An innovative integrated methodology for predicting and mitigating global warming in major Indian cities

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Abstract

Global warming means, it is one of the HOT topics in this century. As per the studies, the main reason for global warming is nothing other than human activities. For example, burning fuels which emit CO2; changing land cover pattern and so on. These activities increase the concentration of gases like CO2, N2O, fluorinated gases and amplify the natural greenhouse effect... Harmful effects of this can be listed long like, Sea level rise, Health disorders, unpredicted climatic changes, disturbances in animal activities etc. There are so many researches to reduce this unfriendly effect. Also, there are so many data regarding this. Some guidelines are as follows, NASA states that CO2 levels have increased nearly 3.8% as of 2009 and methane level have increased 148%. WHO states that the vascular disease is caused by global warming. IPCC (Inter-governmental Panel on Climate Changes) predicts that the net damage cause of climate change is likely to be significant to increase over time. Using the existing data, and also collecting further datum from varieties of resources like Metallurgical department, Health centre and much more, we are ought to analyse the data. With the help of Web technologies, we analyse and showcase the effects of global warming and we try to find some mitigation. Real Time Analysis can also be done using technologies of web. Web technologies are vast. It can be used to represent the visualization of data. As a result of our work, people may get a different way of awareness which will be unique from others by the data visualisation. An effort has been made to reduce Global Warming through Web Technologies.

Index terms: global warming, web technologies, green house effect

1. Introduction

Global warming is an open topic of discussion today. While climate scientist debate on the causes of the gradual temperature rise in the past 50 years (the majority claim the increase of CO2 due to fossil fuel is to blame, other researchers found alternative explanations, like non CO2 greenhouse gases (GHGs)), data scientist had access to ever increasing technologies and data sources to study the phenomenon. Whatever the causes, the data collected by different organizations and from different parts of the world all agree that the global temperature in the world is raising. We show that this trend is not only real, but the temperature increase is accelerating in the last twenty years at a worrisome rate. We aim to update the results obtained
by other institutions with the recent data available, and to do that we want to use more flexible and powerful tools. With the use of distributed computing technologies (like R and JSON) we want to show the capabilities but also the limitations of these new technologies applied in large scale computing. Moreover, we created an interactive graph that may help viewers to visualize the enormous amount of global warming and they may take some steps to mitigate it. Vitolo et.al [1] in their research analyzed the role of web technologies in solving the problems of environmental big data. Flett et.al [2] has taken up CO₂ impact on the environmental disasters. Grillakis et.al [3] in their work summarized the implications of global warming on European summer tourism. Simioni et.al [4] has done distributed data analysis of global warming data. Leung et.al [5] in their work discussed how carbon dioxide can be captured and using storage technologies. Steininger, K. W.et.al [10] have evaluated climate change impact scenario analysis.

2. Related work

Studies on global and regional surface temperature change has been done in past. Researchers showed that the rate of temperature increase has been higher in the last quarter of the century that it has been in the previous years of the 20th century. Moreover they calculated an increase in the average global five year mean of about 1°C. This recent trend is particularly important if we consider the temperature changes in the past millennium, and can be considered an unprecedented anomaly. More recent studies also show that the mean annual temperature has not risen in the last twenty years, despite the continuous increase of GHGs in the atmosphere. This suggests that either the global warming phenomenon that was registered in the period 1975-2000 had different causes or that the more recent stable trend has an origin that balances the greenhouse effects. Research done on the temperature changes in the last century in the U.S. shows that the yearly mean trend is slightly different than the worldwide. Usmani, Z. A., Khan Et.al [6] have done a work on data mining and web technology. Amponsah, N. Y., Wang [7] have studied the effects of green house gases. Sim, J [8] has studied carbon emission evaluation model for container terminal.

3. Proposed methodology

To achieve a green environment and to show the people the extent of global warming Its causes and effects graphically. The classification and prediction is achieved using C5.0 algorithm (reason for choosing this algorithm is it provides More Accuracy,Complexity is less and also IBM ensured this as best compared to others using decision tree). This provides the comparison two major cities Chennai and Delhi, to predict the temperature of Chennai and Delhi.
Data sources

Data has been collected through the website Atmos, CO2 monthly report and from government websites. The proposed research work makes use of a methodology to dynamically grab web sites and also scrap them for identifying keywords pertaining to latest hot terminologies. To facilitate this, a proprietary software tool developed by the researchers is used. An algorithm was developed which was converted into a python code. The following snippet describes the algorithm.

Data analysis environment

HTML that stands for "Hyper Text Mark-up Language" is being used. HTML is known as SGML (Standard Generalized Mark-up Language) application that is used to create web pages worldwide in a convenient manner. It is not a programming language rather it is a formatting language HTML is a user-friendly language that can be write easily, highly portable and easy to write. HTML is not a compiled language and is directly interpreted by a web browser like Google Chrome, Mozilla Firefox, and Opera Mini etc...HTML contains set of instructions. Each instruction in HTML is called as an element or Mark-up.

CSS that stands for “Cascading Style Sheets” controls the presentation aspect of the site and allows your site to have its own unique look. It does this by maintaining style sheets which sit on top of other style rules and are triggered based on other inputs, such as device screen size and resolution. Both HTML and CSS is used to visualise the output.

R is an integrated suite of software facilities for data manipulation, calculation and graphical display. It includes an effective data handling and storage facility, a suite of operators for calculations on arrays, in particular matrices, a large, coherent, integrated collection of intermediate tools for data analysis, graphical facilities for data analysis and display either on-screen or on hardcopy, and a well-developed, simple and effective programming language which includes conditionals, loops, user-defined recursive functions and input and output facilities. Many packages of R was used in this project such as C5.0 (classification and prediction), ggplot2 (for plotting the graph), plot3d (graphical representation), cluster for (clustering). This software is the best for Data manipulation and Data visualization especially the package plotly is more useful than the others.
4. Experiments

The analysis was based on the data available. The basic steps that the analysis performs are:
1. Data has been collected
2. It undergoes pre-processing such as clustering, classification, prediction...
3. Then the data were visualised as predicted with mitigation measures

Figure 1: Clustered data

Figure 2: Architecture
5. Result

The result is displayed graphically with the data visualisation techniques.

![Figure 3: Visualization of data](image)

6. Conclusion

Global warming is a major concern affecting the living beings on the earth. The continuous usage of fossil fuel increases CO$_2$ emissions and other greenhouse gases. It indirectly affects the climatic conditions of the earth leading to either excess rain fall or drought. This research work tried to analyze and show case the effects of these emissions and tries to mitigate these issues.
References


