WEATHER FORECASTING SYSTEM

Predicting Temperature and Rain Using Regression Analysis

Course Title: Software Project Lab I
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INTRODUCTION

This project, Weather Forecasting System, uses regression analysis to predict rain and temperature based on historical weather data like humidity, wind speed, and pressure. It demonstrates the practical application of statistical modeling in C programming for accurate weather predictions.

DATASET

- **Attributes**
  - Date
  - Season
  - Temparature
  - Humidity
  - Wind_Speed
  - Pressure
  - Rain [1 for rain, 0 for sunny/no rain)
- **Size**
  - Dataset loaded with 366 records.

SYSTEM WORKFLOW

Data Loading:

Read dataset from a CSV file.

Feature Normalization:

Normalize continuous features like humidity, wind speed, and pressure.

Data Splitting:

Split data into training (80%) and testing (20%) sets.

Model Training:

- Logistic Regression: Predict rain.
- Linear Regression: Predict temperature.

Evalution:

Test accuracy using metrics like prediction correctness and temperature deviation.

Evalution:

Predict rain and temperature for specific conditions or dates.

IMPLEMENTATION

- **Programming Language:**
  C
- **Standard Libraries**

<stdio.h>: Input/output operations.

<stdlib.h>: Dynamic memory management.

<string.h>: String operations

<math.h>: Mathematical functions for sigmoid and normalization.

KEY FUNCTIONS

Load Data

Reads and parses CSV data.

Train Model

Initializes regression coefficients.

Predict Rain

Predicts rain using logistic regression.

Predict Temperature

Predicts temperature using linear regression.

Split Dataset

Divides the dataset into training and testing sets.

Evaluate Model

Assesses model performance.

MODEL OVERVIEW

Logistic Regression:

- Predicts binary outcomes (rain/no rain).
- Formula: $P(\text{rain}) = \frac{1}{1+e^{-(\beta 0+\beta 1x1+\beta 2x2+\beta 3x3)}}$
- Threshold: $P(\text{rain})>0.5 \rightarrow$ Rain.

Linear Regression:

- Predicts continuous outcomes (temperature).
- Formula: $\hat{y}=\beta 0+\beta 1x1+\beta 2x2+\beta 3x3$.

RESULTS

- **Model Accuracy:**

  Actual accuracy from execution, e.g., 85%

- **Sample Output:**
  - Input: Humidity = 70%, Wind Speed = 3 m/s, Pressure = 1015 hPa.
  - Rain Prediction: No Rain.
  - Temperature Prediction: 24.5°C.

CHALLENGES FACED

Data preprocessing

Handling missing or inconsistent data.

Limited features

Predictions rely heavily on humidity, wind speed, and pressure.

Fixed coefficients

No dynamic optimization or training due to simplicity of implementation.

FUTURE ENHANCEMENTS

Dynamic Training

Use gradient descent to optimize coefficients.

Expanded Features

Include additional factors like solar radiation or cloud cover.

Real-Time Predictions

Integrate live weather data for real-time forecasting.

Visualization

Graphical representation of predictions and trends.

CONCLUSION

Project Summary

This project demonstrates how regression analysis can be applied to weather forecasting using basic algorithms in C.

Impact

- Provides a foundation for more advanced forecasting systems.
- Highlights the importance of data preprocessing and model evaluation.

QUESTIONS

Questions and Discussion

Feel free to ask any questions or provide feedback on the project.

THANK YOU FOR YOUR ATTENTION