GLOBAL TEMPERATURE TRENDS AND IMPACT OF CO2 AND DEFORESTATION ON TEMPERATURE CHANGE

Team 109
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WHAT ARE YOU TRYING TO DO?

- Predict global temperature change for next few decades based on 250+ years of climate change data

- Evaluate the impact of CO2 emissions and deforestation on global temperature change

- Create interactive visualizations to show the temperature change

DATASETS:

- Global Temperature (city)

- CO2 Emissions

- Deforestation

HOW IS IT DONE TODAY? WHAT ARE THE LIMITS OF CURRENT PRACTICE?

- Understanding Climate Change from a Global Analysis of City Analogues **[1]**
  Idea: This paper investigates global climate change by calculating the latitudinal shift using PCA and approximate nearest neighbors.
  Why it is useful: Our model's accuracy can be compared to this paper.
  Shortcoming: There is no further analysis whether there are other factors which affect the climate shift such as CO_2, deforestation etc.
- Impacts of forestation and deforestation on local temperature across the globe **[2]**
  Idea: This research paper focuses on analyzing the relationship between deforestation and forestation on the surface temperature.
  Why it is useful: It suggests that deforestation may increase the temperature and forestation may decrease the temperature, which supports our project's objective
  Shortcoming: This paper focuses only on predicting the future impact of forestation and deforestation in Brazil.

CONTINUED…

- Global research on carbon emissions: A scientometric review **[3]**
  Idea: The authors analyzed carbon emission literature available since 1981.
  Why it is useful: This helped us get an understanding how past studies have regionally studied carbon emissions but identified missing aspects to study moving forward.
  Shortcoming: The paper mentions missing ML for estimation and a comprehensive study of global carbon emissions in current work.

- Machine learning-based time series models for effective CO_2 emission prediction in India **[4]**
  Idea: The paper illustrates prediction of CO_2 emissions in India using machine learning models and uni-variate time series analysis.
  Why it is useful: The prediction approach can be extended in current work to forecast CO_2 emissions for world countries.
  Shortcoming: The paper focuses solely on CO_2 emissions while the proposed project extends this work to predict global temperatures.

- Deforestation and climate change are projected to increase heat stress risk in the Brazilian Amazon **[5]**
  Idea: The paper explains the impact of deforestation on rise in temperature.
  Why it is useful: It shows the approach to predict deforestation impact on climate change which is one of our objectives.
  Shortcoming: The study is limited to Amazon. We want to analyze the impact of deforestation on temperatures globally.

WHAT IS NEW IN YOUR APPROACH?

- Incorporating both deforestation and CO2 emissions as factors to predict temperature change by merging different datasets

- Using interactive visualization to show the temperature change predictions globally for next few decades including impact of deforestation and CO2 emissions

Innovation: In our project, we evaluate the impact of both factors on temperature trends globally with an interactive visualization tool.

WHY WILL IT BE SUCCESSFUL?

- It is scientifically proven that Deforestation and CO2 emission impact the temperature. We are just quantifying and predicting using ML models. We have the right skillsets in the team to implement it. So, it should be successful.

WHO CARES?

- Humanity: food supply, water quality affect everyone

- Governments and other governing authorities can educate and inform the public to take precautions towards climate change.

IF SUCCESSFUL, WHAT DIFFERENCE AND IMPACT WILL IT MAKE?

- City planning and governments can be proactive

- Help identify vulnerability, adaptation, and sustainability

- Public awareness

- Effective visualization for knowledge transfer to make more impact

HOW DO YOU MEASURE THEM?

- Check accuracy of temperature prediction and compare it with existing studies

- Visualize the global temperature trends whether they are explainable by deforestation and CO_2 emission data

WHAT ARE THE RISKS AND PAYOFFS?

Risks:

- Data processing challenges (missing data, incorrect data, normalization, joining huge dataset with smaller ones etc.)

- Limited features and correlated features might impact model development and training

Payoffs:

- Global temperature prediction

- Future work to include mitigation of CO_2 emissions and climate change

HOW MUCH WILL IT COST?

Not Applicable to our project

HOW LONG WILL IT TAKE?

TASK	TASK OWNER	PROGRESS	START	END
Phase 1 Project Proposal				
Finalize Team and explore datasets	All	100%	1/15/23	1/29/23
Finalize dataset and high level project objective	All	100%	1/29/23	2/5/23
Literature Review	3 Articles Each	100%	2/5/23	2/19/23
Project Proposal	All	100%	2/19/23	2/26/23
Proposal Presentation (Slides)		100%	2/26/23	3/1/23
Proposal Presentation (Video)		100%	3/1/23	3/3/23
Phase 2 Progress Report				
Exploratory Data Analysis	Geneva, Phung	10%	3/3/23	3/8/23
Data Cleansing and Data Preparation	Geneva, Phung	0%	3/5/23	3/12/23
Feature Engineering and Model Development	Sachin, Gopi	0%	3/12/23	3/28/23
Start visualization design and development with sample data	Priyanka, Imren	0%	3/16/23	3/28/23
Progress Report	All	0%	3/24/23	3/31/23
Phase 3 Final Report				
Models Training	Sachin, Gopi	0%	3/28/23	4/1/23
Finish Visualization	Priyanka, Imren	0%	3/28/23	4/4/23
Experiments/Results and Innovation	All	0%	4/4/23	4/11/23
Project Presentation Poster	All	0%	4/11/23	4/16/23
Individual Presentations	All Individually	0%	4/16/23	4/21/23
Final Report	All	0%	4/11/23	4/21/23

*All team members have contributed a similar amount of effort

WHAT ARE THE MIDTERM AND FINAL "EXAMS" TO CHECK FOR SUCCESS?
HOW WILL PROGRESS BE MEASURED?

- **Midterm**: EDA/Data Preparation, model development, and basic visual design

- **Final**: Trained ML Model to predict the temperature change and enhanced interactive visualization to show how the temperature is changing in the history and how will it change in future based on model predictions

- Progress will be measured on task completion

REFERENCES

[1] Jean-Francois Bastin, Emily Clark, Thomas Elliott, Simon Hart, Johan Van Den Hoogen, Iris Hordijk, Haozhi Ma, Sabiha Majumder, Gabriele Manoli, Julia Maschler, et al . 2019. Understanding climate change from a global analysis of city analogues. PloS one 14, 7 (2019), e0217592.

[2] Jayme A Prevedello, Gisele R Winck, Marcelo M Weber, Elizabeth Nichols, and Barry Sinervo. 2019. Impacts of forestation and deforestation on local temperature across the globe. PloS one 14, 3 (2019), e0213368.

[3] Lebunu Hewage Udara Willhelm Abeydeera, Jayantha Wadu Mesthrige, and Tharushi Imalka Samarasinghalage. 2019. Global research on carbon emissions: A scientometric review. Sustainability 11, 14 (2019), 3972.

[4] Surbhi Kumari and Sunil Kumar Singh. 2022. Machine learning-based time series models for effective CO_2 emission prediction in India. Environmental Science and Pollution Research (2022), 1–16.

[5] Beatriz Fátima Alves de Oliveira, Marcus J Bottino, Paulo Nobre, and Carlos A Nobre. 2021. Deforestation and climate change are projected to increase heat stress risk in the Brazilian Amazon. Communications Earth & Environment 2, 1 (2021), 207.