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Climate Change Prediction Using ARIMA Model

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Abstract: ***It is a challenging task to forecast weather data accurately. The temperature change has important implications for business and economic activity. Effective management of global climate change impacts will depend upon accurate and cost-effective forecasts. This paper univariate statistic techniques to model the properties of a world mean temperature dataset to develop a parsimonious forecasting model for managerial decision-making over the short-term horizon and the ARIMA-based prognostication tool has been developed by implementing the ARIMA algorithm in python. Although the model is estimated on global temperature data, the methodology could even be applied to temperature data at more localized levels. The statistical techniques include seasonal and non-seasonal unit root testing with and without structural breaks as well as ARIMA and SARIMA modelling. This paper helps us to predict the air temperature, which is the main problem of global warming. Prediction of the likely impact of climate change on monthly mean maximum and minimum temperature in Tamilnadu. Time-series techniques to develop a parsimonious model of global mean temperature change that can be used to forecast over the short-term horizon (5- 10) years.***

Keywords: Global warming, Forecasting, temperature

I. INTRODUCTION

Climate change is one of the major environmental challenges faced by the world today. It is linked with diverse and undesirable impacts on farming, water resources, forest and biodiversity, ocean level increase, and a temperature rise. Climate change is occurred due to some physical factors like N2O, SF6, CO2, CH4, etc., these factors are increasing, thus increasing the Earth's temperature. This is caused by the emission of greenhouse gases from modern industry, vehicles, burning of fossil fuels, etc. Global Warming is the rise in the average long-term temperature of the Earth's climate system. The average temperature of the earth is 1 degree Celsius higher than 100 years ago. Global warming occurs when the greenhouse gases absorb sunlight and solar radiation reflected from the earth's surface.

Weather forecasting is the utilization of science and technology to predict the atmospheric conditions of a given area and time. People try to predict the weather informally for thousands of years and since the 19th century. Weather forecasts are made by collecting information about this state of the atmosphere in an exceedingly area so using the weather to predict how the atmosphere will change. To worldwide warming, the glacier is melting day by day. For that, the common height of the ocean level is additionally increasing, and this can often cause flooding in many coastal areas. Not only that but also the underground water of the globe is decreasing. The ocean's temperature is additionally increasing due to this reason. For that several storms are happening which have fatal results. Individual input continues to be required to select out the sole predictive model to determine the prediction When it involves an act that's largely supported by changes in barometric stress, current climate, and whether or inclemency, forecasting is now hopping on computer-based models that take a glance at the type of celestial objects.

II. LITERATURE REVIEW

There are such many ideas and articles about weather predictions, temperature predictions, and rainfall predictions some are taken for reference purposes. In this project, the climate variation for the upcoming years is predicted. For that weather-based prediction, ideas are focused mainly.

Many scientists think that if the temperature will increase then many cities are sinking the ocean or submerged in the ocean. A paper [6] describes global warming. They explain the causes, effects, and probable solutions for global warming. There is another paper [10], which gives us some idea about the temperature prediction. This helps to predict the air temperature. "Prediction of the likely impact of climate change in monthly mean maximum and minimum temperature in the Chaliyar geographical area, India, using ANN-based models"[1] and "Big data and Climate Changes"[2] are some references for temperature analysis and prediction.

III. SYSTEM ANALYSIS

A. Objectives

1) To predict the average temperature for the subsequent 10 years.
2) To understand the pattern of temperature change over years.

B. Existing System

In this existing system man only can analyze global data and make predictions over climate also man cannot predict accurate datasets regarding the natural actions. Within the classical system, there is not any extract processing to be done by using any techniques. Another technique which is available for extracting information from the actual region regarding the climate, but there is not any extract processing is performed also very difficult to predict the global climate change.

C. Proposed System

The proposed system machine predicts the weather in a selected region as constantly. The study of this system analyzes the dataset and predicts the right global data by using the ARIMA algorithm. By using statistic analysis and future forecast techniques currently performed historical data should be predicted over the future.

D. Problem Statement

Predicting whether the specified place is affected by climate change or not. Climate change is a long-term change in the average weather patterns that have come to define Earth's local, regional, and global climates. These changes have a broad range of observed effects that are synonymous with the term.

E. System/Hardware Requirements

1) processor: Intel Core i3
2) RAM capacity: 4GB or above
3) Speed: 3.3 GHz
4) operating System: Windows 10
5) Middle Ware: ANACONDA (JUPYTER NOTEBOOK)
6) Back End: Python IDLE

IV. IMPLEMENTATION

A. Programming Language Used

The programming language used to develop this project is Python. Python's main handy features are easy to write and easy to read mannerisms, coding in python should reduce one's efficacy to develop a project significantly. Since importing and implementing ML libraries is simple in python, opted for this language to develop this project.

B. Algorithms Used

We used multiple regression techniques to predict the temperature using algorithms such as

- Auto-Regressive Integrated Moving Average (ARIMA)
- Seasonal Auto-Regressive Integrated Moving Average (SARIMA)

1) Auto-Regressive Integrated Moving Averages: **ARIMA** is a form of regression analysis that gauges the strength of one dependent variable relative to other changing variables. The model's goal is to predict future securities or financial market moves by examining the differences between values in the series instead of actual values. **Autoregression**(AR) refers to a model that shows a changing variable that regresses on its own lagged, or prior, values. **Integrated**(I) represents the differencing of raw observations to allow for the time series to become stationary. **Moving Average**(MR) incorporates the dependency between an observation and a residual error from a moving average model applied to lagged observations.

Each component in ARIMA functions as a parameter with a standard notation that would be ARIMA with p, d and q where integer values substitute for the parameters to indicate the type of ARIMA model used.

p – no. of lag observations in the model (known as the lag order)
d – no. of times that the raw observations are differenced (known as the degree of differencing)
q – the size of moving average (order of moving average)

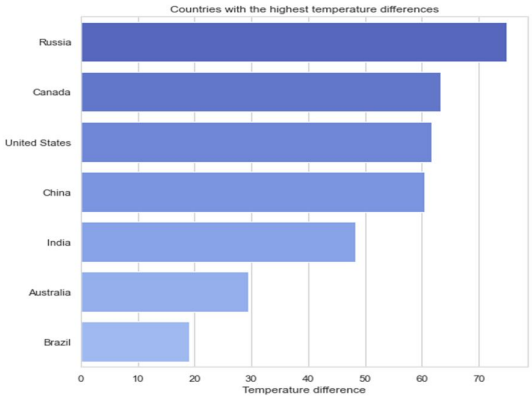
2) Seasonal Autoregressive Integrated Moving Average: **SARIMA** model is one step different from an ARIMA model based on the concept of seasonal trends. It similarly uses past values but also considers any seasonality patterns. The order in the ARIMA model (p, d, q) is used in this model, which does consider seasonality. Added to that 's' indicates the seasonal length in the data. The approaches were taken to determine the ideal ARIMA and SARIMA parameters: ACF and PACF plots were used as a starting point to narrow down to a few potential parameters, and then a grid search was used to identify the best parameters.

C. Dataset Preparation

In this module, the raw data is collected from the different data sets of the temperature of India from 1786 and global seasonal data respectively. Then the data set is changed as per need. This raw data cannot be predicted directly. So, it is needed to clean

and pre-process. Then the data is grouped as per requirement this grouping of data is known as data clustering. The total process before the prediction is known is data pre-processing then the data is used for the prediction and forecasting step.

The pre-processed data is taken for the prediction and can be done in any process, but the Linear Regression algorithm scores more prediction accuracy than the other algorithm and is used for training and test purposes. Then a predictive object is created to predict the test value which is trained by the trained value. The predicted and forecasted data are used to provide a graphical interface separately. Then the predicted data is plotted in a graph separately with the help of the python library. Then the forecasted data of temperature is plotted in the graph with proper scale. Then the greenhouse gases forecasted data are plotted in a single graph with a proper scale.



V. PREDICTION AND DISCUSSION

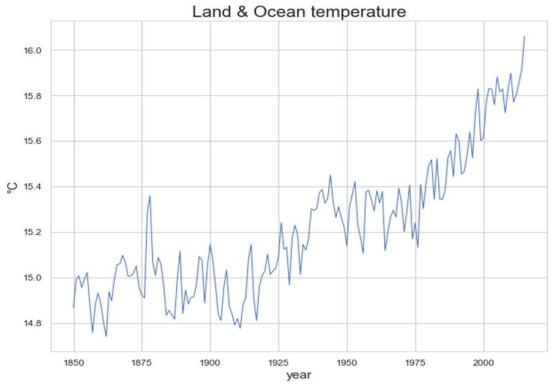
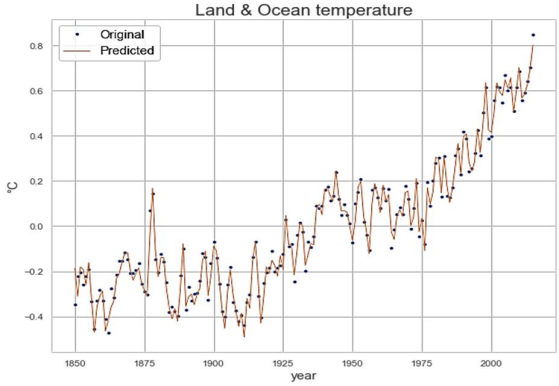


Fig: 1



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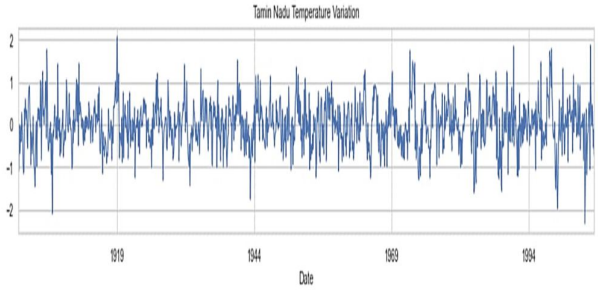

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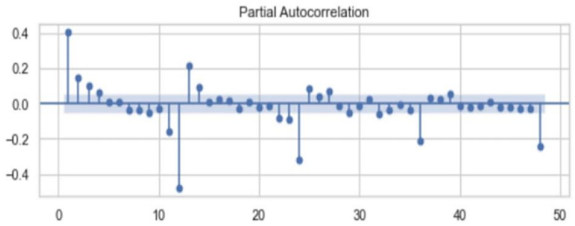

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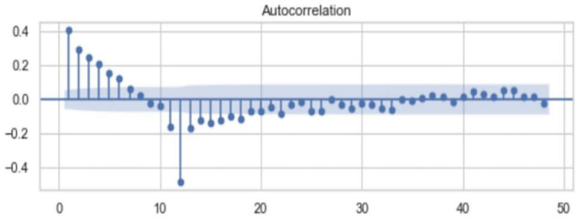

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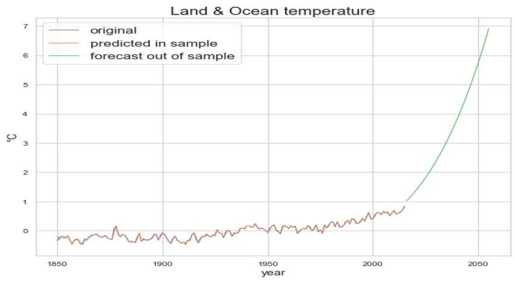

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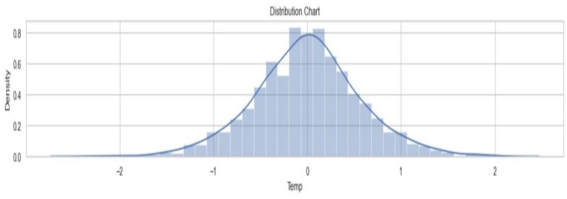

Fig: 7

After the successful training of the temperature, the satisfactory accuracy is predicted and the data for the next upcoming years is forecasted and the graphical representation of the predicted and forecast process is obtained. The graph (fig:1) is show the level of high-temperature cities in our global temperature data. It shows Russia has the highest variation in temperature and India has the 5th highest temperature fall. The graph (fig:2) is plotted with the average temperature over years. The graph (fig:3)

is plotted for the original and predicted temperature obtained from the basic model. Then the Root Mean Squared Error (RMSE) of the baseline will diminish to 1.0568^0 C. It shows that the build model for recent years is the best in terms of modelling a large amount of dataset. It is based on assumptions that data error flow normal distribution (fig: 7) shows the distribution of the prediction data. By using the Dickey-Fuller (DF) test, a unit root is present in an autoregressive time series model that is statistically significant. The graph (fig: 4) shows the variation in the prediction temperature data, which gives the result as the time series data is stationary that is the mean and variance are constant over time. i.e., the test statistic is lower than the critical value of a 5% level of significance. DF test analyzes the Auto Correlation(CF) and Partial Auto Correlation Function(PACF) to obtain the lag between the stationary data and to find the best fit model (fig: 5 & 6). The SARIMAX parameters are founded using the ARIMA component (p, d, q), SARIMA component (P, D, Q) and the Trend. The graph (fig: 8) is plotted as a predicted ARIMA model fitting that shows the forecasting variation for upcoming years. Thus, the temperature which is the reason for climate change and global warming increases day by day in a linear pattern and the result of this model will become more lethal.

VI. CONCLUSION

In this project, 200-250 years of the dataset are analyzed. Timeseries models are used to predict and forecast the temperature for the next 10 years on average. The model for forecasting data for the next 10 years is trained and tested by regression. Some graphs are plotted as a graphical interface for predicted and forecasted data for all the inputs with the help of modelled libraries in python. Using past data some graphs are plotted for the yearly, and monthly average temperature for various global data. The statistical tool, the ATIMA model gives the accurate result and the best fit for the forecast model. This project can be enhanced by using more complex algorithms and using more atmospheric factors.

VII. LIMITATIONS AND FUTURE WORK

There is some limitation in this study that the model is predicted only the average temperature in India. It doesn't explain each month and each state's data separately. The data set is used for this model for 200-250 years. The future predictor can be better for using a greater number of data but other physical entities which are responsible for temperature increase cannot be predicted in this model. The data can be predicted for each entity will make it reasonable to the cause and will be more attractive for all people

VIII. ACKNOWLEDGEMENT

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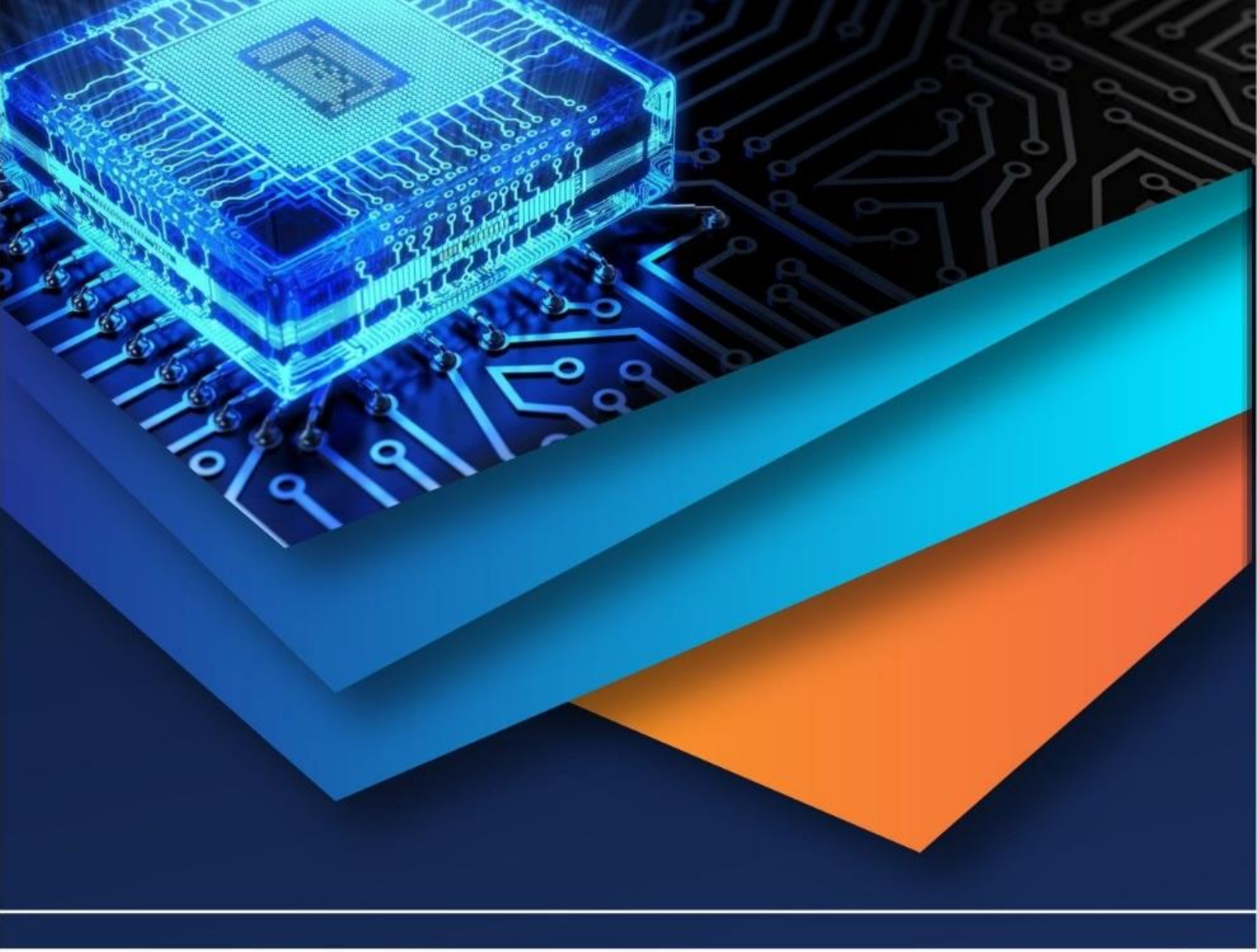
REFERENCES

[1] "Prediction of the likely impact of climate change on monthly mean maximum and minimum temperature in the Chaliyar river basin, India, using ANN-based models" by N.R. Chithra, S.G. Thampi, S. Surapaneni, R. Nannapaneni, A.A.K. Reddy, J.D. Kumar; Theoretical and Applied Climatology (Vol – 121); August-2014
[2] "Big Data and Climate Change" by H. Hassani, Xu Huang and E. Silva; February-20
[3] "Weather Prediction Using Data Mining" by Prashant Biradar, Sarfraz Ansari, Yashavant Paradkar, Savita Lohiya; IJERD (Vol – 5); 2017
[4] "An Integrated Approach for Weather Forecasting based on Data Mining and Forecasting Analysis" by G.Vamsi Krishna; International Journal of Computer Application (Vol – 120); June-2015
[5] "Machine Learning Applied to Weather Forecasting" by Mark Holmstrom, Dylan Liu, Christopher Vo; 2016
[6] "Global Warming: Causes, Effects and Solutions" by Umair Shahzad; Durreesamin Journal (Vol – 1), August 2015
[7] "Big Data and Climate Change" by H. Hassani, Xu Huang and E. Silva; February-2019
[8] "Global warming prediction in India using Machine Learning" by D. Deva Hema, Anirban Pal, Vineet Loyer, Rajeev Gaurav; International Journal of Engineering and Advanced Technology (IJEAT), Volume-9 Issue-1, October 2019.
[9] https://www.weforum.org/agenda/2021/08/how-is-machine-learning-helping-us-to-create-more-sophisticated-climate-change-models
[10] "Atmospheric Temperature Prediction using Support Vector Machines" by Y.Radhika and M.Shashi; International Journal of Computer Theory and Engineering (Vol – 1); April-2009
[11] https://www.frontiersin.org/articles/10.3389/frobt.2019.00032/full- Forecasting Climatic Trends Using Neural Networks: An Experimental Study Using Global Historical Data
[12] Himanshu Vishwakarma - Climate Change Analysis Using Machine Learning - International Journal of Science and Research (IJSR) ISSN: 2319-7064 ResearchGate Impact Factor (2018): 0.28 | SJIF (2019): 7.583
[13] https://www.nature.com/articles/s41612-020-00148-5 - Predicting global patterns of long-term climate change from short-term simulations using machine learning
[14] https://www.scirp.org/journal/paperinformation.aspx?paperid=86337 -Harvey Zheng - Analysis of Global Warming Using Machine Learning



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