Rain_In_Australia-DT-KNN(20F20464)

June 3, 2025

[2]:

```
import pandas as pd
import numpy as np
from sklearn.impute import SimpleImputer
from sklearn.preprocessing import StandardScaler
from sklearn.model_selection import train_test_split
from sklearn.metrics import classification_report, accuracy_score,␣
  ↪confusion_matrix
from sklearn.tree import DecisionTreeClassifier
from sklearn.neighbors import KNeighborsClassifier
from imblearn.under_sampling import RandomUnderSampler
```

[3]:

```
# Load dataset
df = pd.read_csv("weatherAUS.csv")
```

[4]:

```
# Drop rows with missing target and missing rain today
df.dropna(subset=['RainTomorrow'], inplace=True)
df.dropna(subset=['RainToday'], inplace=True)
```

[5]:

```
# Drop columns with more than 40% missing values
High_Missing_percentage = df.isnull().mean()
columns_to_drop = High_Missing_percentage[High_Missing_percentage > 0.4].index.
  ↪tolist()
df.drop(columns=columns_to_drop, inplace=True)
```

[6]:

```
# Impute numerical with median
numeric_columns = df.select_dtypes(include=['float64', 'int64']).columns
df[numeric_columns] = SimpleImputer(strategy='median').
  ↪fit_transform(df[numeric_columns])

categorical_cols = df.select_dtypes(include=['object']).columns.drop('Date')
df[categorical_cols] = df[categorical_cols].fillna(method='ffill')
```

```
/var/folders/68/ym_p7n0x6sq1npn90ymtsxdw0000gn/T/ipykernel_10823/2791234806.py:6
: FutureWarning: DataFrame.fillna with 'method' is deprecated and will raise in
a future version. Use obj.ffill() or obj.bfill() instead.
  df[categorical_cols] = df[categorical_cols].fillna(method='ffill')
```

[7]:

```
# Encode the directional features such as 'WindGustDir', 'WindGustDir9am', and␣
 ↪'WindGustDir3pm' using cyclical encoding
def Cyclical_Encoding(series):
#directions to degrees mapping
    DirectionsToDegrees = {
        'N': 0, 'NNE': 22.5, 'NE': 45, 'ENE': 67.5,
        'E': 90, 'ESE': 112.5, 'SE': 135, 'SSE': 157.5,
        'S': 180, 'SSW': 202.5, 'SW': 225, 'WSW': 247.5,
        'W': 270, 'WNW': 292.5, 'NW': 315, 'NNW': 337.5
    }
    #convert degrees to radians to apply sin and cosine calculations
    Radians = series.map(DirectionsToDegrees).fillna(0) * np.pi / 180
    return np.sin(Radians), np.cos(Radians)

for columns in ['WindGustDir', 'WindDir9am', 'WindDir3pm']:
    df[f'{columns}_sin'], df[f'{columns}_cos'] = Cyclical_Encoding(df[columns])
```

[8]:

```
# Encode the rain today and rain tomorrow features using binary encoding
df['RainToday_binary'] = df['RainToday'].map({'No': 0, 'Yes': 1})
df['RainTomorrow_binary'] = df['RainTomorrow'].map({'No': 0, 'Yes': 1})
```

[9]:

```
# Encode the location feature using one-hot encoding
df = pd.get_dummies(df, columns=['Location'], prefix='Loca_')
```

[10]:

```
# Drop Date column
df.drop(columns=['Date'], inplace=True)
```

[11]:

```
# Preparing the data (after encoding all to numeric)
df_encoded = df.select_dtypes(include=[np.number])
```

[12]:

```
# Outlier removal using IQR
numeric_columns = df_encoded.select_dtypes(include=['float64', 'int64']).columns
numeric_columns = numeric_columns.drop('RainTomorrow_binary')
Q1 = df_encoded[numeric_columns].quantile(0.25)
Q3 = df_encoded[numeric_columns].quantile(0.75)
IQR = Q3 - Q1
Lower_limit = Q1 - 1.5*IQR
Upper_limit = Q3 + 1.5*IQR
df_final = df_encoded[~((df_encoded[numeric_columns] < (Lower_limit)) |␣
 ↪(df_encoded[numeric_columns] > (Upper_limit))).any(axis=1)]
```

[13]:

```
# Split features and target
X = df_final.drop(columns='RainTomorrow_binary')
Y = df_final['RainTomorrow_binary']
```

[14]:

```
# Oversample minority class
from imblearn.over_sampling import SMOTE
```

```python

smote = SMOTE(random_state=42)
X_smote, y_smote = smote.fit_resample(X, Y)
```

[15]:

```python
# Scale the features
feature_scaler = StandardScaler()
Scaled_X = feature_scaler.fit_transform(X_smote)
```

[16]:

```python
# Split dataset - Decision Tree
X_train, X_test, y_train, y_test = train_test_split(Scaled_X, y_smote, test_size=0.21, random_state=51)
```

[17]:

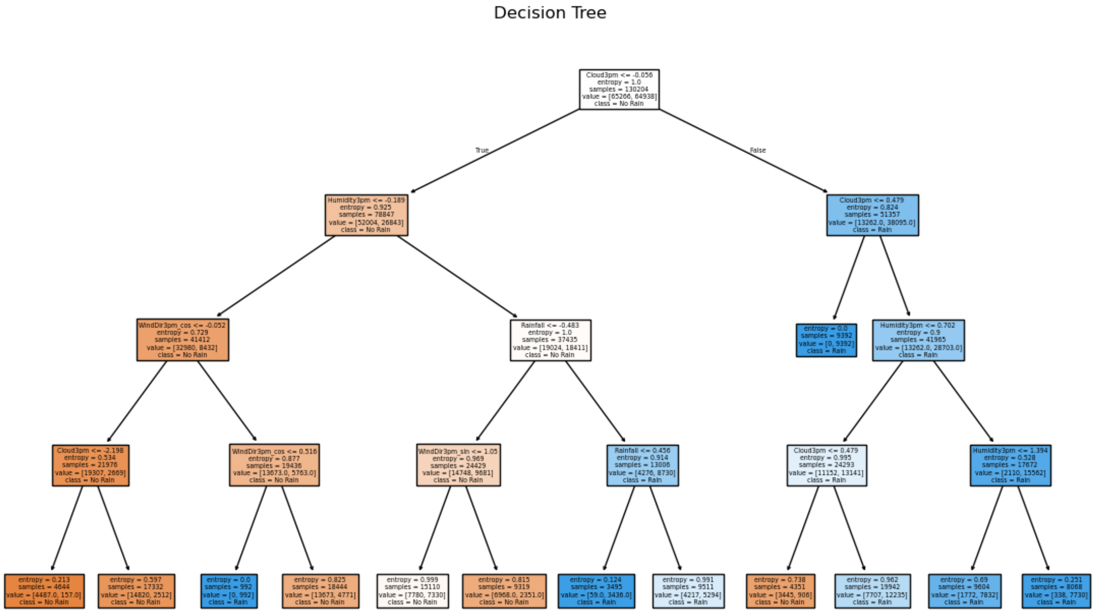
```python
# Entropy-based Decision Tree (Information Gain)
dt_entropy = DecisionTreeClassifier(criterion='entropy', random_state=54)
dt_entropy.fit(X_train, y_train)
y_pred_entropy = dt_entropy.predict(X_test)

print("\nInformation Gain (Entropy) Decision Tree ")
print("\n ")
print("Accuracy:", accuracy_score(y_test, y_pred_entropy))
print("\n ")
print("Confusion Matrix:\n", confusion_matrix(y_test, y_pred_entropy))
print("\n ")
print("Classification Report:\n", classification_report(y_test, y_pred_entropy, target_names=["No Rain", "Rain"]))
print("\n ")
print('accuracy is',accuracy_score(y_pred_entropy,y_test))
```

```
Information Gain (Entropy) Decision Tree



Accuracy: 0.8825262914596094



Confusion Matrix:
 [[15000  2142]
 [ 1924 15546]]



Classification Report:
               precision    recall  f1-score   support

     No Rain       0.89      0.88      0.88     17142
        Rain       0.88      0.89      0.88     17470

    accuracy                           0.88     34612
   macro avg       0.88      0.88      0.88     34612
```

```
weighted avg       0.88      0.88      0.88     34612


accuracy is 0.8825262914596094
```

[18]:

```python
import matplotlib.pyplot as plt
from sklearn.tree import plot_tree

dt_entropy = DecisionTreeClassifier(
    criterion='entropy',
    max_depth=4,
    min_samples_split=10,
    min_samples_leaf=5,
    random_state=54
)

dt_entropy.fit(X_train, y_train)
plt.figure(figsize=(14, 8))
plot_tree(dt_entropy, feature_names=df_encoded.columns, class_names=["No Rain",␣
 ↪"Rain"], filled=True)
plt.title("Decision Tree")
plt.show()
```



[19]:

```
# Split dataset - K-Nearest Neighbour
X_train, X_test, y_train, y_test = train_test_split(Scaled_X, y_smote,␣
 ↪test_size=0.41, random_state=51)
```

[20]:

```
#K-Nearest Neighbour (K = 4)
from sklearn.neighbors import KNeighborsClassifier

KNN_Classify = KNeighborsClassifier(n_neighbors = 4)
KNN_Classify.fit(X_train,y_train)
```

[20]:

```
KNeighborsClassifier(n_neighbors=4)
```

[21]:

```
#K-Nearest Neighbour (K = 4)
y_pred_KNN = KNN_Classify.predict(X_test)
Accuracy_KNN = accuracy_score(y_test,y_pred_KNN)
print('Accuracy :',Accuracy_KNN)
print(classification_report(y_test,y_pred_KNN))
confusion_matrix(y_test,y_pred_KNN)
```

```
Accuracy : 0.8755604883462819
              precision    recall  f1-score   support

           0       0.91      0.84      0.87     33695
           1       0.85      0.91      0.88     33880

    accuracy                           0.88     67575
   macro avg       0.88      0.88      0.88     67575
weighted avg       0.88      0.88      0.88     67575
```

[21]:

```
array([[28167,  5528],
       [ 2881, 30999]])
```

[ ]:

```

```