findings

3.2 PROPOSED SYSTEM

- The also presented a comprehensive study of the spread of the virus outbreak situation in India which will further help in taking necessary steps to manage the huge population of India.
- For the same, two Machine Learning models were used but in future Deep Learning models or hybrid two or models can be used to forecast the further spread of the virus.
- Real-time data has been used for this analysis and not the conventional data because the data validity of real time data highly depends on the time and its response time requirements come from the external world.
- Although the real time data can be relaxed in a few cases unlike the conventional data which needs to satisfy every case, real time data is approximately correct with performance metrics calculated as a number of transactions missing their deadlines per unit time.

- Through our analysis can be concluded that the Polynomial Regression Algorithm.

3.3 SOFTWARE ENVIRONMENT

Python:

Python is a high-level, interpreted, interactive and object-oriented scripting language. Python is designed to be highly readable. It uses English keywords frequently where as other languages use punctuation, and it has fewer syntactical constructions than other languages.

- **Python is Interpreted** – Python is processed at runtime by the interpreter. You do not need to compile your program before executing it. This is similar to PERL and PHP.
- **Python is Interactive** – You can actually sit at a Python prompt and interact with the interpreter directly to write your programs.
- **Python is Object-Oriented** – Python supports Object-Oriented style or technique of programming that encapsulates code within objects.
- **Python is a Beginner's Language** – Python is a great language for the beginner-level programmers and supports the development of a wide range of applications from simple text processing to WWW browsers to games.

History of Python

Python was developed by Guido van Rossum in the late eighties and early nineties at the National Research Institute for Mathematics and Computer Science in the Netherlands.

Python is derived from many other languages, including ABC, Modula-3, C, C++, Algol-68, SmallTalk, and Unix shell and other scripting languages.

Python is copyrighted. Like Perl, Python source code is now available under the GNU General Public License (GPL).

Python is now maintained by a core development team at the institute, although Guido van Rossum still holds a vital role in directing its progress.

Python Features

Python's features include –

- **Easy-to-learn** – Python has few keywords, simple structure, and a clearly defined syntax. This allows the student to pick up the language quickly.
- **Easy-to-read** – Python code is more clearly defined and visible to the eyes.
- **Easy-to-maintain** – Python's source code is fairly easy-to-maintain.
- **A broad standard library** – Python's bulk of the library is very portable and cross-platform compatible on UNIX, Windows, and Macintosh.
- **Interactive Mode** – Python has support for an interactive mode which allows interactive testing and debugging of snippets of code.
- **Portable** – Python can run on a wide variety of hardware platforms and has the same interface on all platforms.
- **Extendable** – You can add low-level modules to the Python interpreter. These modules enable programmers to add to or customize their tools to be more efficient.
- **Databases** – Python provides interfaces to all major commercial databases.
- **GUI Programming** – Python supports GUI applications that can be created and ported to many system calls, libraries and windows systems, such as Windows MFC, Macintosh, and the X Window system of Unix.
- **Scalable** – Python provides a better structure and support for large programs than shell scripting.

Apart from the above-mentioned features, Python has a big list of good features, few are listed below –

- It supports functional and structured programming methods as well as OOP.
- It can be used as a scripting language or can be compiled to byte-code for building large applications.
- It provides very high-level dynamic data types and supports dynamic type checking.
- It supports automatic garbage collection.
- It can be easily integrated with C, C++, COM, ActiveX, CORBA, and Java.

Python is available on a wide variety of platforms including Linux and Mac OS X. Let's understand how to set up our Python environment.

Getting Python

The most up-to-date and current source code, binaries, documentation, news, etc., is available on the official website of Python <https://www.python.org>.

Windows Installation

Here are the steps to install Python on Windows machine.

- Open a Web browser and go to <https://www.python.org/downloads/>.
- Follow the link for the Windows installer python-XYZ.msifile where XYZ is the version you need to install.
- To use this installer python-XYZ.msi, the Windows system must support Microsoft Installer 2.0. Save the installer file to your local machine and then run it to find out if your machine supports MSI.
- Run the downloaded file. This brings up the Python install wizard, which is really easy to use. Just accept the default settings, wait until the install is finished, and you are done.

The Python language has many similarities to Perl, C, and Java. However, there are some definite differences between the languages.

First Python Program

Let us execute programs in different modes of programming.

Interactive Mode Programming

Invoking the interpreter without passing a script file as a parameter brings up the following prompt –

```
$ python

Python2.4.3(#1,Nov112010,13:34:43)

[GCC 4.1.220080704(RedHat4.1.2-48)] on linux2

Type"help","copyright","credits"or"license"for more information.

>>>
```

Type the following text at the Python prompt and press the Enter –

```
>>>print"Hello, Python!"
```

If you are running new version of Python, then you would need to use print statement with parenthesis as in **print ("Hello, Python!");**. However in Python version 2.4.3, this produces the following result –

```
Hello, Python!
```

Script Mode Programming

Invoking the interpreter with a script parameter begins execution of the script and continues until the script is finished. When the script is finished, the interpreter is no longer active.

Let us write a simple Python program in a script. Python files have extension **.py**. Type the following source code in a test.py file –

```
print"Hello, Python!"
```

We assume that you have Python interpreter set in PATH variable. Now, try to run this program as follows –

```
$ python test.py
```

This produces the following result –

```
Hello, Python!
```

Flask Framework:

Flask is a web application framework written in Python. Armin Ronacher, who leads an international group of Python enthusiasts named Pocco, develops it. Flask is based on Werkzeug WSGI toolkit and Jinja2 template engine. Both are Pocco projects.

Http protocol is the foundation of data communication in world wide web. Different methods of data retrieval from specified URL are defined in this protocol.

The following table summarizes different http methods –

Sr.No	Methods & Description
1	GET Sends data in unencrypted form to the server. Most common method.
2	HEAD Same as GET, but without response body

3	POST Used to send HTML form data to server. Data received by POST method is not cached by server.
4	PUT Replaces all current representations of the target resource with the uploaded content.
5	DELETE Removes all current representations of the target resource given by a URL

By default, the Flask route responds to the **GET** requests. However, this preference can be altered by providing methods argument to **route()** decorator.

In order to demonstrate the use of **POST** method in URL routing, first let us create an HTML form and use the **POST** method to send form data to a URL.

Save the following script as login.html

```
<html>

<body>

<form action="http://localhost:5000/login" method="post">

<p>Enter Name:</p>

<p><input type="text" name="nm"/></p>

<p><input type="submit" value="submit"/></p>

</form>

</body>
```

</html>

Now enter the following script in Python shell.

```
from flask import Flask, redirect, url_for, request

app = Flask(__name__)

@app.route('/success/<name>')

def success(name):

    return 'welcome %s' % name

@app.route('/login', methods=['POST', 'GET'])

def login():

    if request.method == 'POST':

        user = request.form['nm']

        return redirect(url_for('success', name = user))

    else:

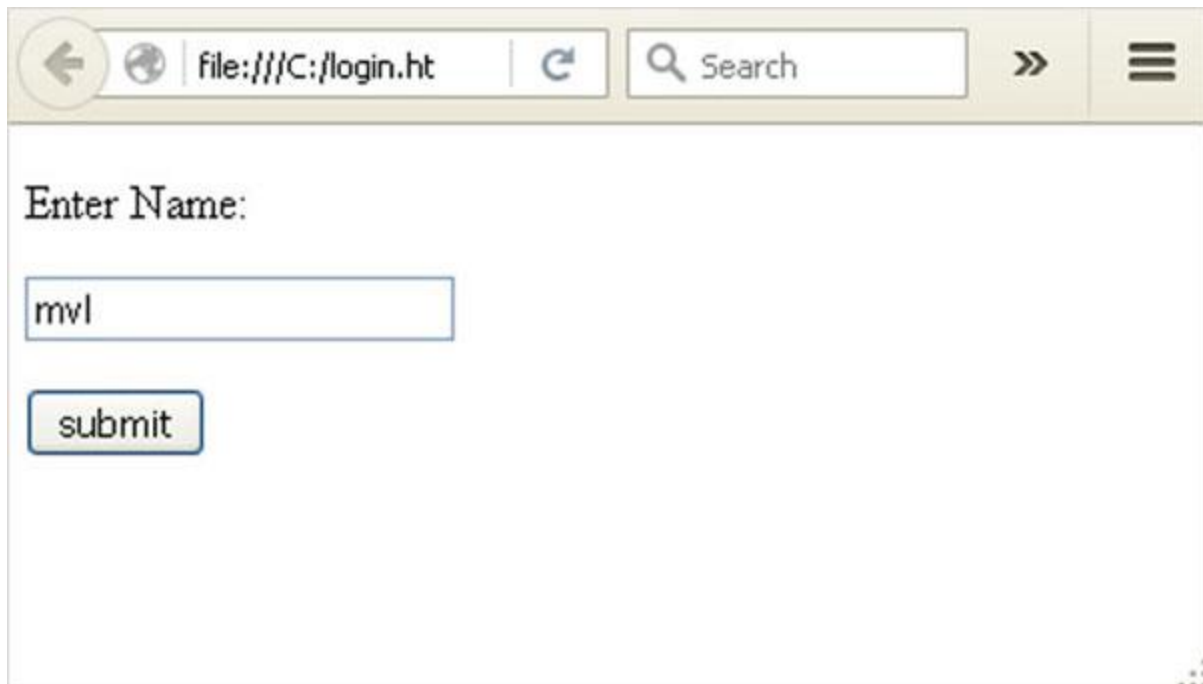
        user = request.args.get('nm')

        return redirect(url_for('success', name = user))

if __name__ == '__main__':

    app.run(debug = True)
```

After the development server starts running, open **login.html** in the browser, enter name in the text field and click **Submit**.



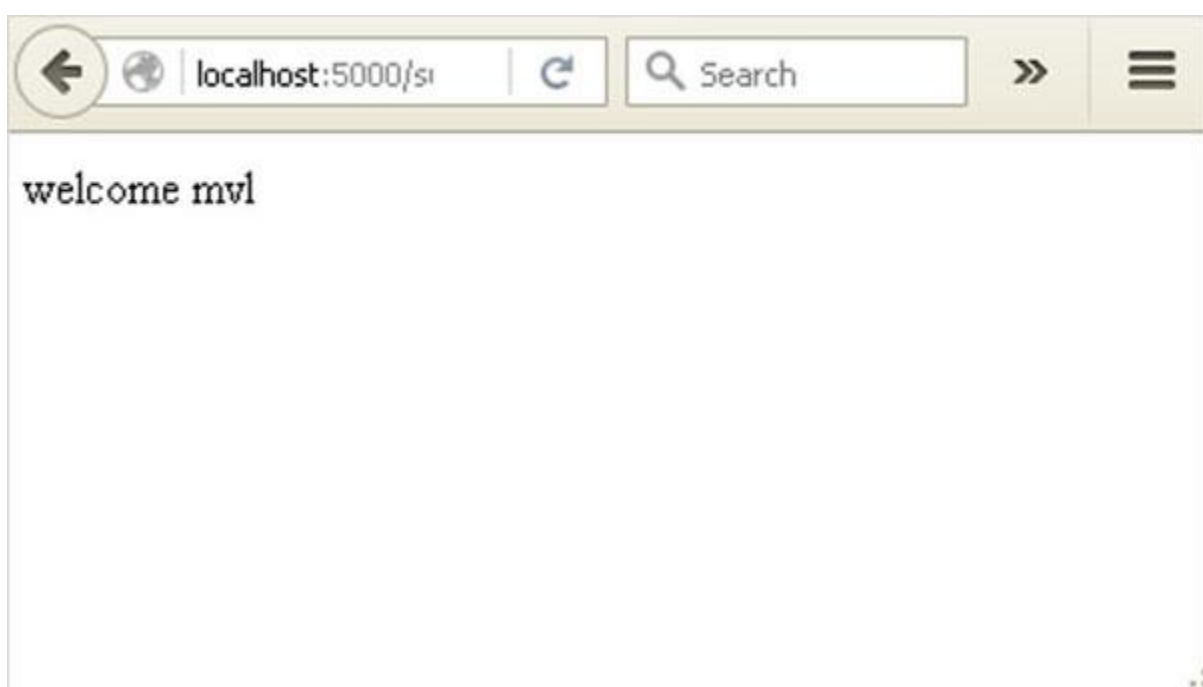
Enter Name:

Form data is POSTed to the URL in action clause of form tag.

http://localhost/login is mapped to the **login()** function. Since the server has received data by **POST** method, value of 'nm' parameter obtained from the form data is obtained by –

```
user = request.form['nm']
```

It is passed to '**success**' URL as variable part. The browser displays a **welcome** message in the window.



welcome mvl

Change the method parameter to '**GET**' in **login.html** and open it again in the browser. The data received on server is by the **GET** method. The value of 'nm' parameter is now obtained by –

```
User = request.args.get('nm')
```

Here, **args** is dictionary object containing a list of pairs of form parameter and its corresponding value. The value corresponding to 'nm' parameter is passed on to '/success' URL as before.

3.4 SYSTEM REQUIRMENTS

3.4.1 HARDWARE REQUIREMENTS

System : Pentium Dual Core.

Hard Disk : 120 GB.

Monitor : 15"LED

Input Devices : Keyboard, Mouse

Ram : 1GB.

3.4.2 SOFTWARE REQUIREMENTS

Operating system : Windows 7.

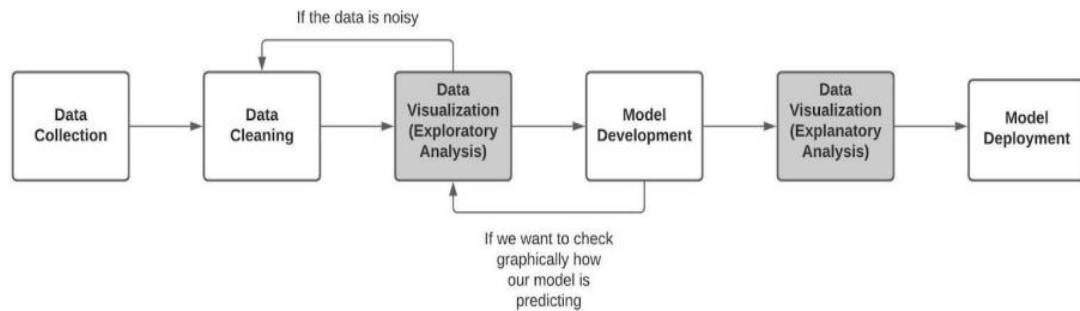
Coding Language : python

Toolkit : Jupitor Notebook

DATABASE : EXCEL

3.5 SYSTEM ARCHITECTURE

The system architectural design is the design process for identifying the subsystems making up the system and framework for subsystem control and communication. The goal of the architectural design is to establish the overall structure of software system.



3.6 MODULES

- Data collection
- EXPECTED SPREAD AND FORECASTING VALIDATION
- MODEL COMPARISON WITH THE SEIRD MODEL
- Covid-19 forecasting
- Accurate forecasting

Data collection

we present a generalized model to characterize the COVID-19 pandemic composed with eight different states or phenotypes. These states are supposed to characterize all the life cycle of an infected case before the infection, during the infection, and after being discharged, either deceased or recovered. Each state in our model is supposed to characterize, at a given unit of time t , in our case day, a specific population's behaviour as follows.

EXPECTED SPREAD AND FORECASTING VALIDATION

we extrapolate the COVID-19 spread in the studied countries using our fitted models to forecast its evolution during the next period. We also discuss in details the evolution of each state. In addition, we provide the upper and lower bounds of the expected spread representing the worst and best cases scenarios for these countries based on our model.

MODEL COMPARISON WITH THE SEIRD MODEL

we can deduce the effect of the weights on the forecast performance. In fact, the forecast of the number of infected cases proves that the weighting technique helps in improving the forecast of the observed data but it will reduce the efficiency of the fitting. Indeed, if the model is trained to perfectly follow the training data, then the model will over-fit the training data and it will perform badly during the forecast.

COVID-19 FORECASTING

We have proposed a mechanistic model for assessing and forecasting the spread of the COVID-19 pandemic. The pandemic of interest is very novel and even though it has already spread all over the world, scientists still do not have enough knowledge to model it properly, especially due to the lack of data and evidence about its contamination process.

ACCURATE FORECASTING

The fitting technique is represented along with the model that aims to endorse its forecasting results by focusing on the last trends of the data, and hence, giving accurate results that are on the verge of these trends. Multiple countries with different spread trends are investigated with the proposed work. We reveal that our model is able to fit the real world data of different countries showing different spread trends. It is shown that accurate forecasting results are obtained.

3.7 PROPOSED ALGORITHMS

POLYNOMIAL REGRESSION

- Polynomial Regression is a regression algorithm that models the relationship between a dependent(y) and independent variable(x) as nth degree polynomial. The Polynomial Regression equation is given below:

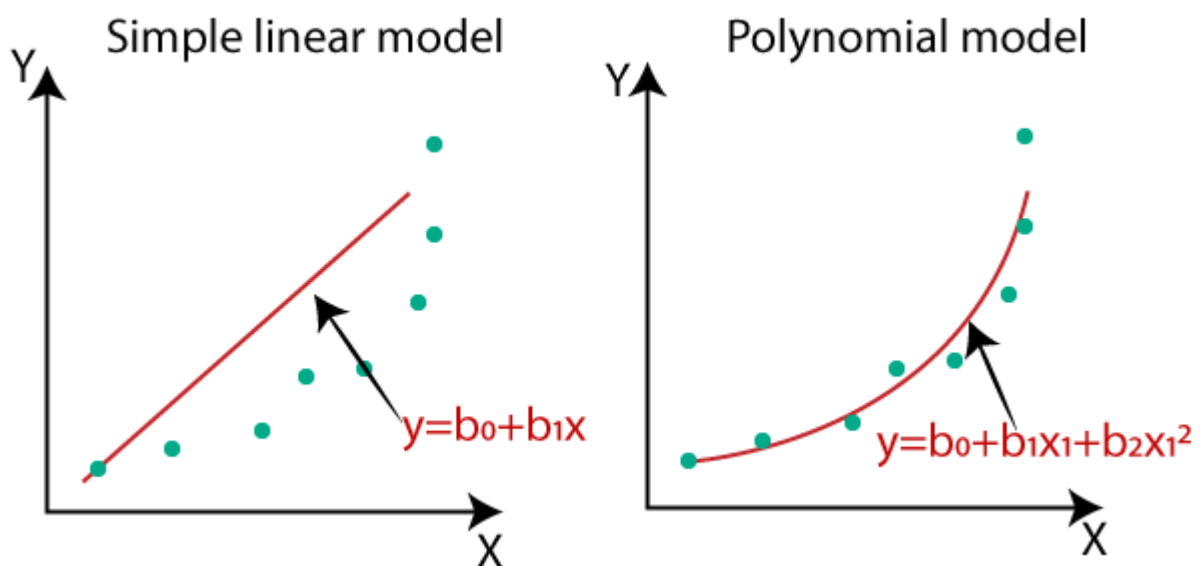
$$y = b_0 + b_1x_1 + b_2x_1^2 + b_3x_1^3 + \dots + b_nx_1^n$$

- It is also called the special case of Multiple Linear Regression in ML. Because we add some polynomial terms to the Multiple Linear regression equation to convert it into Polynomial Regression.
- It is a linear model with some modification in order to increase the accuracy.
- The dataset used in Polynomial regression for training is of non-linear nature.
- It makes use of a linear regression model to fit the complicated and non-linear functions and datasets.
- **Hence, "In Polynomial regression, the original features are converted into Polynomial features of required degree (2,3,...,n) and then modeled using a linear model."**

Need for Polynomial Regression:

The need of Polynomial Regression in ML can be understood in the below points:

- If we apply a linear model on a **linear dataset**, then it provides us a good result as we have seen in Simple Linear Regression, but if we apply the same model without any modification on a **non-linear dataset**, then it will produce a drastic output. Due to which loss function will increase, the error rate will be high, and accuracy will be decreased.
- So for such cases, **where data points are arranged in a non-linear fashion, we need the Polynomial Regression model**. We can understand it in a better way using the below comparison diagram of the linear dataset and non-linear dataset.



- In the above image, we have taken a dataset which is arranged non-linearly. So if we try to cover it with a linear model, then we can clearly see that it hardly covers any data point. On the other hand, a curve is suitable to cover most of the data points, which is of the Polynomial model.
- Hence, *if the datasets are arranged in a non-linear fashion, then we should use the Polynomial Regression model instead of Simple Linear Regression.*

Note: A Polynomial Regression algorithm is also called Polynomial Linear Regression because it does not depend on the variables, instead, it depends on the coefficients, which are arranged in a linear fashion.

Equation of the Polynomial Regression Model:

Simple Linear Regression equation: $y = b_0 + b_1x$ (a)

Multiple Linear Regression equation: $y = b_0 + b_1x + b_2x_2 + b_3x_3 + \dots + b_nx_n$ (b)

Polynomial Regression equation: $y = b_0 + b_1x + b_2x^2 + b_3x^3 + \dots + b_nx^n$ (c)

When we compare the above three equations, we can clearly see that all three equations are Polynomial equations but differ by the degree of variables. The Simple and Multiple Linear equations are also Polynomial equations with a single degree, and the Polynomial regression equation is Linear equation with the nth degree. So if we add a degree to our linear equations, then it will be converted into Polynomial Linear equations.

3.8 SYSTEM DESIGN AND TESTING PLAN

INPUT DESIGN

The input design is the link between the information system and the user. It comprises the developing specification and procedures for data preparation and those steps are necessary to put transaction data in to a usable form for processing can be achieved by inspecting the computer to read data from a written or printed document or it can occur by having people keying the data directly into the system. The design of input focuses on controlling the amount of input required, controlling the errors, avoiding delay, avoiding extra steps and keeping the process simple. The

input is designed in such a way so that it provides security and ease of use with retaining the privacy. Input Design considered the following things:

- What data should be given as input?
- How the data should be arranged or coded?
- The dialog to guide the operating personnel in providing input.
- Methods for preparing input validations and steps to follow when error occur.

OUTPUT DESIGN

A quality output is one, which meets the requirements of the end user and presents the information clearly. In any system results of processing are communicated to the users and to other system through outputs. In output design it is determined how the information is to be displaced for immediate need and also the hard copy output. It is the most important and direct source information to the user. Efficient and intelligent output design improves the system's relationship to help user decision-making.

The output form of an information system should accomplish one or more of the following objectives.

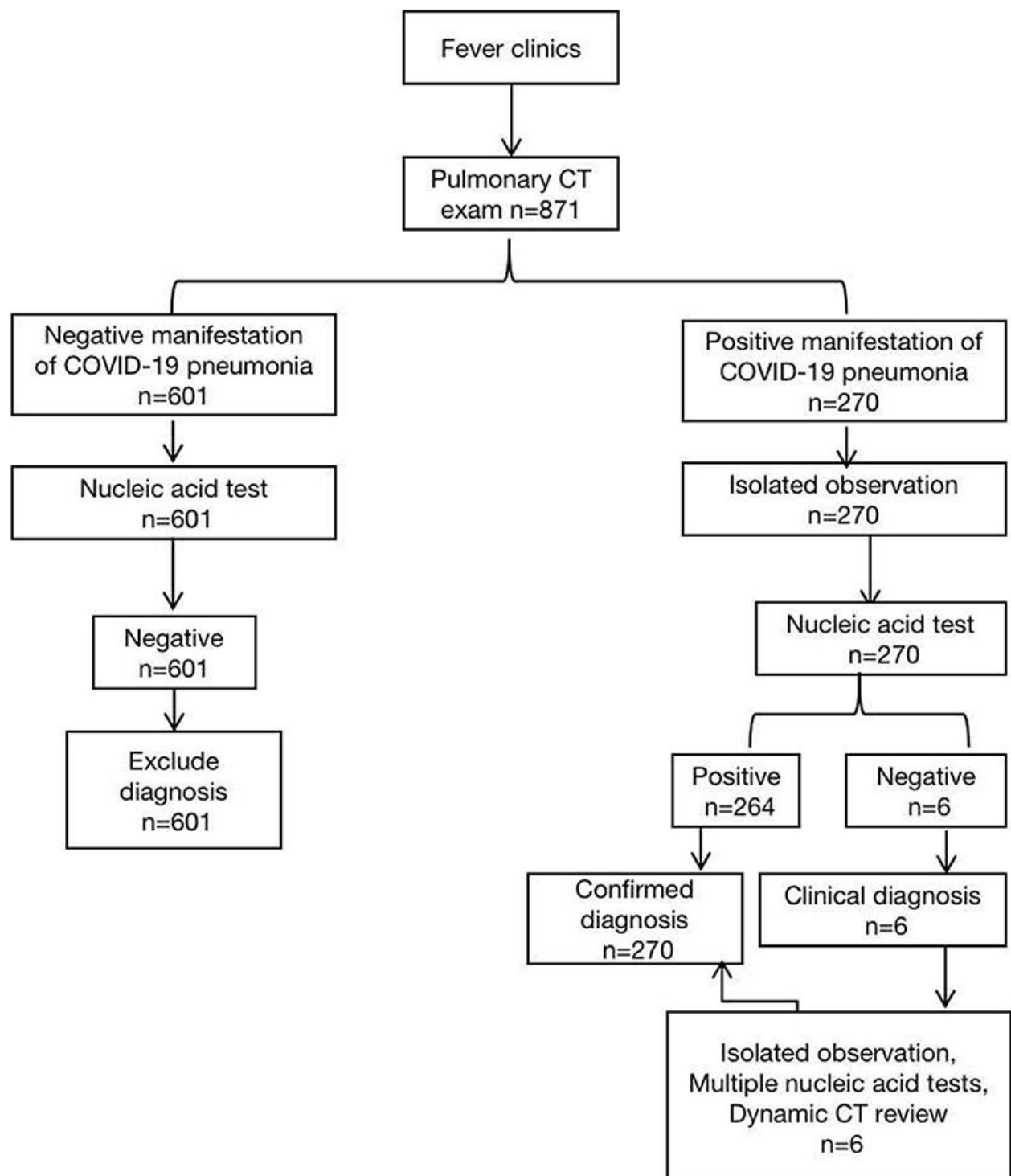
- Convey information about past activities, current status or projections of the
- Future.
- Signal important events, opportunities, problems, or warnings.
- Trigger an action.
- Confirm an action.

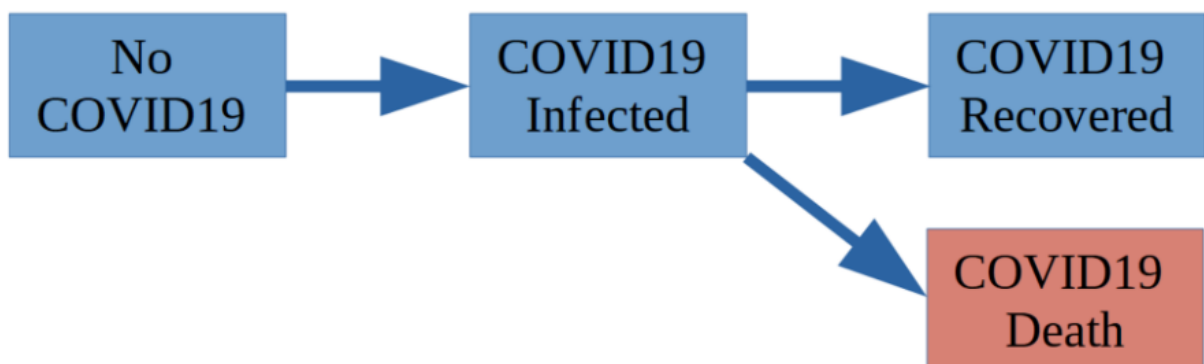
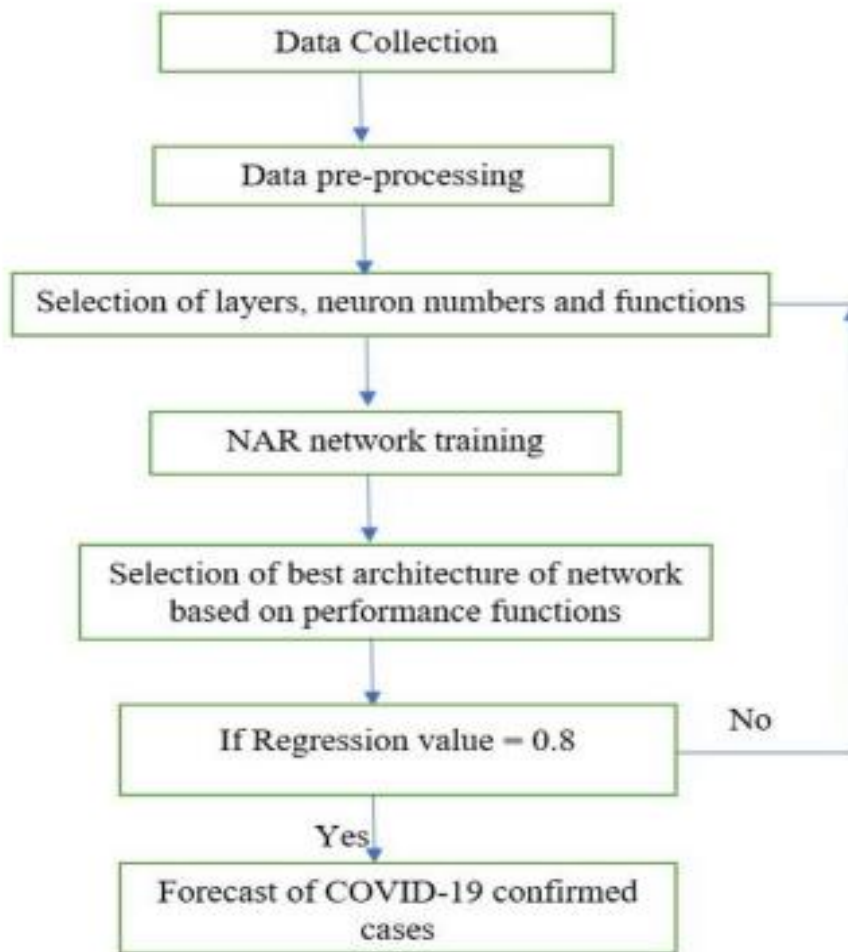
DATA FLOW DIAGRAM

1. The DFD is also called as bubble chart. It is a simple graphical formalism that can be used to represent a system in terms of input data to the system, various processing carried out on this data, and the output data is generated by this system.
2. The data flow diagram (DFD) is one of the most important modeling tools. It is used to model the system components. These components are the system

process, the data used by the process, an external entity that interacts with the system and the information flows in the system.

3. DFD shows how the information moves through the system and how it is modified by a series of transformations. It is a graphical technique that depicts information flow and the transformations that are applied as data moves from input to output.
4. DFD is also known as bubble chart. A DFD may be used to represent a system at any level of abstraction. DFD may be partitioned into levels that represent increasing information flow and functional detail.
5. The DFD is also called as bubble chart. It is a simple graphical formalism that can be used to represent a system in terms of input data to the system, various processing carried out on this data, and the output data is generated by this system.
6. The data flow diagram (DFD) is one of the most important modeling tools. It is used to model the system components. These components are the system process, the data used by the process, an external entity that interacts with the system and the information flows in the system.
7. DFD shows how the information moves through the system and how it is modified by a series of transformations. It is a graphical technique that depicts information flow and the transformations that are applied as data moves from input to output.
8. DFD is also known as bubble chart. A DFD may be used to represent a system at any level of abstraction. DFD may be partitioned into levels that represent increasing information flow and functional detail.





UML DIAGRAMS

UML stands for Unified Modeling Language. UML is a standardized general-purpose modeling language in the field of object-oriented software engineering. The standard is managed, and was created by, the Object Management Group.

The goal is for UML to become a common language for creating models of object oriented computer software. In its current form UML is comprised of two major components: a Meta-model and a notation. In the future, some form of method or process may also be added to; or associated with, UML.

The Unified Modeling Language is a standard language for specifying, Visualization, Constructing and documenting the artifacts of software system, as well as for business modeling and other non-software systems.

The UML represents a collection of best engineering practices that have proven successful in the modeling of large and complex systems.

The UML is a very important part of developing objects oriented software and the software development process. The UML uses mostly graphical notations to express the design of software projects.

GOALS:

The Primary goals in the design of the UML are as follows:

1. Provide users a ready-to-use, expressive visual modeling Language so that they can develop and exchange meaningful models.
2. Provide extendibility and specialization mechanisms to extend the core concepts.
3. Be independent of particular programming languages and development process.
4. Provide a formal basis for understanding the modeling language.
5. Encourage the growth of OO tools market.
6. Support higher level development concepts such as collaborations, frameworks, patterns and components.
7. Integrate best practices

CHAPTER 4

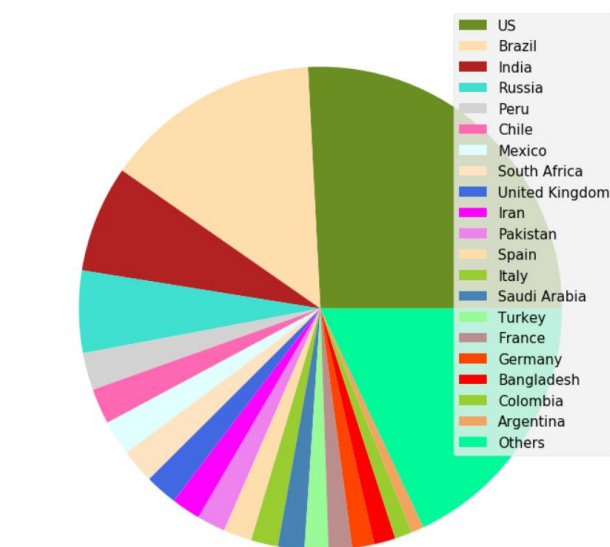
RESULTS AND DISCUSSION

So the final results are analysis of COVID-19 of the world and Indian states and prediction of COVID-19 case. In the first to figures are analysis of cases and the last figure prediction of cases

So algorithm is mentioned as below

1. In the first step we collected data of COVID-19 of different countries
2. Then we train the model using so much data that we collected which contains various different parameters.
3. Then we analyse the data of COVID-19
4. In the last step we perform prediction and here we get the final output

Fig .1 Analysis of COVID-19 cases of several countries



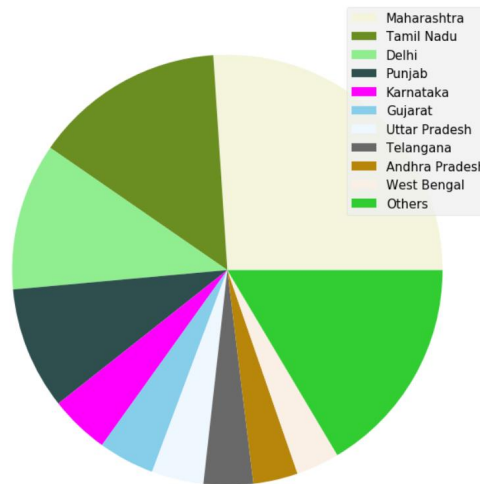


Fig.2 Analysis of COVID-19 cases of state wise in india

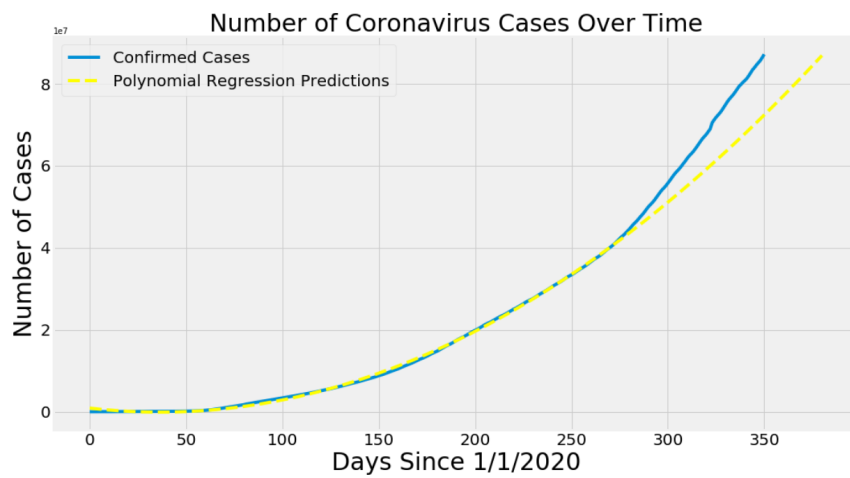


Fig.3 Prediction of COVID-19 cases using Polynomial Regression Algorithm

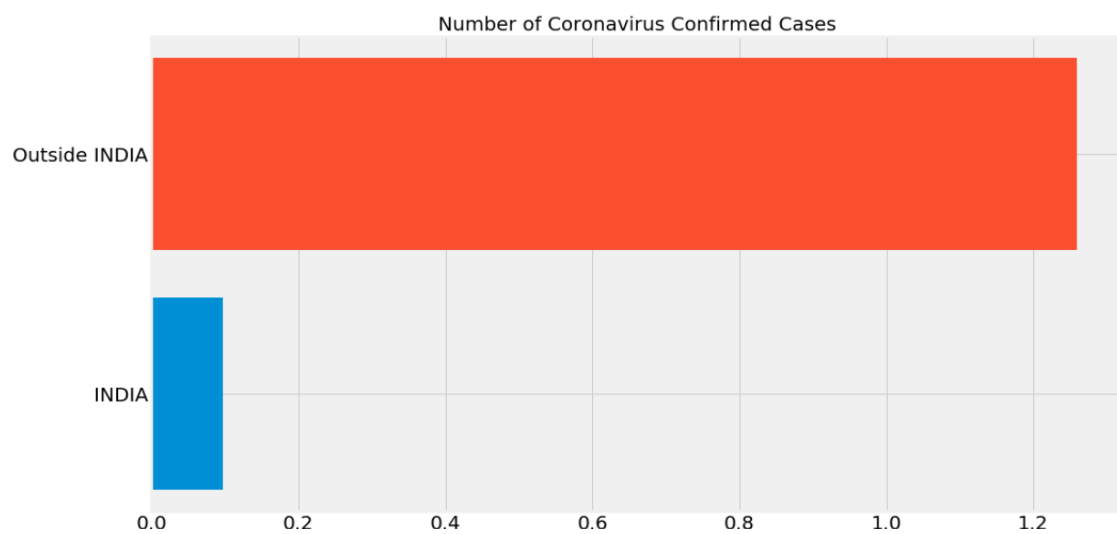


Fig 4 The Analysis of covid india and other countries

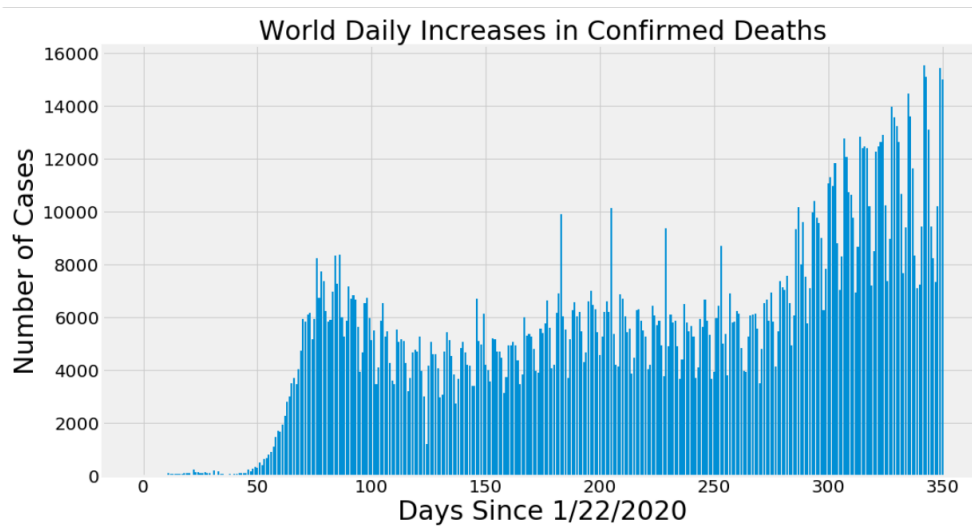


Fig 5 Increasing the cases day by day analysis

CHAPTER 5

CONCLUSION

5.1. CONCLUSION

In this study, we developed a mechanistic model composed of eight states to characterize the COVID-19 spread in different countries. An ODE system is formulated to mathematically model the interactions between the different states. A curve fitting using real world observed data sets is developed to determine accurate fitting solutions and estimate the parameters of the ODE model. We use the LM algorithm to solve and estimate the ODE system parameters. We have shown that the employed algorithms outperform a reference model, i.e., BFGS. The fitting technique is represented along with the model that aims to endorse its forecasting results by focusing on the last trends of the data, and hence, giving accurate results that are on the verge of these trends. Multiple countries with different spread trends are investigated with the proposed work.

5.2 FUTURE WORK

The future work is to provide better significant results using several other machine learning models for finding estimates that helps the clinicians, medical and governmental organizations to look forward for real time preparations ahead at this sort of pandemic disease in future. Also Deep Learning models can be employed to predict the COVID cases.

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APPENDIX

A.SOURCE CODE:

```
import numpy as np

import pandas as pd

import matplotlib.pyplot as plt

import matplotlib.colors as mcolors

import random

import math

import time

from sklearn.linear_model import LinearRegression

from sklearn.model_selection import train_test_split

from sklearn.preprocessing import PolynomialFeatures

from sklearn.svm import SVR

from sklearn.metrics import mean_squared_error, mean_absolute_error

import datetime

import operator

plt.style.use('fivethirtyeight')

%matplotlib inline

# Extracting the date columns

confirmed = confirmed_cases.loc[:, cols[4]:cols[-1]]

deaths = deaths_reported.loc[:, cols[4]:cols[-1]]

recoveries = recovered_cases.loc[:, cols[4]:cols[-1]]

india_confirmed =

latest_data[latest_data['Country_Region']=='India']['Confirmed'].sum()
```

```

outside_india_confirmed = np.sum(confirmed_by_country) - india_confirmed

plt.figure(figsize=(16, 9))

plt.barh('INDIA', india_confirmed)

plt.barh('Outside INDIA', outside_india_confirmed)

plt.title('Number of Coronavirus Confirmed Cases', size=20)

plt.xticks(size=20)

plt.yticks(size=20)

plt.show()

def plot_pie_charts(x, y, title):
    c = random.choices(list(mcolors.CSS4_COLORS.values()), k =
len(unique_countries))

    plt.figure(figsize=(12,12))

    plt.title(title, size=20)

    plt.pie(y, colors=c)

    plt.legend(x, loc='best', fontsize=15)

    plt.show()

def plot_pie_country_with_regions(country_name, title):
    regions =
list(latest_data[latest_data['Country_Region']==country_name]['Province_State'].unique())

    confirmed_cases = []

    no_cases = []

    for i in regions:
        cases = latest_data[latest_data['Province_State']==i]['Confirmed'].sum()

        if cases > 0:

```

```

        confirmed_cases.append(cases)

    else:

        no_cases.append(i)

# remove areas with no confirmed cases

for i in no_cases:

    regions.remove(i)

# only show the top 10 states

regions = [k for k, v in sorted(zip(regions, confirmed_cases),
key=operator.itemgetter(1), reverse=True)]

for i in range(len(regions)):

    confirmed_cases[i] =
latest_data[latest_data['Province_State']==regions[i]]['Confirmed'].sum()

# additional province/state will be considered "others"

if(len(regions)>10):

    regions_10 = regions[:10]

    regions_10.append('Others')

    confirmed_cases_10 = confirmed_cases[:10]

    confirmed_cases_10.append(np.sum(confirmed_cases[10:]))

    plot_pie_charts(regions_10,confirmed_cases_10, title)

else:

    plot_pie_charts(regions,confirmed_cases, title)

def plot_predictions(x, y, pred, algo_name, color):

    plt.figure(figsize=(16, 9))

```

```
plt.plot(x, y)

plt.plot(future_forecast, pred, linestyle='dashed', color=color)

plt.title('Number of Coronavirus Cases Over Time', size=30)

plt.xlabel('Days Since 1/1/2020', size=30)

plt.ylabel('Number of Cases', size=30)

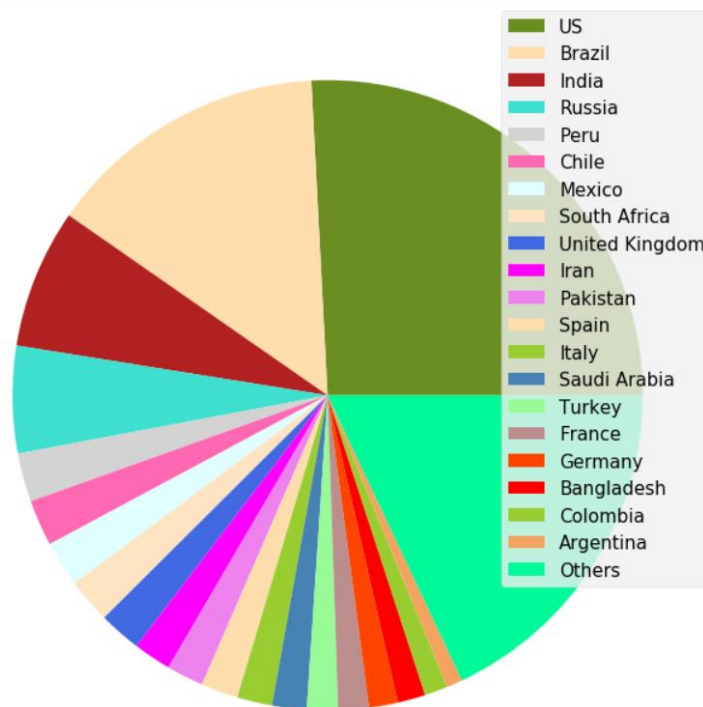
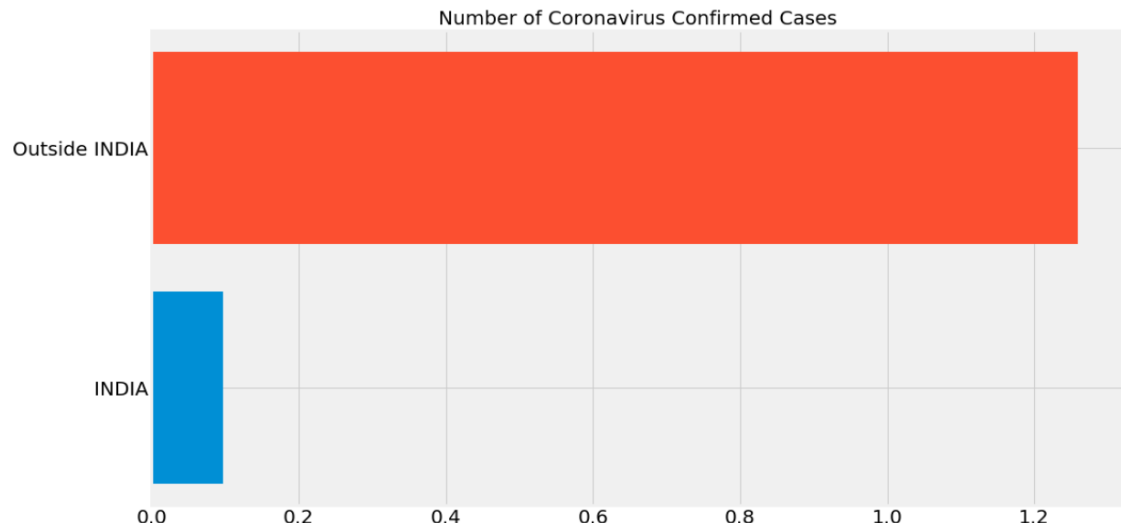
plt.legend(['Confirmed Cases', algo_name], prop={'size': 20})

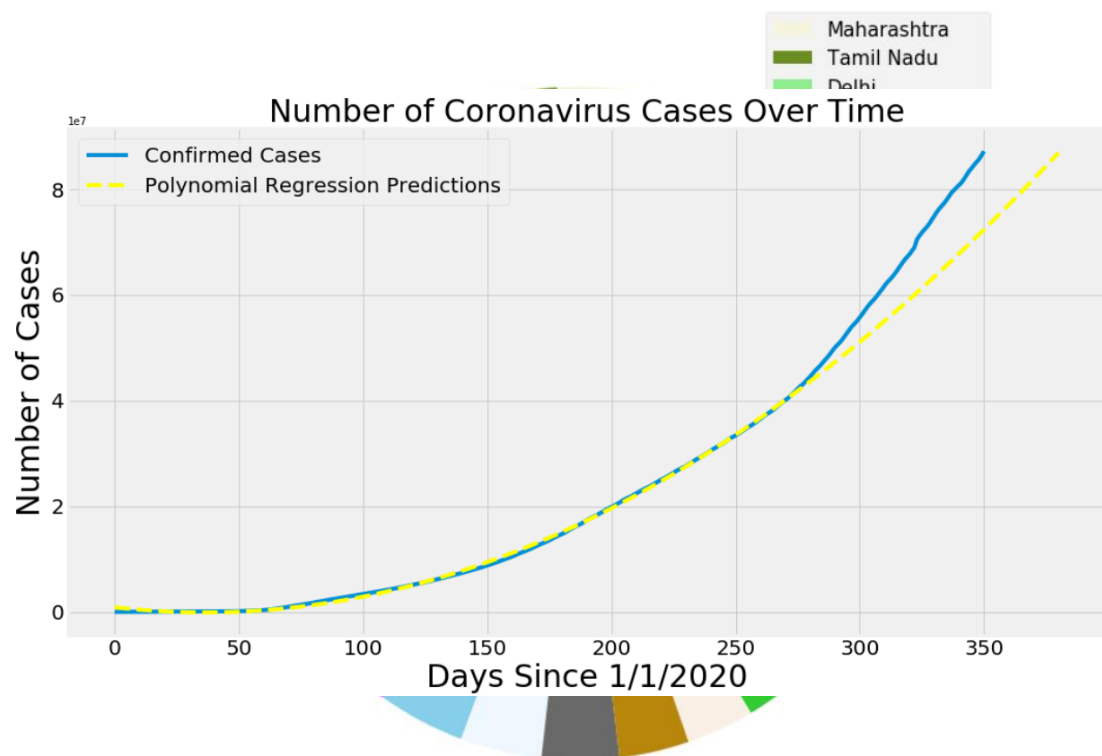
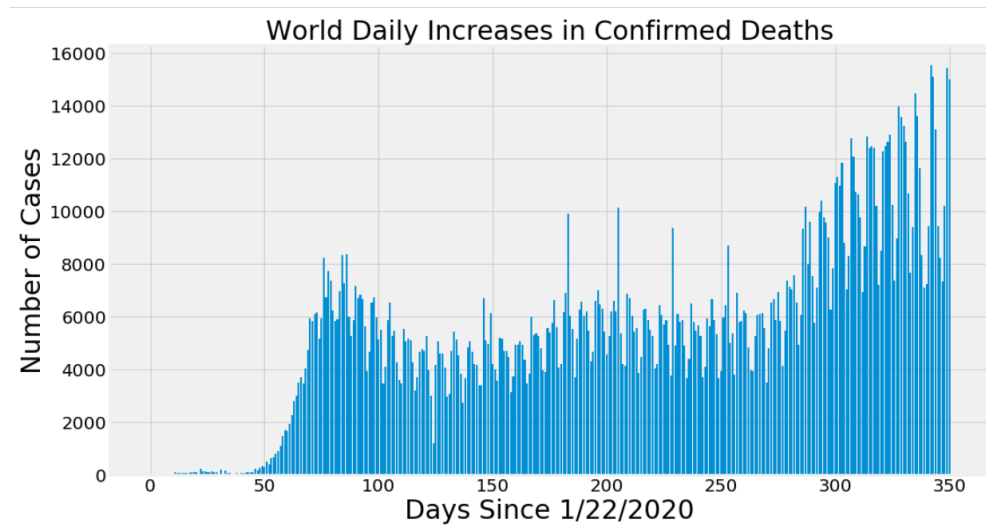
plt.xticks(size=20)

plt.yticks(size=20)

plt.show()
```

B.SCREENSHOTS





C . PUBLICATION PAPER

CORONAVIRUS DISEASE (COVID-19) CASES ANALYSIS USING MACHINE-LEARNING

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Chennai

ABSTRACT

COVID-19, is happening in various areas of the planet and is influencing a large number of individuals around the world. It stays a genuine admonition to general wellbeing and will be probably the greatest plague in world history. It intends to give an itemized outline of how to carry out different Machine Learning models continuously. As well as breaking down worldwide information, the review recognized various methodologies and encounters in various regions of the planet. Data is accessible inside 154 days between January 22, 2020 and June 24,

2020. Planning ahead, the information will be breaking down and many outcomes will be gotten.

KEYWORDS:

Data collection, Covid-19 forecasting, Accurate forecasting, AI

INTRODUCTION

MACHINE learning (ML) has shown to be a significant field of examination somewhat recently, with numerous troublesome and major issues. The ML preparing of the calculation is regularly founded on experimentation, rather than customary calculations that adhere to the guidelines to begin a program dependent on ends, etc. One of the main pieces of ML is arranging, and countless ML calculations are utilized in this part to direct different exercises needed in numerous spaces of utilization, for example, climate estimating, sickness determining, financial exchange anticipating, and illness guaging. Different relapse

strategies and practical techniques are utilized to anticipate patients with specific sicknesses. There is a ton of exploration that utilizes AI methods to anticipate different illnesses, like coronary illness, coronary illness, and bosom malignant growth. Specifically, the review zeroed in on the immediate expectation of the issue distinguished by COVID-19, and the review zeroed in on the forecast and control of COVID-19 illness. The hardest part about spreading the infection is that you can get the infection for quite a long time with practically no manifestations. Because of the risk of spreading, practically all nations have announced extreme or serious savagery in the impacted regions and urban communities. Clinical analysts from everywhere the world are doing their most extreme to track down the right antibody and medication. Since there is right now no authority antitoxin for the infection, the public authority in all nations is

zeroing in on preventive measures. In every single preventive measure, "data" in all pieces of COVID-19 is viewed as significant. Taking part in this segment of the paper, numerous specialists have concentrated on an assortment of good exploration and concocted arrangements that will help mankind.

EXISTING SYSTEM

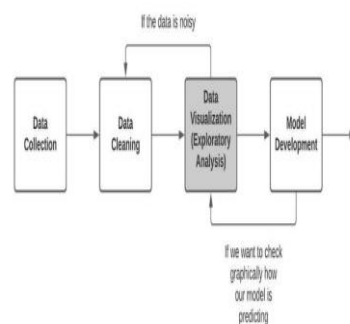
News from the paper has assumed a critical part in enabling people in general even with irresistible illnesses. Notwithstanding, it is intriguing to take note of that our investigation uncovered more bad perspectives. (2548 stanza 561) The word relates to the awful and great mists that show comparative words. An examination of Ebola-determined data and logical data shows comparative outcomes.

PROPOSED SYSTEM

The venture has prompted an inside and out investigation of the infection pestilence in India, which will assist with going to the essential lengths to deal with the enormous populace of India. Since the worth of constant data relies upon the time it removes to get from the world and the

reaction time prerequisites, the real data utilized in the investigation isn't precise. Albeit the real data might be rearranged in a brief timeframe, as opposed to the ordinary data that should be given for each situation, the real data is remedied in the way wherein it is done and counted for a large portion of the exercises finished in one period. From our investigation, we can affirm that it is a polynomial relapse calculation.

ARCHITECTURE DIAGRAM



LITERATURE SURVEY:

COVID-19 Epidemic Analysis using Machine Learning and Deep Learning Algorithms

Narinder Singh Punj · Sanjay Kumar

Sonbhadra · Sonali Agarwal / 2020

Extreme Respiratory Syndrome - Coronavirus (SARS-CoV-2) and furthermore COVID-2019 have brought worldwide wellbeing. The world is putting forth extraordinary attempts to battle the spread of this lethal illness through framework, finance, wellsprings of data, inoculation apparatuses, medical services and different devices. Man-made brainpower analysts use data spread the nation over to zero in on their specialized information to work on pestilence insights.

COVID-19 in India: State-wise Analysis and Prediction

Palash Ghosh, Rik Ghosh, Bibhas Chakraborty/2020

The illness has effectively spread to 212 nations and domains and has contaminated (affirmed) multiple million individuals. The infection was first analyzed in Quite a while on January 30, 2020 by an understudy getting back

from Wuhan in Kerala. Presently, the all out number of tainted individuals in India is more than 37,000 (May 3, 2020). Most examinations and diaries center around the quantity of individuals tainted the nation over.

COVID-19 Outbreak Prediction with Machine Learning

Sina Ardabili, Amir Mosavi, Pedram Ghamisi, Filip Ferdinand/ 2020

Among the most well-known instances of COVID-19 in worldwide the study of disease transmission, basic epidemiological and measurable models are generally welcomed by the specialists and notable in the media. Because of the absence of significant data and the undeniable degree of vulnerability, customary models have shown little truth in foreseeing life span.

Forecasting the novel coronavirus COVID-19

Fotios Petropoulos, Spyros Makridakis, 2020

Arranging requires a ton of authentic data. Simultaneously, there is no question that the future

won't be something similar. What's more, the estimate relies upon the unwavering quality of the data, the advantages got, and the normal changes. It assumes a key part in changing how individuals see, respond to, and dread the outcomes of infection.

sForecasting the novel coronavirus COVID-19

Arti. M. K, K. Bhatnagar/2020

Arranging requires a great deal of authentic data. Simultaneously, there is no question that the future won't be something very similar. Moreover, the figure relies upon the unwavering quality of the data, the advantages got, and the normal changes. Emotional wellness assumes a significant part in how individuals see and react with the impacts of irresistible illnesses, and it is trusted that they will influence them.

Prediction of Spreads of COVID-19 in India from Current Trend

H. Shekhar/2020

Information from March 15, 2020 to April 30, 2020 are utilized to approve the model, and the speed of progress stays consistent. Some

Indian states, like Maharashtra, Gujarat and Delhi, have high paces of every day diseases. It keeps up with a similar speed and can measure up to pondering the primary disease. Abrupt shocks are distinguished in these three nations utilizing the worth recuperation technique.

An interpretable mortality prediction model for COVID-19 patients

Yan, L., Zhang, H., Goncalves, J. et al/2020

The unexpected ascent in COVID-19 is putting a strain on worldwide wellbeing administrations. At this stage, it is vital to evaluate the seriousness of the sickness rapidly, precisely, and early. To help direction and arranging in wellbeing programs, the review utilized blood tests from 485 tainted patients in Wuhan, China, to recognize indications of death from the illness.

Propagation analysis and prediction of the COVID-19

L. Li, Z. Yang, Z. Dang, C. Meng, J. Huang, H. Meng, D. Wang, G.

Chen, J. Zhang, H. Peng, Y. Shao

As indicated by the authority data transmission framework, this record looks at how the 2019 Coronavirus (COVID-19) is communicated. The mistake between the model and the information bend is tiny. At that point, he anticipated the plague and comprehended it prior to settling on a choice and examining the nations that aided settle on the choice.

RELATED WORK

COVID-19

Irresistible sicknesses brought about by the SARS-COV-2 infection, known as COVID-19, need earnest support in excess of 200 nations all over the planet, and the quantity of individuals tainted in the initial four months later disease changes. Something like 200,000 individuals have kicked the bucket, around 20 million. In any case, all of this power exists since it is hard to recognize great individuals from COVID-19 because of the various manifestations of COVID-19. Accordingly,

SARS testing - the CoV-2 infection is considered significant in the location of irresistible illnesses (Brinati et al. 2020). Radiology and imaging are the absolute generally significant and significant strategies used to gauge COVID-19 levels and the impacts of cellular breakdown in the lungs and chest tomography checks (Day 2020). Early identification of COVID-19 is essential to diminish disease and patient consideration. As of late, segregating sound individuals associated with being contaminated or tainted with the infection and proceeding with the separation program is the most ideal way to forestall COVID-19 (Dan 2020). AI strategies have exhibited critical understanding into COVID-19, like computed tomography (CT) lungs. RT - PCR), and recognizing COVID-19 from pneumonia and other viral contaminations through lung CT examines (Kassani et al. (2004)).

MODULES

Data collection

Expected spread and forecasting validation

Model comparison with the seird model

Covid-19 forecasting

Accurate forecasting

DATA COLLECTION

We present an overall outline of the qualities of the COVID-19 pandemic, which comprises of eight unique states or aggregates. These elements ought to decide the existence of a contaminated individual who has passed on or recuperated before disease, during contamination, and later release from the emergency clinic. Every area in our model must be characterized in a specific timeframe, and for our situation, the particular conduct of the local area in the accompanying manner.

EXPECTED SPREAD AND FORECASTING VALIDATION

We clarify the pervasiveness of COVID-19 in taught nations utilizing the model we have set up to decide the following advancement. We likewise talk about the change of each state in more detail. Also, we give the upper and lower limits of the model

dependent on our model, which shows the negative and positive parts of these nations.

MODEL COMPARISON WITH THE SEIRD MODEL

We can compute the impact of weight on the normal exhibition. Indeed, the quantity of tainted individuals proposes that the estimation technique will assist with working on the determining of the data gave, yet additionally lessen the presentation of the board. Indeed, luckily the plan is prepared to follow the arrangement data well, and the plan will be notable alongside the plan data and will be executed on time.

COVID-19 FORECASTING

We requested an example of COVID-19 scourges. Albeit the pestilence of interest is new and has spread all over the planet, researchers actually have sufficient information to copy it, particularly the absence of data and proof of how it is communicated.

ACCURATE FORECASTING

The exchanging strategy depends on a model that spotlights on the most recent data in the information, approves the anticipated outcomes, and afterward gives practical responses on the negative side. The arranged occasion will inspect various nations with various ways to deal with conveyance. We show that our model can be joined with genuine data from various nations, showing various ways of spreading it. It shows that the anticipated outcomes are valid

Result

So the final results are analysis of COVID-19 of the world and Indian states and prediction of COVID-19 case. In the first to figures are analysis of cases and the last figure prediction of cases

So algorithm is mentioned as below

1. In the first step we collected data of COVID-19 of different countries
2. Then we train the model using so much data that we collected which contains various different parameters.
3. Then we analyse the data of COVID-19

4. In the last step we perform prediction and here we get the final output

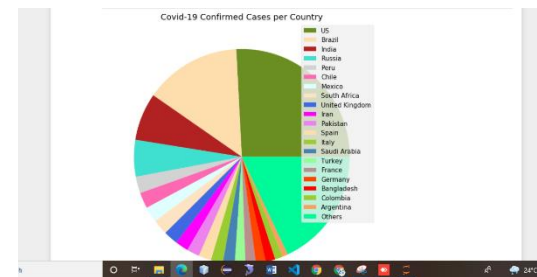


Fig.1 Analysis of COVID-19 cases of several countries

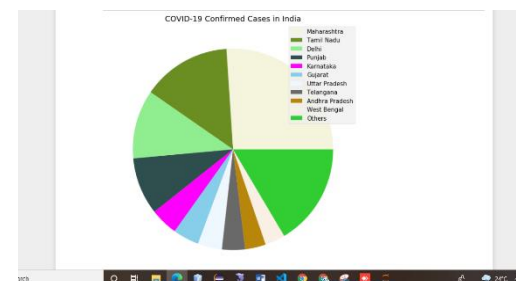


Fig.2 Analysis of COVID-19 cases of state wise in India

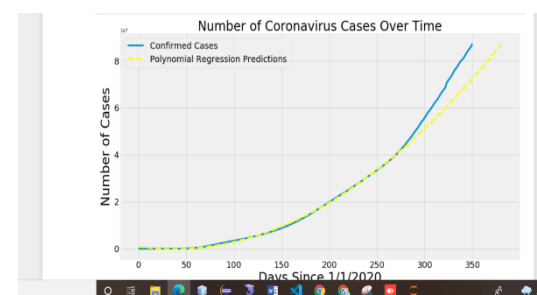


Fig.3 Prediction of COVID-19 cases using Polynomial Regression Algorithm

CONCLUSION

The review zeroed in on points utilizing AI programs and various calculations for various purposes in COVID-19 sickness, and 14 out of 16 utilizing controlled

learning, of which just one utilized uninformed learning and the other utilized uninformed learning, the two of which show genuine outcomes. The review utilized AI from various nations and various writers, however every one of them were identified with the COVID-19 plague, (5) involving the strategic relapse calculations in these articles, all of which yielded results that yielded brings about COVID-19. The articles on manual systems administration (3) showed victories, while the excess 14 articles utilized diverse control and checking calculations, and all models showed genuine outcomes. Our decision is that ML involves various models and calculations in medication to give sensible, passionate, and interesting outcomes. By and large, the aftereffects of the examined archives were awesome in distinguishing COVID-19 manifestations, which were higher (92%) than in the uncontrolled (7.1%).

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