“Classify Plants Based on Water Needs”

A Project Report

Submitted by

Pranjal Yagyasaini

University Roll no:- 202401100300175

in partial fulfillment for the award of the degree

of

BACHELOR OF TECHNOLOGY

SESSION 2024-25

Under the supervision of

“Mr. Mayank Lakhotia”

KIET Group of Institutions, Ghaziabad

Introduction:

- This report focuses on classifying plants based on their water requirements using machine learning techniques. The dataset includes various plant features, such as soil type, to predict whether the plant requires low, medium, or high amounts of water. Random Forest Classifier is employed to build the model due to its robustness in handling various types of data and its effectiveness in classification tasks.

- The goal is to develop an accurate prediction model to help in agricultural planning, water management, and plant care

Methodology:

- **Dataset**: The dataset used in this analysis contains plant features, such as soil type and water needs, which are critical to predicting water requirements.

- **Data Preprocessing**:
  - The categorical columns (`soil type` and `water need`) are encoded using LabelEncoder to convert them into numerical values for machine learning algorithms.
  - The dataset is then split into features (`X`) and the target variable (`y`).

- **Model Selection**: A Random Forest Classifier is chosen for this classification task due to its ability to handle large datasets and its performance in classification problems.

- **Evaluation Metrics**: The model's performance is evaluated using accuracy, precision, and recall. A confusion matrix is generated to provide further insights into the model’s performance.

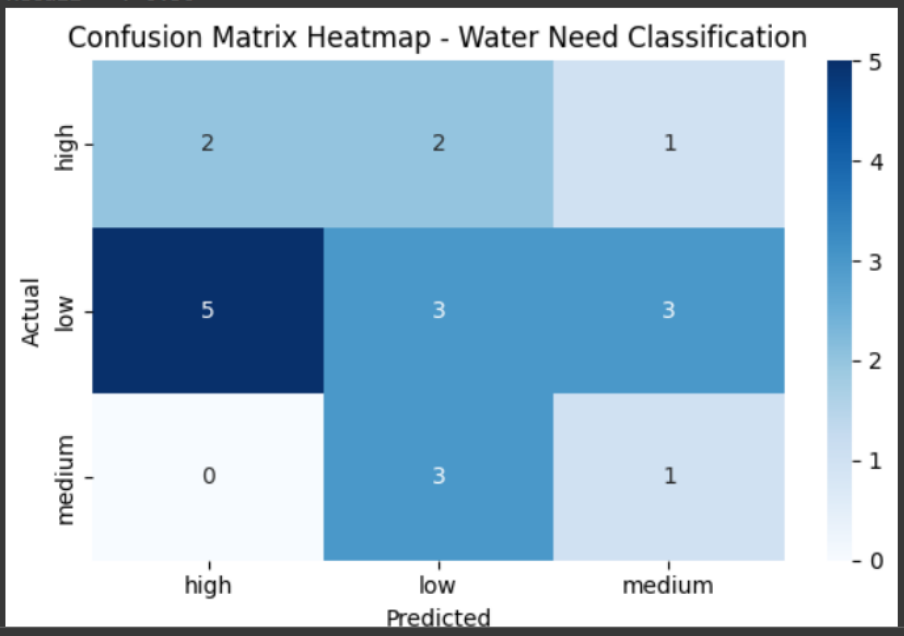
CODE:

```
# Import required libraries
import pandas as pd  # for data manipulation
from sklearn.model_selection import train_test_split  # for splitting data
from sklearn.preprocessing import LabelEncoder  # for encoding categorical data
from sklearn.ensemble import RandomForestClassifier  # the classification model
from sklearn.metrics import accuracy_score, precision_score, recall_score, confusion_matrix  # evaluation metrics
import seaborn as sns  # for visualization
import matplotlib.pyplot as plt  # for plotting

# Load the dataset
df = pd.read_csv("/content/plants.csv")  # load CSV file containing plant data
print("Dataset loaded successfully!")
print(df.head())  # display first few rows of the dataset

# Encode categorical features
label_encoders = {}  # dictionary to store encoders
for column in ['soil_type', 'water_need']:  # loop through categorical columns
    le = LabelEncoder()
    df[column] = le.fit_transform(df[column])  # encode column values as integers
    label_encoders[column] = le  # save the encoder for future use

# Split features and target
X = df.drop('water_need', axis=1)  # select all columns except 'water_need' as features
y = df['water_need']  # 'water_need' is the target variable

#Split the dataset into training and testing sets
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2, random_state=42)  # 80/20 split

# Train the Random Forest model
clf = RandomForestClassifier(random_state=42)  # initialize classifier
```

```
clf = RandomForestClassifier(random_state=42)  # initialize classifier
clf.fit(X_train, y_train)  # train the model with training data
print("Model training completed.")

#Make predictions on the test data
y_pred = clf.predict(X_test)  # predict using the trained model

#Evaluate the model
accuracy = accuracy_score(y_test, y_pred)  # compute accuracy
precision = precision_score(y_test, y_pred, average='weighted')  # compute precision
recall = recall_score(y_test, y_pred, average='weighted')  # compute recall

#Print evaluation results
print("\n Model Evaluation Matrics:")
print(f"Accuracy : {accuracy:.2f}")
print(f"Precision: {precision:.2f}")
print(f"Recall   : {recall:.2f}")

# 🌡️ Generate and plot confusion matrix
cm = confusion_matrix(y_test, y_pred)  # create confusion matrix
class_names = label_encoders['water_need'].classes_  # retrieve original class labels

#Visualize the confusion matrix as a heatmap
plt.figure(figsize=(6, 4))
sns.heatmap(cm, annot=True, fmt='g', cmap='Blues',
            xticklabels=class_names,
            yticklabels=class_names)
plt.xlabel("Predicted")
plt.ylabel("Actual")
plt.title("Confusion Matrix Heatmap - Water Need Classification")
plt.tight_layout()
plt.show()  # display the heatmap
```

Output:

```
Dataset loaded successfully!
   sunlight_hours  watering_freq_per_week soil_type water_need
0        7.789136                       6     sandy        low
1       11.668008                       4     loamy       high
2        9.003943                       2     loamy        low
3       11.148641                       5     loamy        low
4        9.384333                       2      clay       high
Model training completed.

 Model Evaluation Matrics:
Accuracy : 0.30
Precision: 0.32
Recall   : 0.30
```



0s completed at 10:29 AM

Credits/References:

- Dataset Source: plants.csv
- Libraries Used:
  - Pandas: https://pandas.pydata.org/
  - scikit-learn: https://scikit-learn.org/
  - Seaborn: https://seaborn.pydata.org/
  - Matplotlib: https://matplotlib.org/
- Special Thanks to Mr. Mayank Sir for such an effort toward me in the guidance.