Forecasting and Modeling Climatic Variables– Temperature, Groundwater Level, and Rainfall in Bangladesh: A machine learning approach.

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INTRODUCTION

General Aims:

To develop and enhance a model for Climatic Variables analysis and prediction in Bangladesh using Machine Learning.

Specific Objectives:

This study utilizes advanced computational techniques to improve the understanding, accuracy, and efficiency of Climatic Variables forecasting in Bangladesh.

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LITERATURE REVIEW

References	Title	Outcome
Shahid, S., Wang, X. J., Harun, S. B., Shamsudin, S. B., & Ismail, T. (2017)	Climate variability and changes in the major cities of Bangladesh: observations, possible impacts, and adaptation.	Highlights significant climate shifts in major cities and suggests adaptation strategies.
Shamsudduha, M., Taylor, R. G., Chandler, R. E., & Ahmed, K. M. (2009)	Recent trends in groundwater levels in a highly seasonal hydrological system: the Ganges-Brahmaputra Meghna Delta.	Identifies seasonal groundwater level fluctuations and their implications for water management.
Shahid, S. (2010)	Rainfall variability and the trends of wet and dry periods in Bangladesh.	Details significant rainfall variability and trends, impacting agricultural and water management planning.
Rahman, M. S., M. N., & Miah, M. A. (2019)	Impact of climate change on crop production and adaptation practices in Bangladesh: A case study of Rajshahi District.	Examines climate change effects on crop yield and evaluates effective local adaptation practices.

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OBJECTIVES

- **Develop Accurate Predictive Models:** Create machine learning models to forecast temperature, groundwater levels, and rainfall with high accuracy.
- **Improve Resource Management:** Provide tools for better management of water resources and agricultural planning.
- **Support Decision Making:** Aid policymakers and stakeholders in making informed decisions regarding climate adaptation and disaster risk reduction.
- **Advance Scientific Understanding:** Contribute to the scientific understanding of climatic trends and patterns in Bangladesh.

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METHODOLOGY

- **Data Collection:** Gather historical climate data from reliable sources.
- **Data Preprocessing:** Clean, normalize, and standardize the data.
- **Feature Selection:** Identify relevant features using statistical techniques and domain knowledge.
- **Model Selection:** Evaluate and choose suitable machine learning models (e.g., ARIMA, SARIMA, Multiple Linear Regression, Random Forest Regression, LSTM, SVR).
- **Model Training and Validation:** Split data, train models, and validate their accuracy.
- **Model Evaluation:** Assess models using metrics like RMSE, MAE, and R^2.
- **Implementation:** Implement the best models and integrate them into a user-friendly tool.

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WORKFLOW DIAGRAM

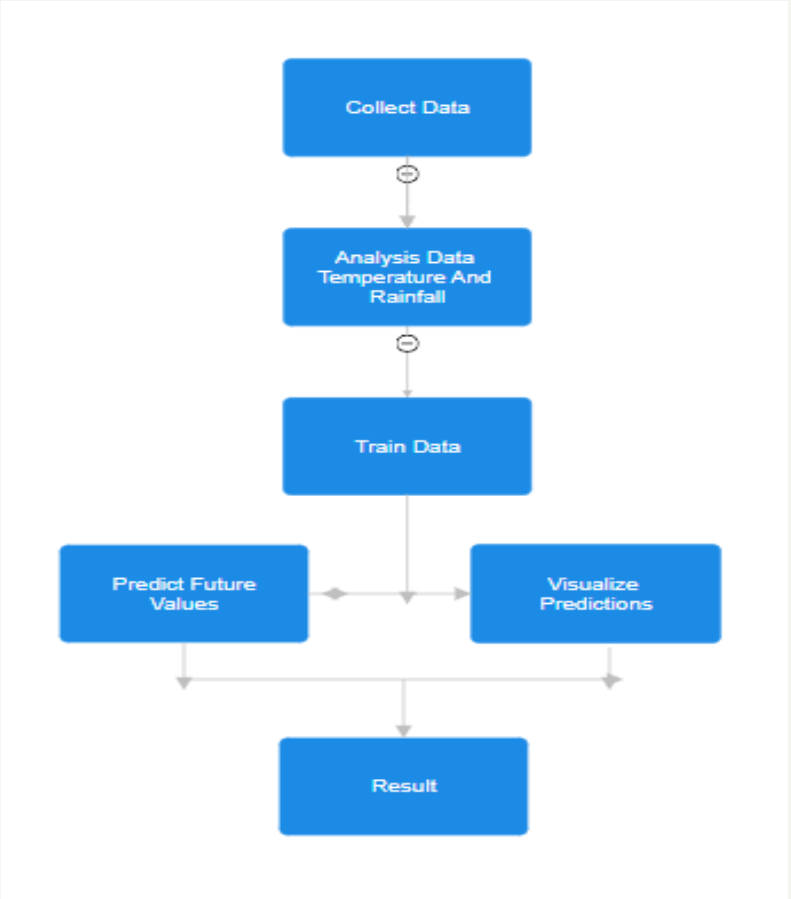
We use four machine learning algorithms to develop this model which are :

1. Linear Regression
   -> Simple and interpretable model

2. Polynomial Regression
   -> Captures non-linear relationships

3. Isotonic Regression
   -> Maintains order of data points

4. Support vector Regressor
   -> Handles high-dimensional data



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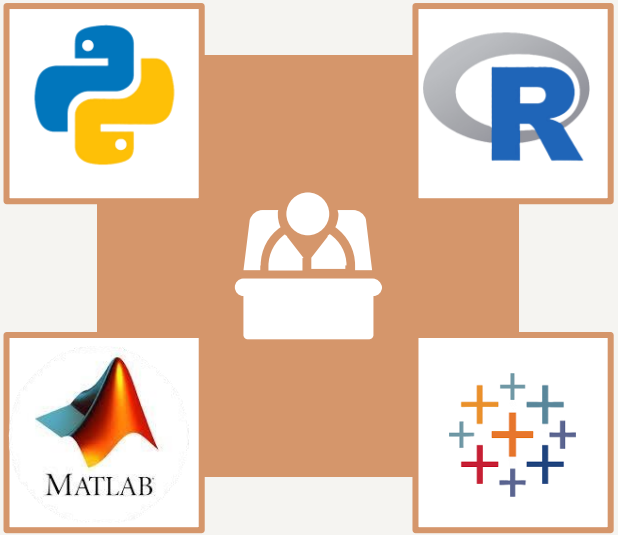
REQUIRED TOOLS

Python

Statistical libraries (NumPy, Pandas, SciPy, Stats models)

MATLAB

Environment for numerical computing, data visualization



R Language

SVM regression or Support Vector Regression (SVR).

Tableau

Create interactive and shareable dashboards.

EXPECTATIONS

- Enhanced Predictive Accuracy
- Improved Water Resource Management
- Enhanced Agricultural Productivity
- Disaster Risk Reduction
- Contribution to Climate Science
- Support for Socio-Economic Stability
- Long-Term Climate Adaptation

REFERENCES

- Huq, S., Ahmed, A. U., & Koudstaal, R. (2019). Vulnerability of Bangladesh to climate change and sea level rise. In Climate Change and World Food Security.
- Rahman, M. S., Rahman, M. M., Islam, M. N., & Miah, M. A. (2019). Impact of climate change on crop production and adaptation practices in Bangladesh: A case study of Rajshahi District.
- Sophocleous, M. (2004). Global and regional water scarcity: shifting realities, expected limits, and the need to redefine water scarcity.
- Salem, B. S., Rahman, M. S., & Rahman, S. M. (2018). Impact of climate change on the water resources of Bangladesh.
- Shahid, S., Wang, X. J., Harun, S. B., Shamsudin, S. B., & Ismail, T. (2017). Climate variability and changes in the major cities of Bangladesh: observations, possible impacts, and adaptation.
- Islam, A. S., Tarekul, M., & Ahsan, M. N. (2021). Development of a machine learning model to predict rainfall variability and its impact on agricultural production in Bangladesh.
- Shahid, S. (2010). Rainfall variability and the trends of wet and dry periods in Bangladesh.
- Karmakar, S., & Shrestha, M. L. (2021). Recent climate change in Bangladesh.
- Khan, M. A. S. A., Guttikunda, S. K., & Mitra, A. P. (2011). Surface temperature trends in Bangladesh.
- Rahman, M. S., Rahman, M. M., Islam, M. N., & Miah, M. A. (2019). Impact of climate change on crop production and adaptation practices in Bangladesh: A case study of Rajshahi District.

Thank You