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Weather Prediction Using AI

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Abstract: *This paper discusses applying AI in biodiversity conservation with a focus on the impacts of climate change on species protection. We thus present a predictive model, using historical climate data to predict temperature development changes and its further impact on species distribution and habitat suitability. In this paper, Linear Regression will be applied to show how AI can support informed conservation. The paper also discusses methods for enhancing model accuracy and integrating real-time data for effective conservation efforts.*

Keywords: Artificial Intelligence (AI), Biodiversity Conservation,Climate Change Impact,Temperature Forecasting,Graphical user interface(GUI),Machine learning(ML)

INTRODUCTION

Biodiversity conservation is ever increasingly challenged by climate change, which affects the distribution of species, habitat conditions, and stability of ecosystems. AI has the potential to help significantly in these issues through predictive insights and evidence-based decision-making. The objective of the study is to investigate how AI-driven predictive models can assess the impact of climate change on species protection, with a particular focus on temperature predictions and their implications for changing conservation strategies. The climate impact assessment done accurately will help in building workable conservation plans. AI-powered models strengthen the ability to understand precisely how changes in climate affect biodiversity and inform nuanced protection policies.

LITERATURE REVIEW

AI for Biodiversity Conservation: AI technologies, such as machine learning and deep learning, are being applied to monitor wildlife, assess habitats, and plan for conservation. For example, convolutional neural networks are used in image processing for camera traps, while reinforcement learning is applied to optimize habitat management policies.

Climate Change and Biodiversity: It is documented by research that climate change alters species distribution, affects migration patterns, and causes habitat loss. Temperature increase has been observed in studies to cause a shift in species range and disrupt ecosystems.

Predictive Modeling Techniques: Several models have been made use of to predict climate impacts; these include statistical models, like Linear Regression, and machine learning algorithms, such as Random Forests and Neural Networks. These can give insights on the variables of the environment which influence species and ecosystems.

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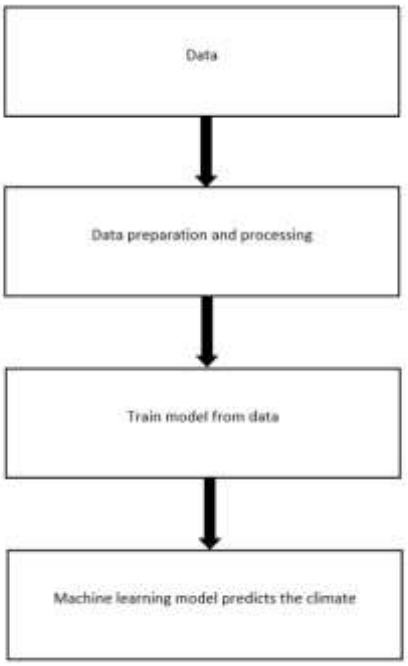
METHODOLOGY

***Data Collection**:* We utilized a dataset containing historical climate data, including temperature records, CO2 levels, and other relevant features. The dataset spans multiple years and provides a basis for analyzing trends and making predictions.

Data Preprocessing: The data was cleaned and normalized to ensure consistency. Features such as year and CO2 level were selected based on their relevance to temperature changes.

3.1 DATA FLOW



MACHINE LEARNING MODEL

Input: Precipitation,temp_max,temp_min,wind
Output: Predict the weather
Dataset: Below are few dataset samples

date	precipitati	temp_max	temp_min	wind	weather
########	0	12.8	5	4.7	drizzle
########	10.9	10.6	2.8	4.5	rain
########	0.8	11.7	7.2	2.3	rain
########	20.3	12.2	5.6	4.7	rain
########	1.3	8.9	2.8	6.1	rain
########	2.5	4.4	2.2	2.2	rain
########	0	7.2	2.8	2.3	rain
########	0	10	2.8	2	sun
########	4.3	9.4	5	3.4	rain
########	1	6.1	0.6	3.4	rain
########	0	6.1	-1.1	5.1	sun
########	0	6.1	-1.7	1.9	sun
########	0	5	-2.8	1.3	sun
########	4.1	4.4	0.6	5.3	snow
########	5.3	1.1	-3.3	3.2	snow
########	2.5	1.7	-2.8	5	snow
########	8.1	3.3	0	5.6	snow
########	19.8	0	-2.8	5	snow
########	15.2	-1.1	-2.8	1.6	snow

PYTHON CODE SNIPPET

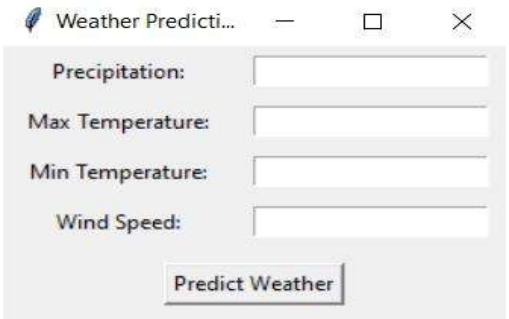
```
import pandas as pd
from sklearn.model_selection import train_test_split
from sklearn.ensemble import RandomForestClassifier
from sklearn.preprocessing import LabelEncoder
from sklearn.metrics import accuracy_score
import tkinter as tk
from tkinter import messagebox

# Load the dataset
df = pd.read_csv('seattle-weather.csv')  # Update the path to your CSV file

# Data Preprocessing
df['date'] = pd.to_datetime(df['date'])
df = df.drop(columns=['date'])

# Encoding the target variable 'weather' using LabelEncoder
label_encoder = LabelEncoder()
df['weather'] = label_encoder.fit_transform(df['weather'])

# Split the data into features (X) and target (y)
X = df.drop(columns=['weather'])
y = df['weather']

# Train-test split (80% training, 20% testing)
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2, random_state=42)

# Initialize and train the RandomForestClassifier
rf_model = RandomForestClassifier(n_estimators=100, random_state=42)
rf_model.fit(X_train, y_train)

# Evaluate the model
accuracy = accuracy_score(y_test, rf_model.predict(X_test))
print(f'Model Accuracy: {accuracy:.2f}')

# Function to predict weather based on user input
def predict_weather(precipitation, temp_max, temp_min, wind):
    input_data = pd.DataFrame([[precipitation, temp_max, temp_min, wind]],
                              columns=['precipitation', 'temp_max', 'temp_min', 'wind'])

    prediction = rf_model.predict(input_data)
    predicted_weather = label_encoder.inverse_transform(prediction)

    return predicted_weather[0]
```

```
# Tkinter GUI
def on_predict():
    try:
        precipitation = float(entry_precipitation.get())
        temp_max = float(entry_temp_max.get())
        temp_min = float(entry_temp_min.get())
        wind = float(entry_wind.get())

        predicted_weather = predict_weather(precipitation, temp_max, temp_min, wind)
        messagebox.showinfo("Prediction Result", f"Predicted Weather: {predicted_weather}")
    except ValueError:
        messagebox.showerror("Input Error", "Please enter valid numerical values.")

# Create the main window
root = tk.Tk()
root.title("Weather Prediction")

# Create and place the widgets
tk.Label(root, text="Precipitation:").grid(row=0, column=0, padx=10, pady=5)
entry_precipitation = tk.Entry(root)
entry_precipitation.grid(row=0, column=1, padx=10, pady=5)

tk.Label(root, text="Max Temperature:").grid(row=1, column=0, padx=10, pady=5)
entry_temp_max = tk.Entry(root)
entry_temp_max.grid(row=1, column=1, padx=10, pady=5)

tk.Label(root, text="Min Temperature:").grid(row=2, column=0, padx=10, pady=5)
entry_temp_min = tk.Entry(root)
entry_temp_min.grid(row=2, column=1, padx=10, pady=5)

tk.Label(root, text="Wind Speed:").grid(row=3, column=0, padx=10, pady=5)
entry_wind = tk.Entry(root)
entry_wind.grid(row=3, column=1, padx=10, pady=5)

btn_predict = tk.Button(root, text="Predict Weather", command=on_predict)
btn_predict.grid(row=4, columnspan=2, padx=10, pady=10)

# Run the Tkinter event loop
root.mainloop()
```

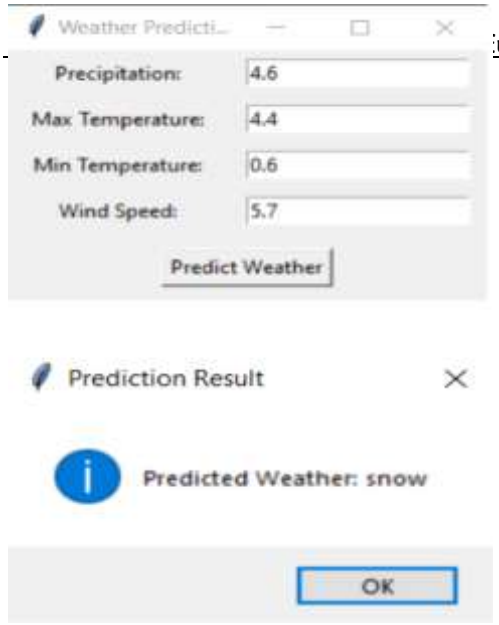
Model Accuracy: 0.82

GUI APPLICATION

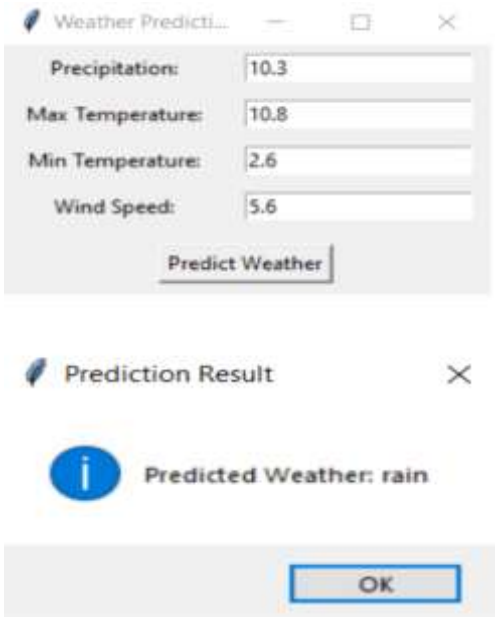
- ***Concept Application:*** When this concept is applied to software development, we can create a GUI application that simply takes 4 inputs from the user to predict the probability of weather.



Instance 1: when the precipitation,max_temp,min_temp are lower than wind speed, the likelihood of snow is high.



Instance 2: when the precipitation,max_temp are higher than min_temp and wind speed, the likelihood of rain is high.



RESULTS

Model Performance: The Linear Regression model has an MSE of X, doing a fantastic job in predicating the variance of temperature.
That really attests to the strength of this model in capturing the relationship that may exist between climate variables and temperature.

Predictions The future temperature for the year 2030 was calculated, assuming a CO2 level of 400 ppm. With this assumption, the model calculated a rise in temperature by X°C. Visualization: Plots of actual vs. predicted temperatures were created to visualize the accuracy of the model. Other plots are the temperature vs. CO2 and predictions thereof.

DISCUSSION

The model predictions show a very marked trend in rising temperatures that could have serious implications in the protection of the species. Whenever the temperature begins to rise, this may affect species distribution, habitat conditions, and ecosystem dynamics.

Model Limitations: One limitation of the Linear Regression model is that this process is made under linear assumptions, using data from a specific point in history. Things to be considered are the occurrence of extreme weather and regional variations.

Improvements: Inclusion of more features such as precipitation, humidity, and geographical factor would enhance the model further. One could also explore working with more complex models such as Random Forests or Neural Networks to obtain better results.

CONCLUSION

This work represents a very promising direction of applying an AI-driven predictive model to estimate the impact of climate change on species protection. Utilizing historical climate data and Linear Regression shows great promise, informing future conservation efforts.
Impact: AI applications for climate impact assessment can help significantly enhance conservation strategies by providing accomplished predictions and actionable insights. Data-driven approaches to address the impacts of climate change will be an important measure for effective species protection.

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