Climate Change Analysis and Forecasting

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Objective

- Analyze global temperature data to find trends, seasonality and autocorrelation patterns in it.
- Explore the dataset and find out some meaningful insights on climatic conditions.
- Develop and deploy a web UI based solution, that used to get analysis and forecasts for average temperatures per month.
- The analysis and forecasts dependent on country and state selected.

About Data

For this project we used 3 csv file and 1 json. This are –

1) **GlobalTemperatures.csv :** For global average land temperatures.
2) **GlobalLandTemperaturesByCountry.csv :** For average temperatures group by countries.
3) **GlobalLandTemperaturesByState.csv :** For average temperatures group by states.
4) **Countries.geo.json :** Fo geographical locations of countries.

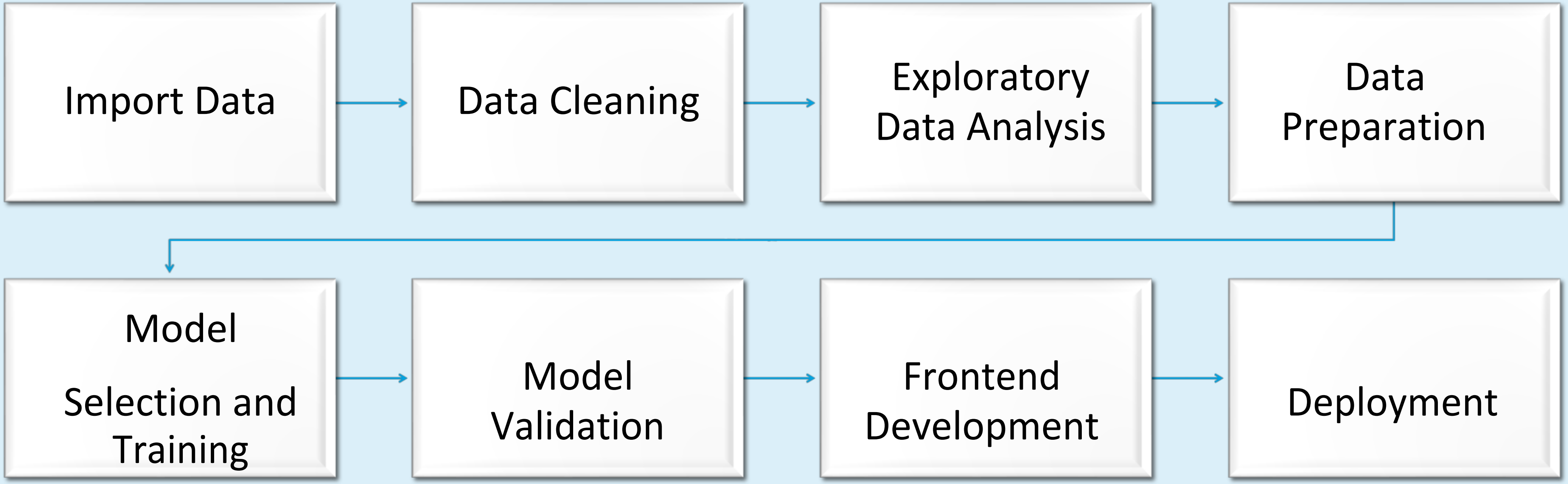
This data was collected from http://berkeleyearth.org/data/

Software and Tools

- Python : used as the primary programming and scripting language.
- Jupyter Notebook : For python scripting, data analysis and research.
- Spyder : For application backend Programming.
- Pandas : used for data frame manipulation.
- NumPy : For array manipulation.
- Plotly Express : for interactive plots.
- Neural Prophet : For Deep Learning modelling and forecasting.
- Streamlit : For frontend development.
- Html / CSS : For frontend improvement.

- Git : For project version control.

Project Flow



Import Data

Data Cleaning

Exploratory Data Analysis

Data Preparation

Model Selection and Training

Model Validation

Frontend Development

Deployment

Import Data

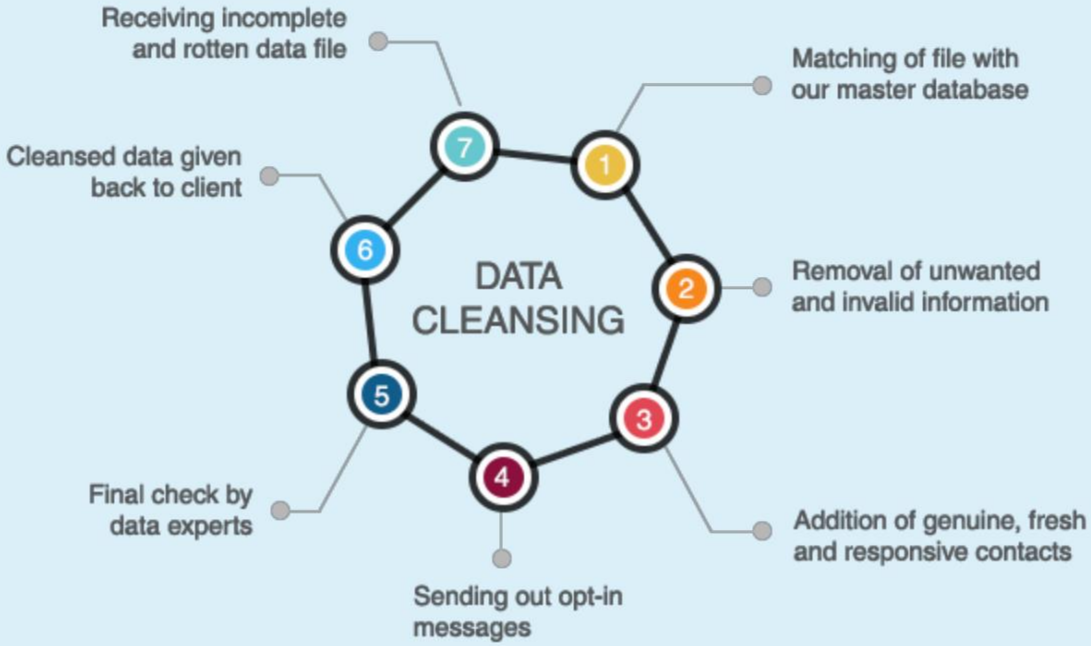
- All the csv and json files collected for this project stored inside a folder “datasets” in the repository.

- Now load this csv files as pandas dataframe object into the python program to get access on this datasets.

- The json file imported as json object using python in-built json library.

Data Cleaning

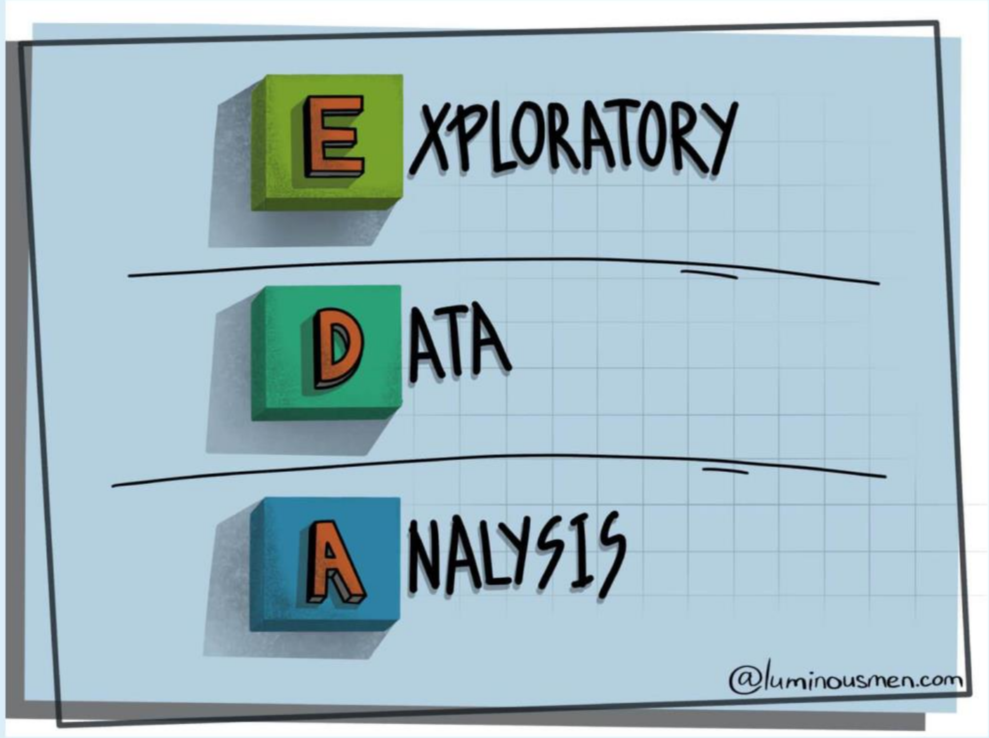
- ➢All the unnecessary features removed.
- ➢Missing Values imputed on monthly average data.


Receiving incomplete and rotten data file
7
Matching of file with our master database
1
Cleansed data given back to client
6
DATA CLEANSING
2
Removal of unwanted and invalid information
5
3
Final check by data experts
4
Addition of genuine, fresh and responsive contacts
Sending out opt-in messages

Exploratory Data Analysis

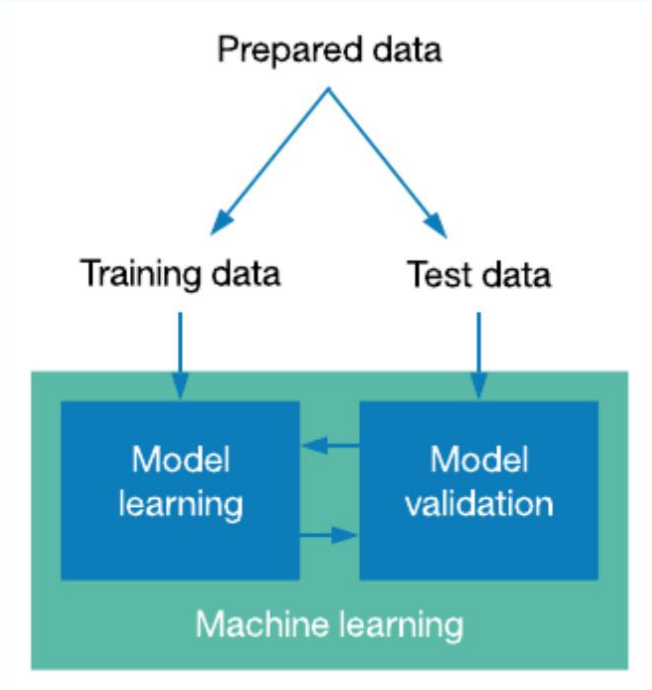
This Exploratory Data Analysis contains,

- Lag Plot and Analysis
- ACF or Autocorrelation plots and Analysis
- Trend Plot and Analysis
- Seasonal Plot and Analysis
- Chloropleth Map of Average Temperature by Countries and Analysis



Data Preparation

- Data prepared for training and validation.
- First 80% of data used as training data for training.
- Last 20% of data used as test data for validation.



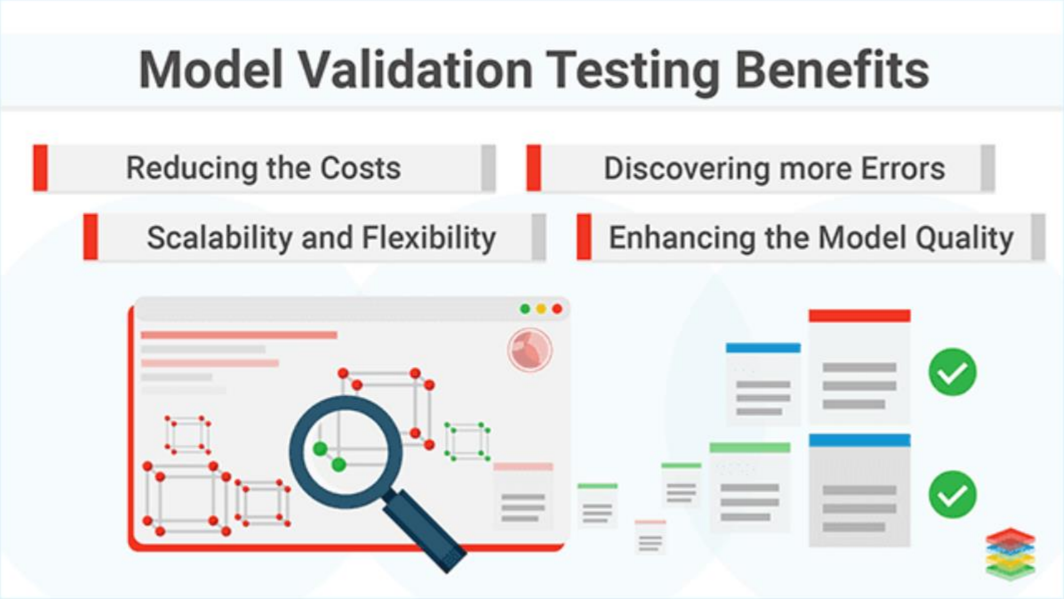
Model Selection and Training

- Choosing the best model and train it.
- Meta’s state of art time series deep learning model Neuralprophet used.
- This model is upgraded version of fbprophet.
- This model built in pytorch.
- Very fast and convenient API compare to tensorflow ANN, RNN etc.
- Model trained on prepared training with 10 epochs.

Neural
Prophet

Model Validation

- Analysis and plotting training per epochs loss and RMSE.
- Validating model performance based on test data.
- Evaluation metrices used : RMSE and R2 Score.
- Demo forecasting for next 2 years.

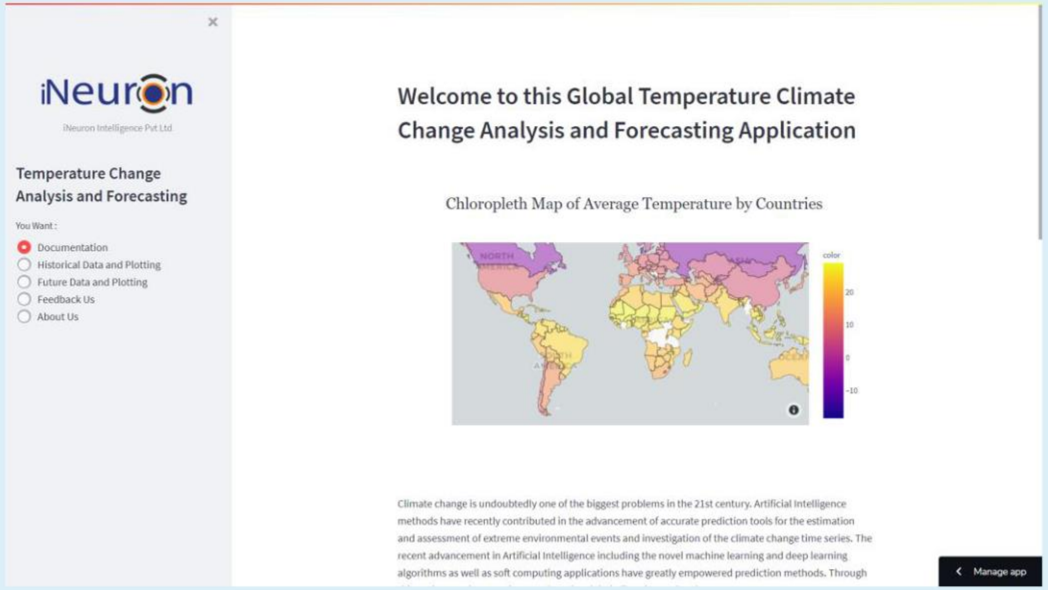

Model Validation Testing Benefits
Reducing the Costs
Discovering more Errors
Scalability and Flexibility
Enhancing the Model Quality

Frontend Development

Multi paged web based solution developed using streamlit to show plots, analysis and forecasts.

Here 5 different web pages developed inside the application. This are –

- Documentation
- Historical Data and Plotting
- Future Data and Plotting
- Feedback Us
- About Us



Temperature Change Analysis and Forecasting

You Want :

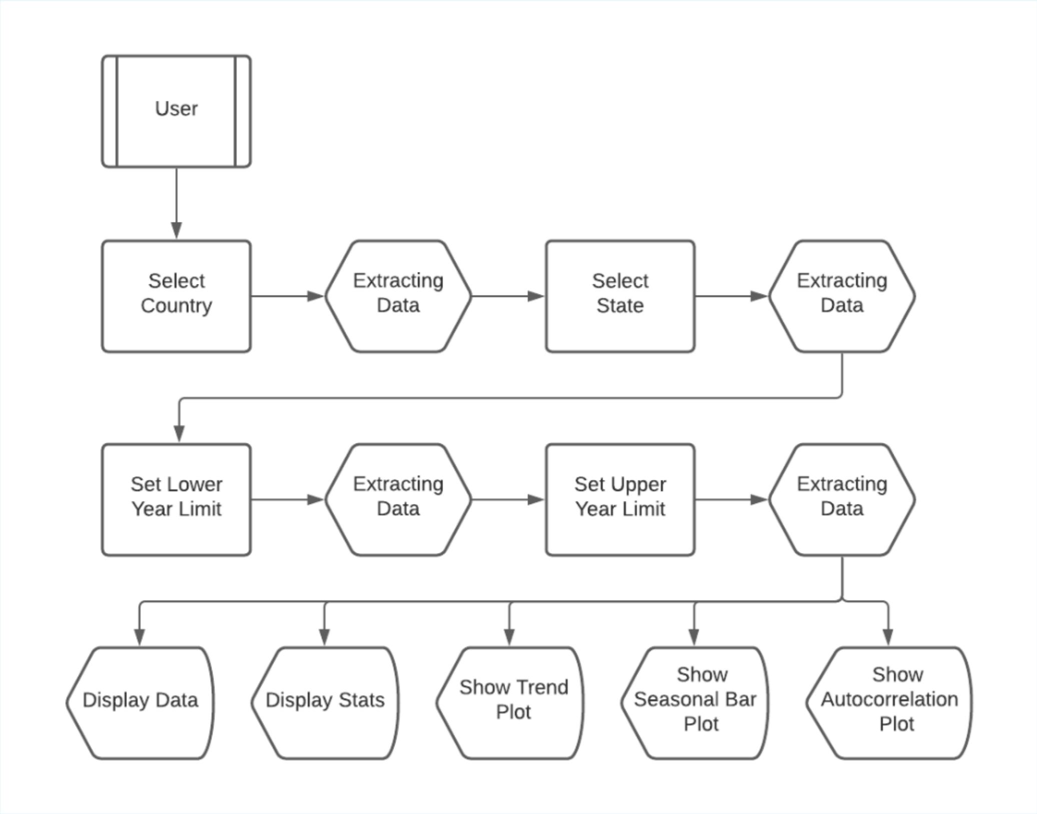
● Documentation
○ Historical Data and Plotting
○ Future Data and Plotting
○ Feedback Us
○ About Us

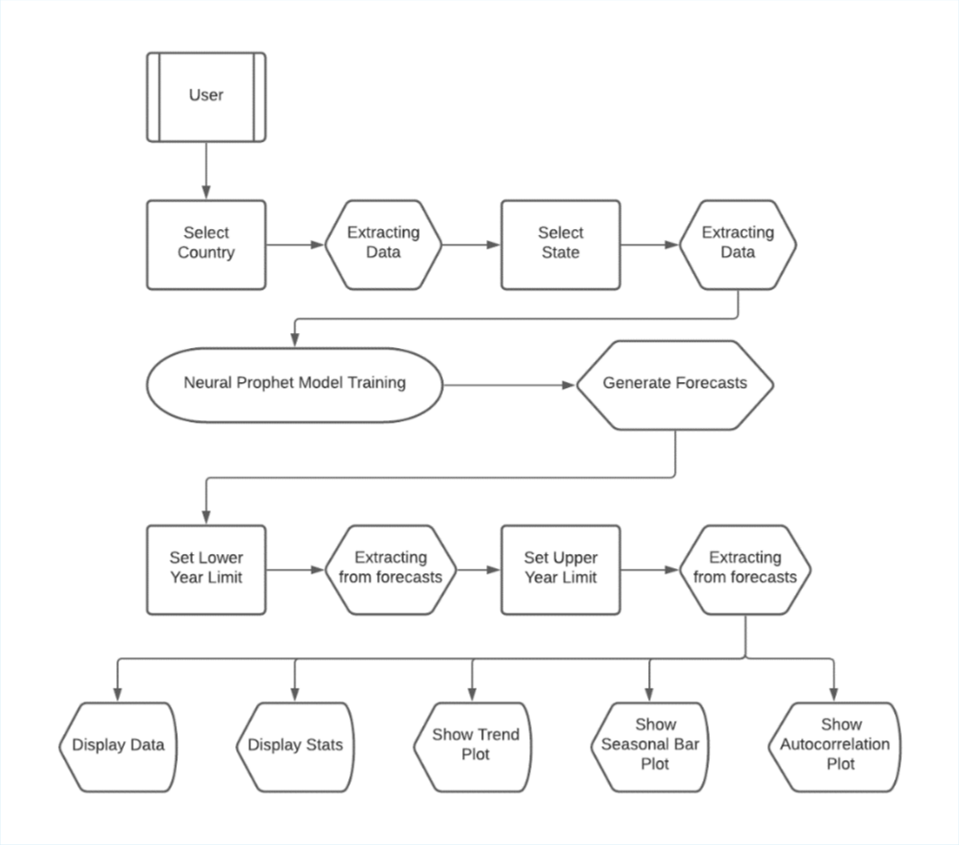
Welcome to this Global Temperature Climate Change Analysis and Forecasting Application

Chloropleth Map of Average Temperature by Countries

Climate change is undoubtedly one of the biggest problems in the 21st century. Artificial Intelligence methods have recently contributed in the advancement of accurate prediction tools for the estimation and assessment of extreme environmental events and investigation of the climate change time series. The recent advancement in Artificial Intelligence including the novel machine learning and deep learning algorithms as well as soft computing applications have greatly empowered prediction methods. Through

Architecture of this Application



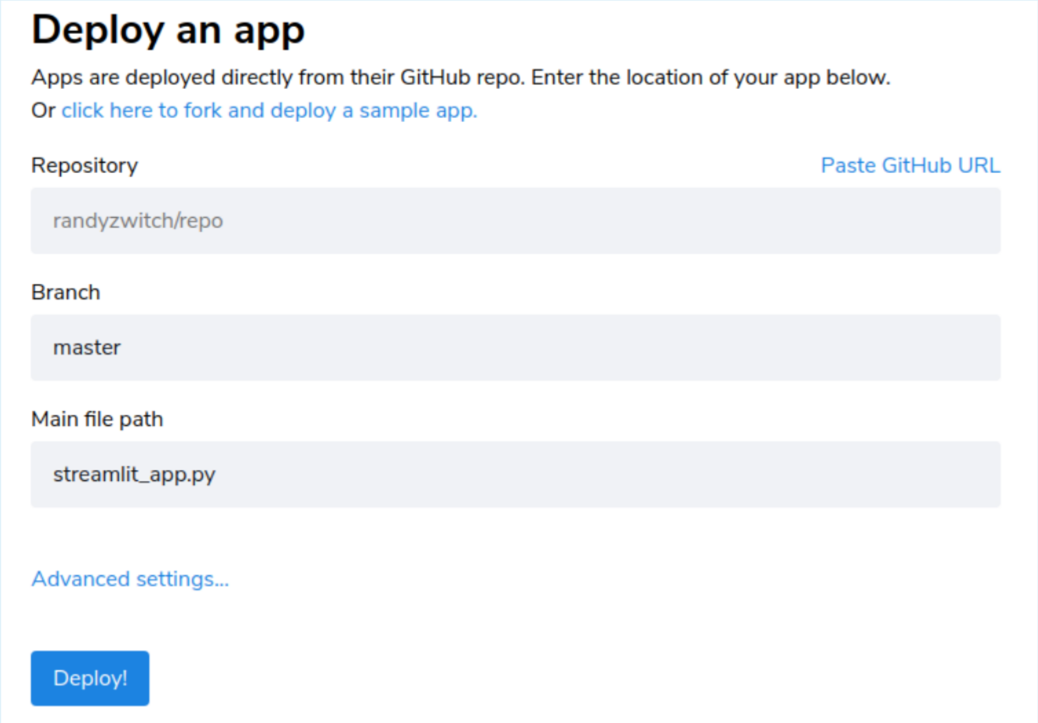


Deployment

- The project successfully deployed through Streamlit Cloud.

- The Github repository of the project needed to publish this application.

- After deployment the website will automatically update on update of github repository.



Deploy an app

Apps are deployed directly from their GitHub repo. Enter the location of your app below.
Or click here to fork and deploy a sample app.

Repository: randyzwitch/repo

Branch: master

Main file path: streamlit_app.py

Conclusion

Undoubtedly, this application will help users to analyze past and future climatic trends and changes. As well as users can get to know the monthly seasonality and autocorrelation. Users can able to filter this insights as per there choice of country, state and time range.

THANK
YOU!