

Classify Plants Based on Water Needs

A project report

Submitted by

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Introduction

Plants are essential components of ecosystems and play a significant role in the environment by providing oxygen, enhancing air quality, supporting wildlife, and adding aesthetic value to surroundings. However, each plant species has unique requirements for sunlight, soil, temperature, and especially water. Over- or under-watering is a common issue among plant owners, often leading to poor plant health or even death.

Classifying plants based on their water needs is an important step toward efficient plant care and sustainable gardening practices. With growing interest in water conservation and climate-adaptive landscaping, understanding and predicting the watering frequency for different plant species can help both individuals and organizations make informed choices.

This project aims to categorize plants based on their water needs—low, medium, or high—by analyzing environmental preferences such as sunlight exposure, soil type, humidity, temperature, and plant type. Leveraging predictive models or rule-based systems, this classification can serve as a guide for horticulturists, gardeners, and urban planners alike.

Methodology

The classification process followed a structured approach:

- **Data Collection:** *A dataset of plant species was gathered, including attributes like sunlight preference, soil type, temperature tolerance, humidity levels, and typical watering frequency.*
- **Data Preparation:** *Missing or inconsistent data entries were cleaned. Categorical variables were encoded, and watering frequencies were standardized to a weekly schedule.*
- **Feature Selection:** *Key environmental features were retained for analysis. In some cases, derived indicators like drought tolerance were included.*
- **Classification Criteria:**
 - **Low Water Needs:** *Drought-tolerant plants, typically watered once a week or less.*
 - **Medium Water Needs:** *Require watering 2–3 times per week.*
 - **High Water Needs:** *Moisture-loving plants, often watered daily.*
- **Modeling (optional):** *In machine learning-based classification, algorithms like Decision Tree or Random Forest were applied to predict plant categories.*

Code

```
import pandas as pd

from sklearn.model_selection import train_test_split
from sklearn.preprocessing import LabelEncoder
from sklearn.naive_bayes import GaussianNB
from sklearn.metrics import accuracy_score, classification_report, confusion_matrix

# Load the dataset

df = pd.read_csv('/content/plants.csv')

# Encode categorical columns

label_encoder = LabelEncoder()

df['soil_type'] = label_encoder.fit_transform(df['soil_type'])
df['water_need'] = label_encoder.fit_transform(df['water_need'])

# Features and target

X = df[['sunlight_hours', 'watering_freq_per_week', 'soil_type']]
y = df['water_need']

# Split the dataset

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

# Train Naive Bayes model

model = GaussianNB()

model.fit(X_train, y_train)

# Predict and evaluate

y_pred = model.predict(X_test)

print("Accuracy:", accuracy_score(y_test, y_pred))

print("\nClassification Report:\n", classification_report(y_test, y_pred))

print("Confusion Matrix:\n", confusion_matrix(y_test, y_pred))
```

Output Result



Accuracy: 0.35

Classification Report:

	precision	recall	f1-score	support
0	0.00	0.00	0.00	5
1	0.60	0.55	0.57	11
2	0.14	0.25	0.18	4
accuracy			0.35	20
macro avg	0.25	0.27	0.25	20
weighted avg	0.36	0.35	0.35	20

Confusion Matrix:

[[0 2 3]
[2 6 3]
[1 2 1]]

References

1. National Gardening Association. (2023). Plant Care and Watering Guide.
2. USDA Plant Database. (2022). Species Profiles and Environmental Needs.
3. Singh, R., & Patel, V. (2021). "Predictive Modeling for Plant Watering Needs." *Journal of Agricultural Informatics*, 9(3), 45–52.
4. GrowGreen Project. (2020). Smart Watering Techniques for Urban Gardens.
5. Open Source Plant Dataset - Kaggle. (Accessed 2024).