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Climate Change Prediction using ARIMA Model

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Abstract: ***Autoregressive integrated moving average (ARIMA) is a data mining technique that is generally used for time series analysis and future forecasting. Climate change forecasting is essential for preventing the world from unexpected natural hazards like floods, frost, forest fires and droughts. It is a challenging task to forecast weather data accurately. In this paper, the ARIMA based weather forecasting tool has been developed by implementing the ARIMA algorithm in Climate change has important implications for business and economic activity. Effective management of climate change impacts will depend on the availability of accurate and cost-effective forecasts. This paper uses time series techniques to model the properties of a global mean temperature dataset in order to develop a parsimonious forecasting model for managerial decision-making over the short-term horizon. Although the model is estimated on global temperature data, the methodology could also 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 GARCH modeling. A forecasting evaluation shows that the chosen model performs well against rival models. The estimation results confirm the findings of a number of previous studies, namely that global mean temperatures increased significantly throughout the 20th century.***
Keyword: Climate Change, Weather Forecasting, Prediction, Global.

I. INTRODUCTION

Climate change will have a wide range of impacts on business and economic activities (see inter alia Cline(1992)). Operational and strategic decision-making in these activities will have to take into account not just the realised effects of climate change, but also potential effects. Crucial to effective managerial decision-making will be forecasts of climate change that are accurate and cost-effective. A key indicator of climate change, although by no means the only one, is global temperature change. This paper employs econometric 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). Statistical analysis of global mean temperature data has focused on whether there is a significant change in mean temperature and, if so, what are the causes of the change.[1]These are referred to as the detection and attribution problems, respectively. The modeling techniques in this paper focus on the detection problem. In today's environment, climate plays a vital role in the sustainability of life on earth. However, the climate is causes many severe problems like flooding, landslide and drought. These problems affect the agriculture and farming. In a country like India where agriculture and farming are its backbones, the most significant concern is the success and failure of the crop every year. A minute change in the seasonal rainfall and temperature may lead to a devastating effect on crops. Temperature data is also essential for the sustainability of agriculture, vegetation, water resources and tourism. Also, the temperature has a direct impact on evaporation & melting of snow or ice and an indirect impact on precipitation condition and atmospheric stability. Therefore accurate prediction of future rainfall and temperature are essential for preventing the country from natural disasters and managing natural resources. It is a challenging task to predict future climate data accurately. Although many algorithms have been proposed and developed but still, accurate forecasting is robust.

II. EXISTING SYSTEM

The system analysis includes existing system limitations, proposed system with features, and requirements of the system which includes both hardware and software requirements and also the functionality of each module.In this existing system man only can analyze global data and make prediction over climate also man cannot predict accurate dataset regarding the climate change. In the classical system here are no extract processing to be done by using any techniques.[2] Some other techniques which are available for extracting information from the particular region regarding the weather conditions, but there are no extract processing is performed also very difficult to predict the actual climate change absolutely.

A. Drawbacks

1) No extract processing is performed to analyze the proper global change
2) Man only can analyze global data and make prediction over climate
3) Man cannot predict accurate dataset regarding the climate change also impossible to keep track of huge dataset.

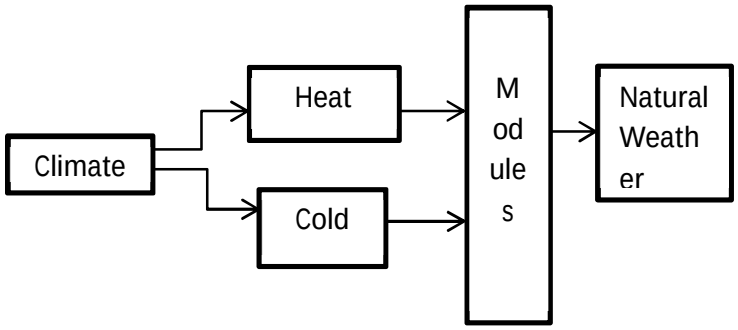
III. PROPOSED SYSTEM

In the proposed system machine used to predict the weather conditions regarding a particular region as constantly. The study of this system analyzes the dataset and predicts the proper global data by using ARIMA algorithm.[3] By using time series analysis and future forecast techniques currently performed historical data should be predicted over future.

A. Advantages

1) Machine can be predicting the actual dataset regarding the climate change.
2) By using the ARIMA algorithm global data should be predicted absolutely.
3) Time consumption is very low.

IV. SYSTEM ARCHITECTURE



In data modeling module, the machine learning algorithms the time series analysis and future forecast techniques were used to predict the weather conditions. ARIMA model were used to predict the weather conditions and analyze the historical data regarding the particular season and then fulfill the performance of current changes accurately. The user provides the ARIMA model with a dataset that includes desired inputs and outputs, and the algorithm finds a method to determine how to arrive at those results.
Input design will consider the following steps:

A. The dataset should be given as input.
B. The dataset should be arranged.
C. Methods for preparing input validations

V. ALGORITHM /TECHNIQUE USED

A. Arima Model.

1) *Algorithm Description:* An ARIMA model is a class of statistical models for analyzing and forecasting time series data. It explicitly caters to a suite of standard structures in time series data, and as such provides a simple yet powerful method for making skillful time series forecasts. ARIMA is an acronym that stands for Autoregressive Integrated Moving Average. It is a generalization of the simpler Autoregressive Moving Average and adds the notion of integration.

This acronym is descriptive, capturing the key aspects of the model itself. Briefly, they are:

1) *AR:* Autoregression. A model that uses the dependent relationship between an observation and some number of lagged observations.
2) *I:* Integrated. The use of differencing of raw observations (e.g. subtracting an observation from an observation at the previous time step) in order to make the time series stationary.
3) *MA:* Moving Average. A model that uses the dependency between an observation and a residual error from a moving average model applied to lagged observations.

Each of these components are explicitly specified in the model as a parameter.[4] A standard notation is used of ARIMA(p,d,q) where the parameters are substituted with integer values to quickly indicate the specific ARIMA model being used.
The parameters of the ARIMA model are defined as follows:

a) p: The number of lag observations included in the model, also called the lag order.
b) d: The number of times that the raw observations are differenced, also called the degree of differencing.
c) q: The size of the moving average window, also called the order of moving average.

A linear regression model is constructed including the specified number and type of terms, and the data is prepared by a degree of differencing in order to make it stationary, i.e. to remove trend and seasonal structures that negatively affect the regression model.

VI. MODULES

A. *Data Preprocessing*

Data pre-processing is an important step to prepare the data to form a QSPR model. There are many important steps in data pre-processing, such as data cleaning, data transformation. Data cleaning and transformation are methods used to remove outliers and standardize the data so that they take a form that can be easily used to create a model. Data pre-processing has a significant impact on the performance of supervised learning models In this module selected data is formatted, cleaned and sampled. The data preprocessing steps includes following:

1) *Formatting:* The data which is been selected may not be in a suitable format. The data may be in a file format and we may like it in relational database or vice versa.
2) *Cleaning:* Removal or fixing of missing data is called as cleaning. The dataset may contain record which may be incomplete or it may have null values. Such records need to remove.
3) *Sampling:* As number of frauds in dataset is less than overall transaction, class distribution is unbalanced in credit card transaction. Hence sampling method is used to solve this issue. because unreliable samples probably lead to wrong outputs.

B. *Data Cleaning*

At the start of a data science project, you will inherit multiple data-sets from different teams. You will then be asked to solve for a specific business problem. Your solution may not need all the data you got - you might have to remove columns, modify columns, remove duplicate values, deal with missing values, deal with outlier data etc.

C. *Data Virtualization*

Data virtualization software acts as a bridge across multiple, diverse data sources, and bringing critical decision-making data together in one virtual place to fuel analytics. Data visualization is the graphical representation of information and data. Data virtualization supports multiple lines of business, hundreds of projects, and thousands of users that can increase from project to enterprise scale.

D. *Data Modeling*

In data modeling module, the machine learning algorithms the time series analysis and future forecast techniques were used to predict the weather conditions. ARIMA model were used to predict the weather conditions and analyze the historical data regarding the particular season and then fulfill the performance of current changes accurately. The user provides the ARIMA model with a dataset that includes desired inputs and outputs, and the algorithm finds a method to determine how to arrive at those results.

E. *Data Prediction*

The Climate change prediction Problem includes modeling the historical dataset with the knowledge of the ones that turned out to be non-predictable weather condition. ARIMA model is then used to analyze the historic dataset and then predict the current climate change accurately.

F. *Data Validation*

Data validation is an essential part of any data handling task whether you're in the field collecting information, analyzing data, or preparing to present your data to stakeholders. If your data isn't accurate from the start, your results definitely won't be accurate either. That's why it's necessary to verify and validate your data before it is used.In ARIMA model by using the system analyze the historic dataset and then preprocessing and cleaning the particular data. Also predict accurate dataset regarding the climate change also possible to keep track of huge dataset too. Finally validate the current dataset and make the performance regarding climate change.

VII. CONCLUSION

Human-induced climate change has contributed to changing patterns of extreme weather across the globe, from longer and hotter heat waves to heavier rains. From a broad perspective, all weather events are now connected to climate change. While natural variability continues to play a key role in extreme weather, climate change has shifted the odds and changed the natural limits, making certain types of extreme weather more frequent and more intense. While our understanding of how climate change affects extreme weather is still developing, evidence suggests that extreme weather may be affected even more than anticipated. Extreme weather is on the rise, and the indications are that it will continue to increase, in both predictable and unpredictable ways. The study of this system analyzes the dataset and predicts the proper global data by using ARIMA algorithm. By using time series analysis and future forecast techniques currently performed historical data should be predicted over future.[5]

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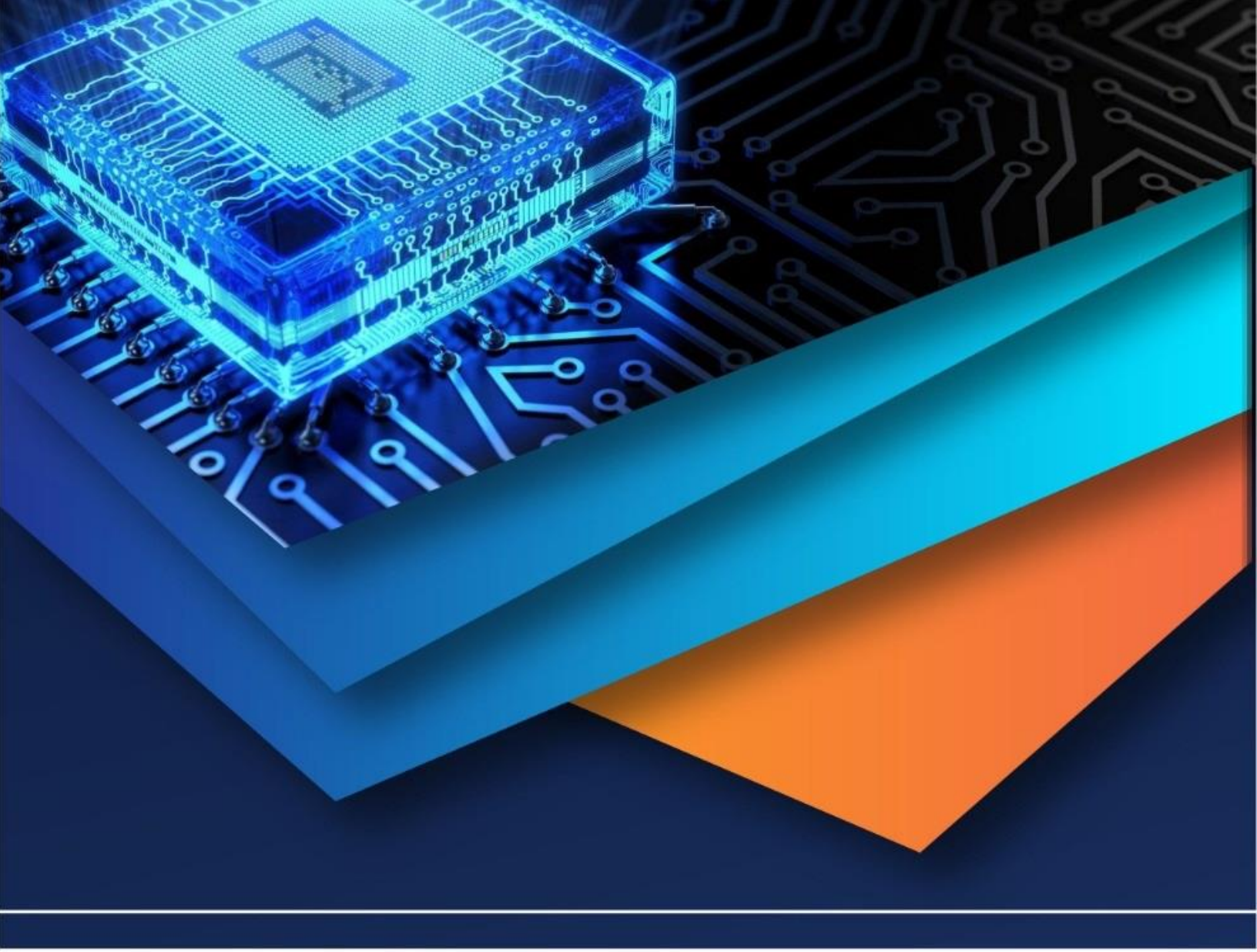

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