



Department of Computer Science & Engineering
Shri Shankaracharya Institute of Professional Management & Technology
Raipur (C.G.)

A major project phase-I Report
On
DEVELOPMENT AND ANALYSIS OF
ARTIFICIAL NEURAL NETWORK MODEL FOR
RAINFALL PREDICTION

Submitted To



Chhattisgarh Swami Vivekanand Technical University
Bhilai, India

For
The Partial Fulfillment of Degree
of
Bachelor of Technology
in
Computer Science & Engineering
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Department of Computer Science & Engineering
Shri Shankaracharya Institute of Professional Management & Technology
Raipur (C.G.)

DEVELOPMENT AND ANALYSIS OF ARTIFICIAL NEURAL NETWORK MODEL FOR RAINFALL PREDICTION.



DECLARATION BY THE CANDIDATE

We the undersigned solemnly declare that the report of the Project work entitled *Development and Analysis of Artificial Neural Network for Rainfall Prediction* Project is based on my own work carried out during the course of my study under the supervision of Mr. Manoj Kumar Singh.

We assert that the statements made, and conclusions drawn are an outcome of the project work. We further declare that to the best of my knowledge and belief that the report does not contain any part of any work which has been submitted for the award of any other degree/diploma/certificate in this University/deemed University of India or any other country.

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CERTIFICATE OF THE SUPERVISOR

This is to certify that the project report of *Development and Analysis of Artificial Neural Network for Rainfall Prediction*, is a record of bonafide research work/Project work carried out by **Ayush Kumar Sahu (Roll No. 303302219027 Enrollment No. BH3710)**, **Lokesh Nirmalkar (Roll No. 303302219058 Enrollment No. BH3741)** and **Shikhar Bargah (Roll No. 303302219092 Enrollment No. BH3775)** respectively under my guidance and supervision for the partial fulfillment of the Degree of Bachelor of Technology of Chhattisgarh Swami Vivekanand Technical University, Bhilai (C.G.), India.

To the best of my knowledge and belief the thesis embodies the work of the candidate him, Has duly been completed, Fulfils the requirement of the Ordinance relating to the B.Tech degree of the University .Is up to the desired standard both in respect of contents and language for being referred to the examiners.

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The Thesis/Project entitled *Development and analysis of artificial neural network model for rainfall predictions* Submitted by: **Ayush Kumar Sahu**(Roll No. 303302219027 Enrollment No. BH3710), **Lokesh Nirmalkar** (Roll No. 303302219058 Enrollment No. BH3741) and **Shikhar Bargah** (Roll No. 303302219092 Enrollment No. BH3775) has been examined by the undersigned as a part of the examination and is hereby recommended for the partial fulfillment of the degree of Bachelor of Technology of Chhattisgarh Swami Vivekanand Technical University, Bhilai.

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We thank the almighty for giving us the encourage and perseverance in completing *“Development and analysis of artificial neural network model for rainfall prediction”*. This project itself is acknowledgements for all those people who have given us their heartfelt co-operation in making this project a grand success. We extend our sincere thanks to **Mr. Nishant Tripathi, Chairman of our college**, for providing sufficient infrastructure and good environment in the college to complete our course.

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LIST OF SYMBOLS

,	Comma
.	Full Stop
,	Inverted comma
()	Parenthesis
:	Colon
-	Hyphen
“ ”	Double inverted comma
[]	Angle Bracket

LIST OF ABBREVIATIONS

SRS	System Requirement Specification
DFD	Data Flow Diagram
SDLC	Software Development Life Cycle
ER	Entity Relationship
ER-D	Entity Relationship Diagram

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CHAPTER-I

INTRODUCTION



1.Introduction About Project

Weather forecasting is one of the most imperative and demanding operational responsibilities carried out by meteorological services all over the world. It is a complicated procedure that includes numerous specialized fields of know-how. The task is complicated because in the field of meteorology all decisions are to be taken in the visage of uncertainty.

Different scientists over the globe have developed stochastic weather models which are based on random number of generators whose output resembles the weather data to which they have been fit. The reason is that ANN (Artificial Neural Network) model is based on 'prediction' by smartly 'analysing' the trend from an already existing voluminous historical set of data. Apart from ANN, the other models are either mathematical or statistical.

These models have been found to be very accurate in calculation, but not in prediction as they cannot adapt to the irregularly varying patterns of data which can neither be written in form of a function, or deduced from a formula. by 'artificial neurons' which can learn from experience, that is by back-propagation of errors in next guess and so on. This may lead to a compromise in accuracy, but give us a better advantage in 'understanding the problem', duplicating it or deriving conclusions from it. Amongst all weather happenings, rainfall plays the most imperative part in human life. Human civilization to a great extent depends upon its frequency and amount to various scales.

Several stochastic models have been attempted to forecast the occurrence of rainfall, to investigate its seasonal variability, to forecast yearly/monthly rainfall over some geographical area. The paper endeavours to develop an ANN model to forecast average monthly rainfall in the Udupi district of Karnataka. Indian economy is standing on the summer monsoon. So prediction of rainfall is a challenging topic to Indian atmospheric scientists. Back propagation ANN to forecast the average summer monsoon rainfall over Udupi district and aroma of newness further lies in the fact that here various MANN models are attempted to find out the best fit.



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CHAPTER-II

LITERATURE REVIEW & PROBLEM IDENTIFICATION

2.1 Literature Review & Problem Identification

Weather forecasting is one of the most imperative and demanding operational responsibilities carried out by meteorological services all over the world. It is a complicated procedure that includes numerous specialized fields of know-how. The task is complicated because in the field of meteorology all decisions are to be taken in the visage of uncertainty. Different scientists over the globe have developed stochastic weather models which are based on random number of generators whose output resembles the weather data to which they have been fit.

The reason is that ANN (Artificial Neural Network) model is based on 'prediction' by smartly 'analysing' the trend from an already existing voluminous historical set of data. Apart from ANN, the other models are either mathematical or statistical. These models have been found to be very accurate in calculation, but not in prediction as they cannot adapt to the irregularly varying patterns of data which can neither be written in form of a function, or deduced from a formula.

By 'artificial neurons' which can learn from experience, that is by back-propagation of errors in next guess and so on. This may lead to a compromise in accuracy, but give us a better advantage in 'understanding the problem', duplicating it or deriving conclusions from it. Amongst all weather happenings, rainfall plays the most imperative part in human life. Human civilization to a great extent depends upon its frequency and amount to various scales. Several stochastic models have been attempted to forecast the occurrence of rainfall, to investigate its seasonal variability, to forecast yearly/monthly rainfall over some geographical area. The paper endeavours to develop an ANN model to forecast average monthly rainfall in the Udupi district of Karnataka. Indian economy is standing on the summer monsoon. So prediction of rainfall is a challenging topic to Indian atmospheric scientists. Back propagation ANN to forecast the average summer monsoon rainfall over Udupi district and aroma of newness further lies in the fact that here various MANN models are attempted to find out the best fit.



2.2 System analysis: Requirement analysis, SRS:

The SRS is a specification for a specific software product, program, or set of applications that perform particular functions in a specific environment.

The Software Requirements of our system are:-

- 1.flask
- 2.wtforms
- 3.fbprophet
- 3.sklearn
- 4.Keras
- 5.Tensorflow
- 6.Imblearn

The Hardware Requirements of our system are:-

- Laptop / PC
- 4GB RAM
- 512GB ROM
- Intel i3 processor and above
- Internet connection

2.3 SDLC Model

Prototyping Model

The Prototyping Model is one of the most popularly used Software Development Life Cycle Models (SDLC models). This model is used when the customers do not know the exact project requirements beforehand. In this model, a prototype of the end product is first developed, tested and refined as per customer feedback repeatedly till a final acceptable prototype is achieved which forms the basis for developing the final product.

In this process model, the system is partially implemented before or during the analysis phase thereby giving the customers an opportunity to see the product early in the life cycle. The process starts by interviewing the customers and developing the incomplete high-level paper model. This document is used to build the initial prototype supporting only the basic functionality as desired by the customer. Once the customer figures out the problems, the prototype is further refined to eliminate them. The process continues until the user approves the prototype and finds the working model to be satisfactory.

Phases of Prototyping Model-

- 1._Requirement Identification: After analyzing the problem statement, we drew up a list of the requirements for building the portal.
- 2._Design Stage: Using the requirements as a starting point, a hand drawn design of the portal was created
- 3._Initial Prototype: Based on the feedback provided by users, the first prototype is built based on the original design, and further prototypes are built based on user feedback.
- 4._Review of the Prototype: After the product completes all the iterations of the update, it will be presented to the customers. The response is accumulated in an organized way so that they can be used for further system enhancements.
5. Iteration and Enhancement of Prototype: Once the review of the product is done, it is set for further enhancement based on factors like - time, workforce as well as budget.

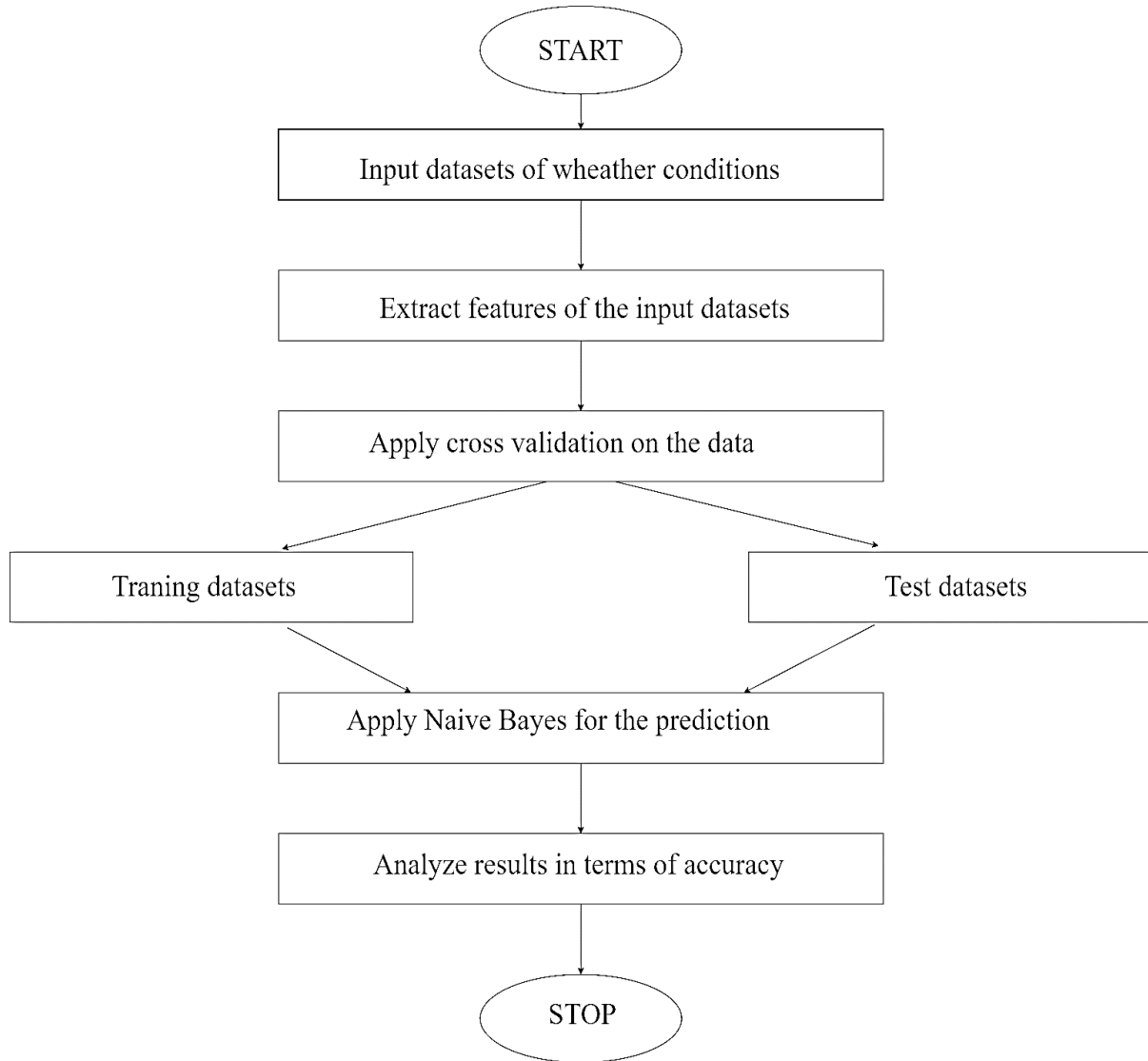


Fig.2.3 prototyping model

Advantages-

- The customers get to see the partial product early in the life cycle. This ensures a greater level of customer satisfaction and comfort.
- New requirements can be easily accommodated as there is scope for refinement.
- Missing functionalities can be easily figured out.
- Errors can be detected much earlier thereby saving a lot of effort and cost, besides enhancing the quality of the software.
- The developed prototype can be reused by the developer for more complicated projects in the future.
- Flexibility in design.

Disadvantages-

- Costly w.r.t time as well as money.
- There may be too much variation in requirements each time the prototype is evaluated by the customer.
- Poor Documentation due to continuously changing customer requirements.
- It is very difficult for developers to accommodate all the changes demanded by the customer.

2.4 Data Flow Diagram

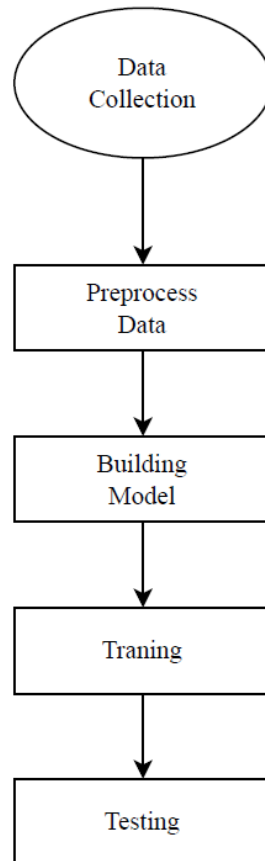


Fig.2.4 Data Flow Diagram



CHAPTER-III

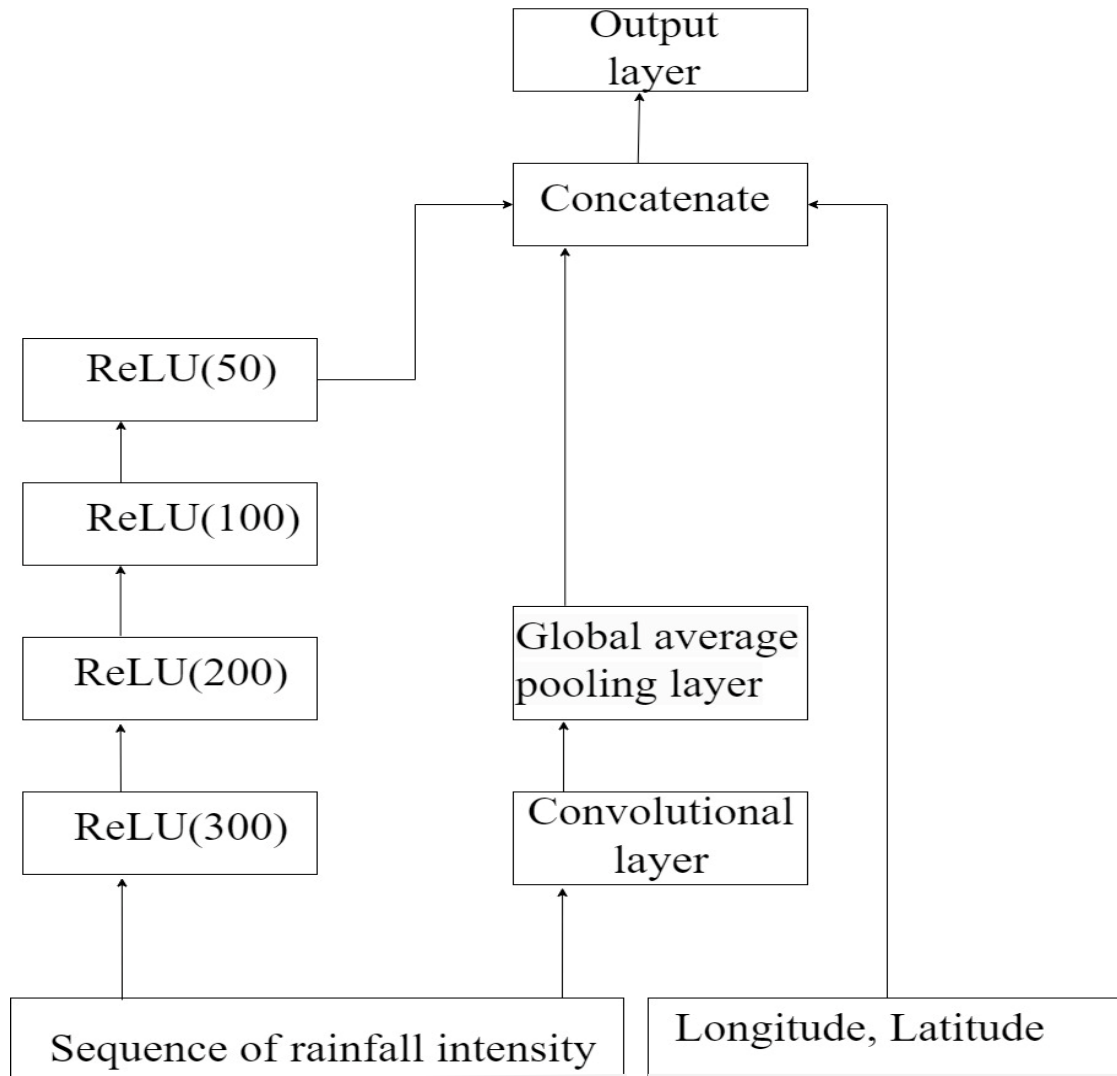
SYSTEM ANALYSIS

Machine learning approach deals with predicting rainfall using machine learning approach. It finds the accuracy of the machine learning approach using two types of errors that is, RE and RMSE. In these four major trends of machine learning are being used. The first one is called hybridization, which means multiple machine learning approaches are being used together and accordingly prediction is being done. The second one deals with improving the quality of dataset which is being used. Data mining approach helps to find the hidden pattern, which will help to predict the rainfall correctly.

This approach takes all the parameters, which affect the rainfall such as climate, wind speed etc. and predict the future rainfall. Customized, integrated and modified data mining technique is used to predict rainfall. Many climate variables are being taken to predict rainfall.

We have proposed ANN (ARTIFICIAL NEEURAL NETWORK) based rainfall prediction and forecasting system to efficiently predict the rainfall and to do forecasting for upcoming years. It provides the better accuracy comparing to the existing approach. It consumes less time for huge amount of data.

ANN MODEL



ANN MODEL

Artificial neural networks (ANNs)- usually simply called **neural networks (NNs)** or **neural nets**, are computing systems inspired by the biological neural networks that constitute animal brains.

An ANN is based on a collection of connected units or nodes called artificial neurons, which loosely model the neurons in a biological brain. Each connection, like the synapses in a biological brain, can transmit a signal to other neurons. An artificial neuron receives signals then processes them and can signal neurons connected to it.

The "signal" at a connection is a real numbers and the output of each neuron is computed by some non-linear function of the sum of its inputs. The connections are called *edges*. Neurons and edges typically have a weights that adjusts as learning proceeds. The weight increases or decreases the strength of the signal at a connection. Neurons may have a threshold such that a signal is sent only if the aggregate signal crosses that threshold.

Typically, neurons are aggregated into layers. Different layers may perform different transformations on their inputs. Signals travel from the first layer (the input layer), to the last layer (the output layer), possibly after traversing the layers multiple times.

3.1 Workflow Diagram

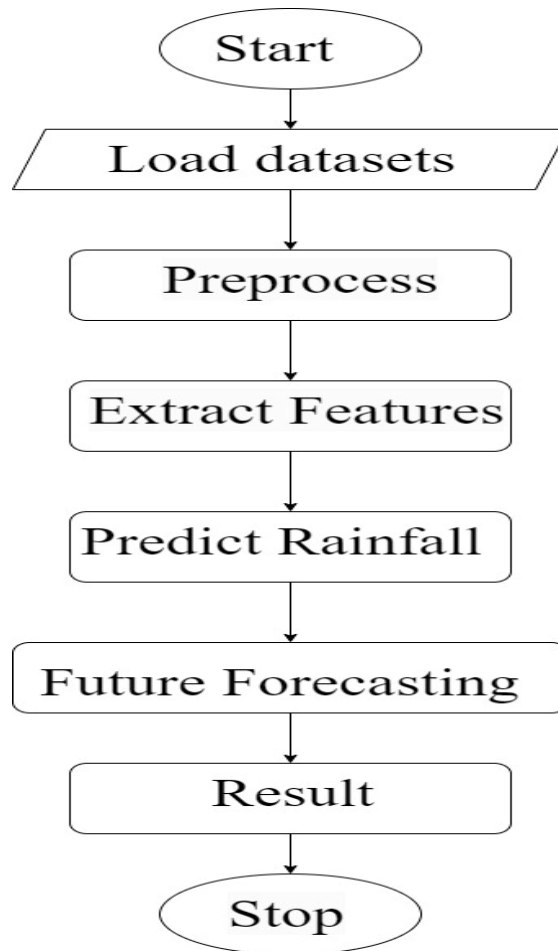


Fig.3.1 Workflow Diagram

A workflow diagram (also known as a workflow) provides a graphic overview of the business process. Using standardized symbols and shapes, the workflow shows step by step how your work is completed from start to finish. It also shows who is responsible for work at what point in the process. Designing a workflow involves first conducting a thorough workflow analysis, which can expose potential weaknesses. A workflow analysis can help you define, standardize and identify critical areas of your process.

Workflows are also useful to help employees understand their roles and the order in which work is completed, and to create more unity within different departments. Originating from the manufacturing industry, workflows are now used by a variety of industries—from government to finance to commerce—and are easier than ever to create.

In the above figure it describes the working of the model, it shows the working of the model in a diagrammatic way which can easily understandable.

3.2 E-R Diagram

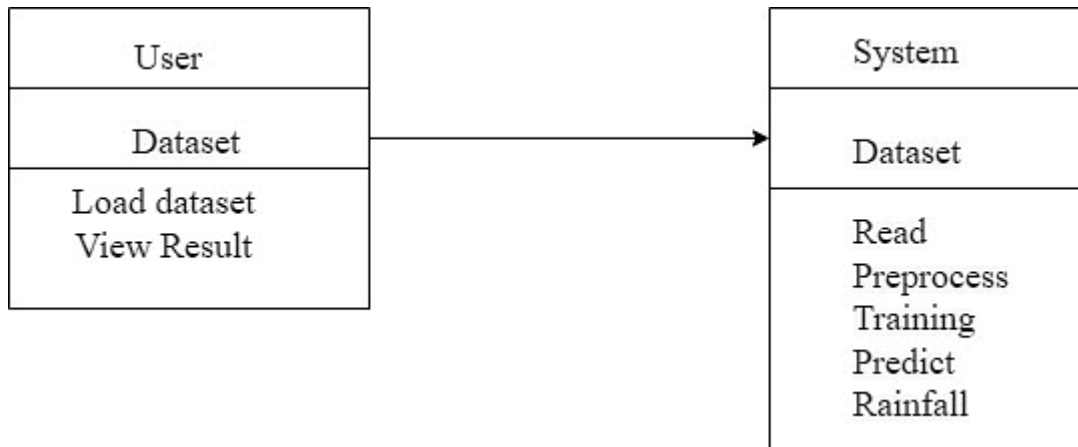


Fig.3.2 E-R Diagram

3.3 Use Case Diagram

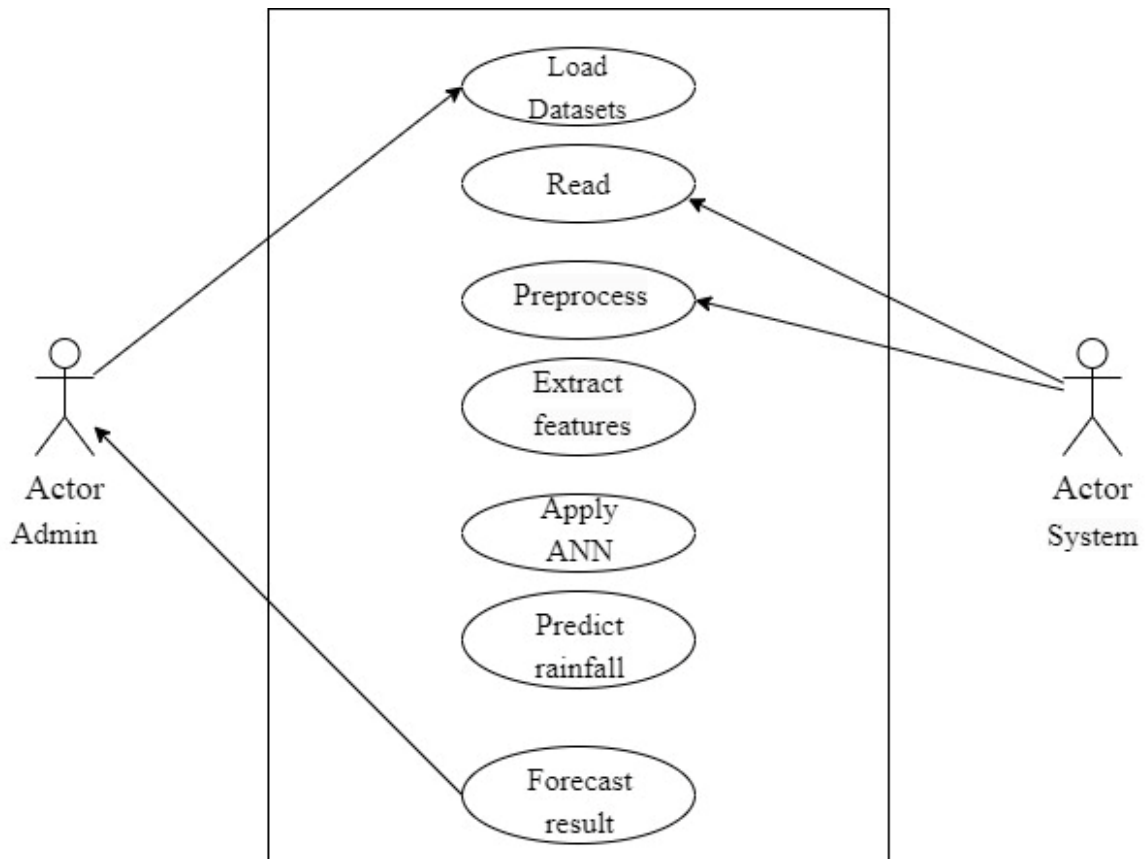


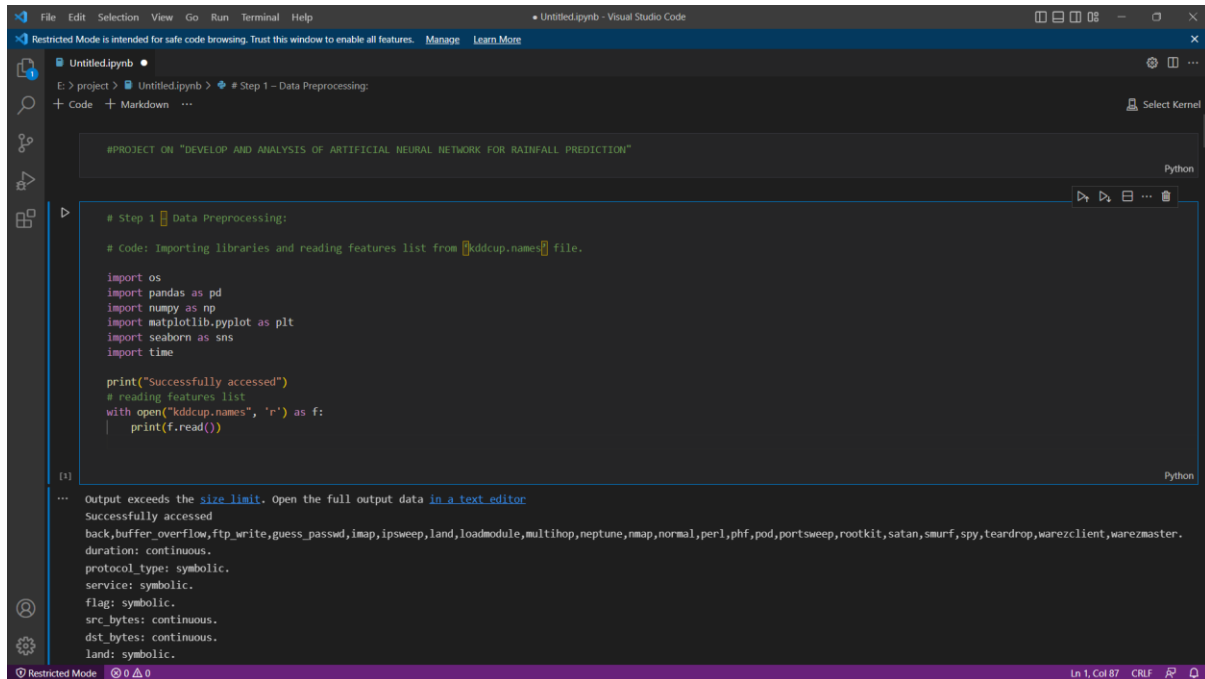
Fig.3.3 Use Case Diagram



CHAPTER-IV

SNAPSHOT

4.Snapshots



```

#PROJECT ON "DEVELOP AND ANALYSIS OF ARTIFICIAL NEURAL NETWORK FOR RAINFALL PREDICTION"

# Step 1 Data Preprocessing:

# Code: Importing libraries and reading features list from kddcup.names file.

import os
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
import time

print("Successfully accessed")
# reading features list
with open("kddcup.names", 'r') as f:
    print(f.read())

```

Output exceeds the size limit. Open the full output data in a text editor

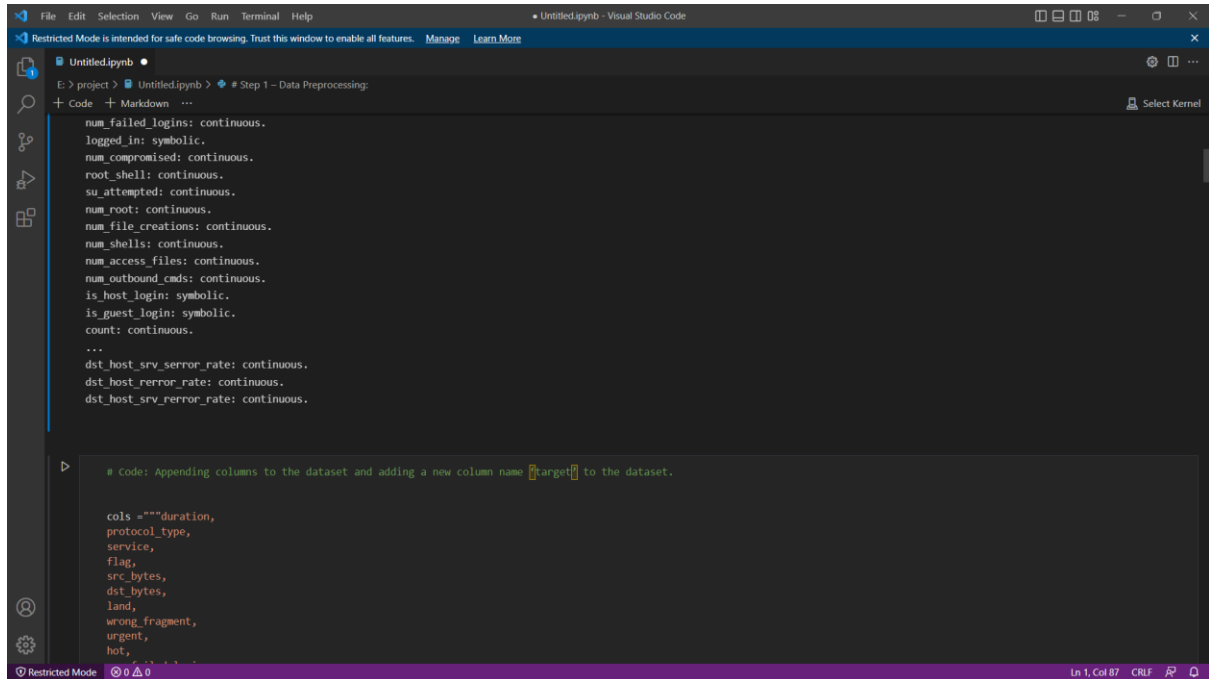
```

Successfully accessed
back,buffer_overflow,ftp_write,guess_passwd,imap,ipsweep,land,loadmodule,multihop,neptune,rmap,nmap,normal,perl,phf,pod,portsweep,rootkit,satan,smurf,spy,teardrop,warezclient,warezmaster.
duration: continuous.
protocol_type: symbolic.
service: symbolic.
flag: symbolic.
src_bytes: continuous.
dst_bytes: continuous.
land: symbolic.

```

Fig.4.1 Python Code for Prediction

In the above snapshot it represents the code written in python for prediction of rainfall using ANN this is a snapshot of the original code in the above code, we used the ANN model for predicting the outcome ANN is very good at predicting the outcomes because it has very strong mathematical and computational concepts.



```

num_failed_logins: continuous.
logged_in: symbolic.
num_compromised: continuous.
root_shell: continuous.
su_attempted: continuous.
num_root: continuous.
num_file_creations: continuous.
num_shells: continuous.
num_access_files: continuous.
num_outbound_cmds: continuous.
is_host_login: symbolic.
is_guest_login: symbolic.
count: continuous.
...
dst_host_srv_error_rate: continuous.
dst_host_error_rate: continuous.
dst_host_srv_error_rate: continuous.

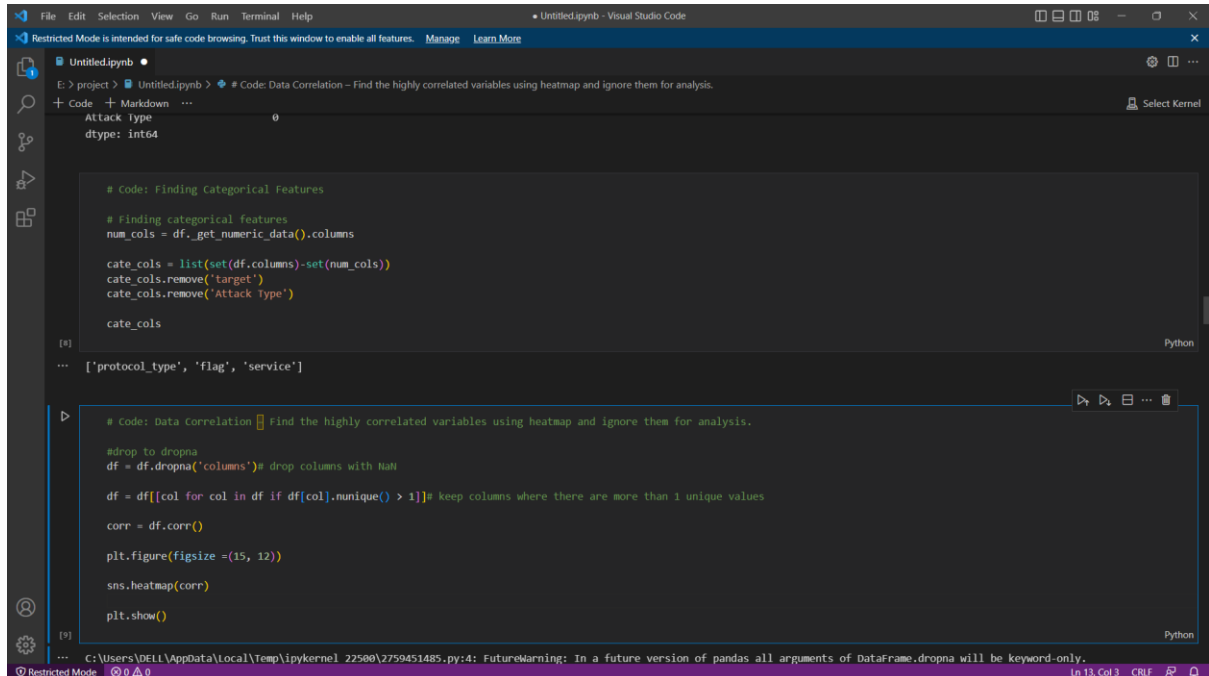
# code: Appending columns to the dataset and adding a new column name 'target' to the dataset.

cols = ["duration",
        "protocol_type",
        "service",
        "flag",
        "src_bytes",
        "dst_bytes",
        "land",
        "wrong_fragment",
        "urgent",
        "hot",

```

Fig.4.2 Python Code for Loading Datasets

In the above snapshot it represents the code written in python for loading datasets of rainfall using ANN this is a snapshot of the original code in the above code, we used the ANN model for predicting the outcome ANN is very good at predicting the outcomes because it has very strong mathematics and computations.



```

# Code: Data Correlation - Find the highly correlated variables using heatmap and ignore them for analysis.
Attack_Type
dtype: int64

# Code: Finding Categorical Features
# Finding categorical features
num_cols = df.get_numeric_data().columns

cate_cols = list(set(df.columns)-set(num_cols))
cate_cols.remove('target')
cate_cols.remove('Attack_Type')

cate_cols

[4]
...
['protocol_type', 'flag', 'service']

# Code: Data Correlation Find the highly correlated variables using heatmap and ignore them for analysis.
#drop to dropna
df = df.dropna('columns')# drop columns with NaN

df = df[[col for col in df if df[col].nunique() > 1]]# keep columns where there are more than 1 unique values

corr = df.corr()

plt.figure(figsize=(15, 12))

sns.heatmap(corr)

plt.show()

[9]
...
C:\Users\DELL\AppData\Local\Temp\ipykernel_22580\2759451485.py:4: FutureWarning: In a future version of pandas all arguments of DataFrame.dropna will be keyword-only.

```

Fig.4.3 Python Code for traning the model

In the above snapshot it represents the code written in python for traning model for rainfall using ANN this is a snapshot of the original code in the above code, we used the ANN model for predicting the outcome ANN is very good at predicting the outcomes because it has very strong mathematics and computations



CHAPTER-V

CONCLUSION

5.Conclusion

This project represented the Deep Learning Approach for predicting the rainfall by using the ANN (ARTIFICIAL NEURAL NETWORK). Comparing the present architecture with other state approaches. This project provided a study of different types of methodologies used to forecast and predict rainfall and issues that could be found when applying different approaches to forecasting rainfall. Because of nonlinear relationships in rainfall datasets and the ability to learn from the past, Artificial Neural Network makes a superior solution to all approaches available. The future work of the project would be the improvement of architecture for light and other weather scenarios. Also, can develop a model for small changes in climate in future. An algorithm for testing daily basis dataset instead of accumulated dataset could be of paramount Importance for further research.

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The paper endeavours to develop an ANN model to forecast average monthly rainfall in the Udupi district of Karnataka. Indian economy is standing on the summer monsoon. So prediction of rainfall is a challenging topic to Indian atmospheric scientists. Back propagation ANN to forecast the average summer monsoon rainfall over Udupi district and aroma of newness further lies in the fact that here various MANN models are attempted to find out the best fit.



CHAPTER-VI

FUTURE SCOPE

6.Future Scope

Weather forecasting is one of the most imperative and demanding operational responsibilities carried out by meteorological services all over the world. It is a complicated procedure that includes numerous specialized fields of know-how. The task is complicated because in the field of meteorology all decisions are to be taken in the visage of uncertainty. This may lead to a compromise in accuracy, but give us a better advantage in 'understanding the problem', duplicating it or deriving conclusions from it. Amongst all weather happenings, rainfall plays the most imperative part in human life. Human civilization to a great extent depends upon its frequency and amount to various scales. Several stochastic models have been attempted to forecast the occurrence of rainfall, to investigate its seasonal variability, to forecast yearly/monthly rainfall over some geographical area.

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Journal of Advances in Computer Networks, 2 (3) (September 2014), pp. 173-179



CHAPTER-VII

PUBLICATIONS

RAINFALL PREDICTION USING TIME SERIES ANALYSIS

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Abstract — we are creating a rainfall prediction application by using time series analysis this will predict the rainfall by using the data of previous years and predict the rainfall of the current year in time series analysis it uses the ARIMA algorithm for predicting and forecasting

Keywords- Autoregressive integrated moving average(ARIMA)

I. INTRODUCTION & OBJECTIVE OF THE PROJECT

In India there is a large number of people who earn money by doing farming and brings the greatest crops available to us, for this they work very hard because farming is not the easy thing, this is done for very long period of time because there is many crops which takes so much time to grow and if they will not be properly cared the all the work of farmers will vanish on a single moment. As many crops requires care and time they need proper amount of water also for their nourishment in this the role of rainfall is major in all aspects of farming, without rainfall the farmers will not be able to do farming they will not be able to produce crops or any other thing without rainfall. This project will help to predict the proper amount of rainfall will take place in any region by analyzing the date over a period of time by using time series analysis, it allows one to see what factors that influence certain variables from one time period to another time period. This methods uses various algorithms in which ARIMA (Autoregressive integrated moving average) is best for forecasting and predicting, this will very helpful for farmers who does farming, this will provide the amount of rainfall takes place in the particular region where farming will takes place .

Being able to predict rainfall can, be very useful by this farmers can know about amount of rainfall, and by this they can know when to plant and harvest their crops. In India the amount of rainfall is 925 mm during monsoon season that is from June 1 to September 30. Thus 6.49 percent more rainfall was recorded this season. This process will take this data as a set and it will analyze it and after that this will predict the amount of rainfall occur in next monsoon which will going to help farmers in farmig.

III. FEATURE EXTRACTION

Here are some feature extraction for the research paper firstly you have to save the content in a separate file after writing it before starting the paper, complete all the organizational editing as well as all the content before formatting it, always keep graphic files and text separate till the text has been formatted and styled.

A. Acronyms and Abbreviations

ML	Machine learning
DFD	Data Flow Diagram
ARIMA	AUTOREGRESSIVE INTEGRATED MOVING AVERAGE