Assessment Report

on

“Classifying Plants Based on Water Needs”

submitted as partial fulfillment for the award of

BACHELOR OF TECHNOLOGY DEGREE

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in

CSE(AI)

By

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1. Introduction

Accurate prediction of a plant's water requirements is essential for effective gardening and sustainable resource use. Plants have varying water needs based on environmental factors like sunlight, soil type, and watering frequency. The goal of this project is to create a machine learning model that classifies plants into **low**, **medium**, or **high** water need categories based on these factors.

Using data on sunlight hours, watering frequency, and soil type, the model will help optimize plant care, guide automated irrigation systems, and improve plant care recommendations. This classification approach aims to provide gardeners and plant care applications with better insights into water management, promoting healthier plant growth and more efficient water usage.

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2 🌿 Methodology

- **Data Collection**: The dataset is provided in a CSV file containing plant characteristics.
- **Data Preprocessing**:
  - Handle missing values with mean or mode imputation.
  - One-hot encode categorical variables like soil type.
  - Scale numerical features using **StandardScaler**.
- **Model Building**:
  - Split the data into training and testing sets.
  - Train a **Random Forest Classifier**.
- **Model Evaluation**:
  - Evaluate using accuracy, precision, recall, and F1-score.

- Visualize the confusion matrix with a heatmap.

Code :

```
import pandas as pd

import seaborn as sns

import matplotlib.pyplot as plt

from sklearn.model_selection import train_test_split

from sklearn.preprocessing import LabelEncoder

from sklearn.ensemble import RandomForestClassifier

from sklearn.metrics import confusion_matrix,
classification_report, accuracy_score, precision_score,
recall_score, f1_score


# Load data

file_path = "/content/plants.csv"

data = pd.read_csv(file_path)
```

```
# Encode categorical features

label_encoder = LabelEncoder()

data['soil_type_encoded'] =
label_encoder.fit_transform(data['soil_type'])

data['water_need_encoded'] =
label_encoder.fit_transform(data['water_need'])


# Features and target

X = data[['sunlight_hours', 'watering_freq_per_week',
'soil_type_encoded']]

y = data['water_need_encoded']


# Train/Test Split

X_train, X_test, y_train, y_test = train_test_split(X, y,
test_size=0.2, random_state=42)
```

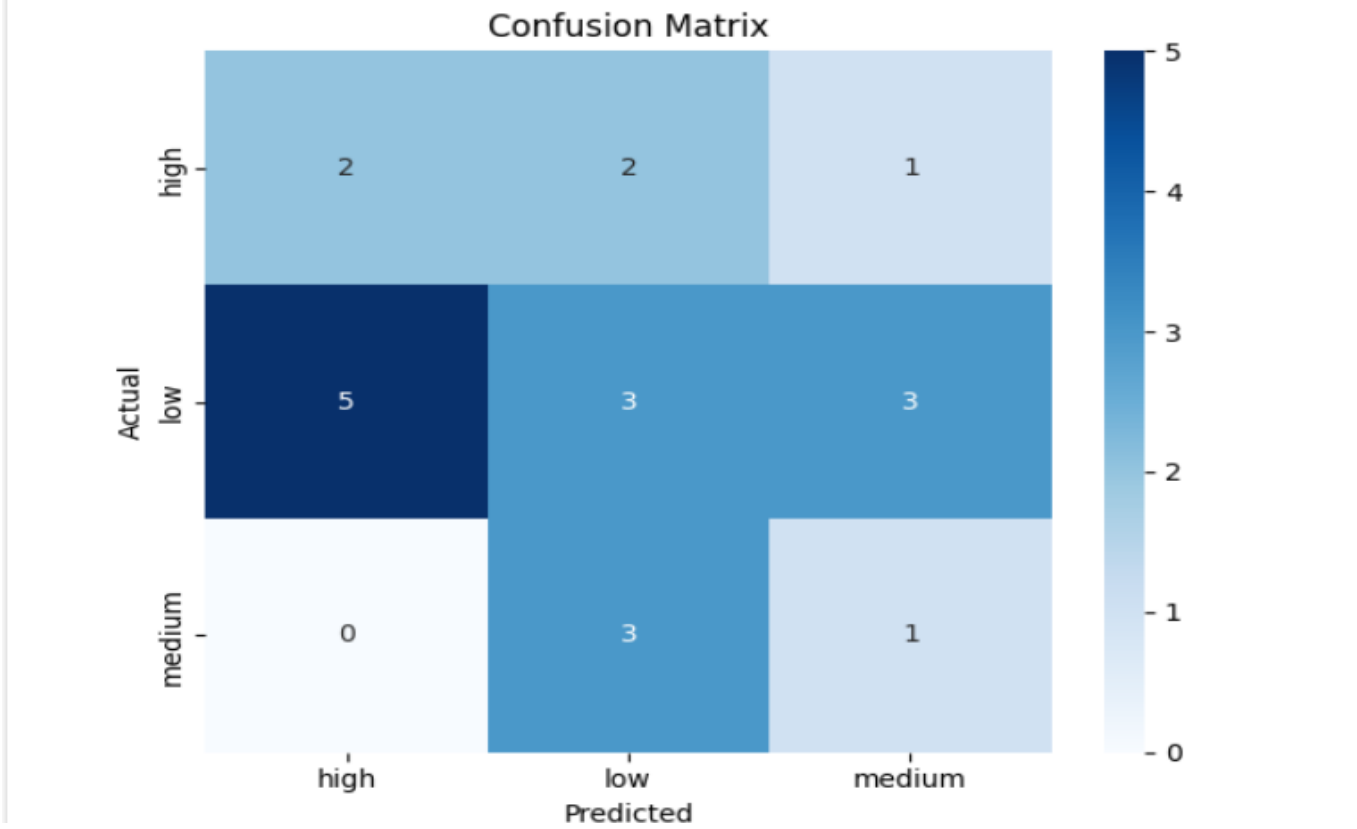
```
# Train Model

model = RandomForestClassifier(n_estimators=100,
random_state=42)

model.fit(X_train, y_train)


# Predict

y_pred = model.predict(X_test)


# Evaluation Metrics

accuracy = accuracy_score(y_test, y_pred)

precision = precision_score(y_test, y_pred,
average='weighted', zero_division=0)

recall = recall_score(y_test, y_pred, average='weighted',
zero_division=0)

f1 = f1_score(y_test, y_pred, average='weighted',
zero_division=0)
```

```
print(f"Accuracy: {accuracy:.2f}")

print(f"Precision: {precision:.2f}")

print(f"Recall: {recall:.2f}")

print(f"F1 Score: {f1:.2f}\n")


# Classification Report

print("Classification Report:\n",
classification_report(y_test, y_pred,
target_names=label_encoder.classes_))


# Confusion Matrix Heatmap

cm = confusion_matrix(y_test, y_pred)

plt.figure(figsize=(6, 5))

sns.heatmap(cm, annot=True, fmt='d', cmap='Blues',

        xticklabels=label_encoder.classes_,

        yticklabels=label_encoder.classes_)

plt.title("Confusion Matrix")
```

```
plt.xlabel("Predicted")

plt.ylabel("Actual")

plt.tight_layout()

plt.show()
```

Screenshot of Output :

```
Classification Report:
              precision    recall  f1-score   support

        high       0.29      0.40      0.33         5
         low       0.38      0.27      0.32        11
      medium       0.20      0.25      0.22         4

    accuracy                           0.30        20
   macro avg       0.29      0.31      0.29        20
weighted avg       0.32      0.30      0.30        20
```



5 🌿 References/Credits

- **Dataset**: Provided by faculty / custom-created for plant classification
- **Libraries**: Utilized scikit-learn, pandas, matplotlib, and seaborn for data processing, modeling, and visualization
- **Platform**: Google Colab used for cloud-based coding and execution
- **Guidance**: Assistance taken from AI tools and official online documentation