

Experiment 3: Classification Using ID3 Decision Tree Algorithm

Aim:

To demonstrate **classification** using the **ID3 Decision Tree algorithm** on the Weather dataset and derive **decision rules** for **Play**.

Theory:

- **ID3** is a decision tree algorithm that uses **Information Gain** to select the best attribute at each node.
 - Suitable for **nominal/categorical attributes**.
 - The resulting tree can be **converted into decision rules** for classification.
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Dataset (weather.arff)

@relation weather

@attribute Outlook {Sunny, Overcast, Rain}

@attribute Temperature {Hot, Mild, Cool}

@attribute Humidity {High, Normal}

@attribute Windy {True, False}

@attribute Play {Yes, No}

@data

Sunny,Hot,High,False,No

Sunny,Hot,High,True,No

Overcast,Hot,High,False,Yes

Rain,Mild,High,False,Yes

Rain,Cool,Normal,False,Yes

Rain,Cool,Normal,True,No

Overcast,Cool,Normal,True,Yes

Sunny,Mild,High,False,No

Sunny,Cool,Normal,False,Yes

Rain,Mild,Normal,False,Yes

Sunny,Mild,Normal,True,Yes

Overcast,Mild,High,True,Yes

Overcast,Hot,Normal,False,Yes

Rain,Mild,High,True,No

Class Attribute: Play (Yes/No)

Procedure (Using WEKA):

1. Open **WEKA** → **Explorer**.
 2. Click **Open File** → select **weather.arff**.
 3. Ensure **all attributes are nominal**.
 4. Go to **Classify tab**.
 5. Choose **Classifier** → **trees** → **ID3**.
 6. Click **Start** to build the decision tree.
 7. Observe output:
 - Generated decision tree
 - Correctly classified instances
 - Confusion matrix
 8. Derive **decision rules** from the tree for **Play**.
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Result (Sample / Expected):

Generated ID3 Decision Tree (Simplified):

Outlook = Sunny

| Humidity = High : No

| Humidity = Normal : Yes

Outlook = Overcast : Yes

Outlook = Rain

| Windy = False : Yes

| Windy = True : No

Derived Decision Rules:

1. If Outlook = Sunny AND Humidity = High → Play = No
2. If Outlook = Sunny AND Humidity = Normal → Play = Yes

3. If Outlook = Overcast \rightarrow Play = Yes
 4. If Outlook = Rain AND Windy = False \rightarrow Play = Yes
 5. If Outlook = Rain AND Windy = True \rightarrow Play = No
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Conclusion:

- ID3 effectively classifies the Weather dataset with all nominal attributes.
- Decision tree can be easily converted into **decision rules**.
- WEKA simplifies the **tree generation and rule extraction** process.