**AI FOR LLM- CSA1704**

**15. Python program to implement a Decision Tree**

**CODE:**

import math

# Calculate entropy

def entropy(data, target\_attr):

values = [record[target\_attr] for record in data]

classes = set(values)

ent = 0

for c in classes:

p = values.count(c) / len(values)

ent -= p \* math.log2(p)

return ent

# Calculate information gain

def info\_gain(data, attr, target\_attr):

values = [record[attr] for record in data]

unique\_vals = set(values)

subset\_entropy = 0

for val in unique\_vals:

subset = [record for record in data if record[attr] == val]

subset\_entropy += (len(subset) / len(data)) \* entropy(subset, target\_attr)

return entropy(data, target\_attr) - subset\_entropy

# ID3 Algorithm

def id3(data, attributes, target\_attr):

values = [record[target\_attr] for record in data]

if values.count(values[0]) == len(values): # all same class

return values[0]

if not attributes: # no more attributes

return max(set(values), key=values.count)

# choose best attribute

gains = [info\_gain(data, attr, target\_attr) for attr in attributes]

best\_attr = attributes[gains.index(max(gains))]

tree = {best\_attr: {}}

unique\_vals = set(record[best\_attr] for record in data)

for val in unique\_vals:

subset = [record for record in data if record[best\_attr] == val]

new\_attrs = [a for a in attributes if a != best\_attr]

tree[best\_attr][val] = id3(subset, new\_attrs, target\_attr)

return tree

# Example dataset (Play Tennis)

dataset = [

{"Outlook":"Sunny", "Temp":"Hot", "Humidity":"High", "Wind":"Weak", "Play":"No"},

{"Outlook":"Sunny", "Temp":"Hot", "Humidity":"High", "Wind":"Strong", "Play":"No"},

{"Outlook":"Overcast", "Temp":"Hot", "Humidity":"High", "Wind":"Weak", "Play":"Yes"},

{"Outlook":"Rain", "Temp":"Mild", "Humidity":"High", "Wind":"Weak", "Play":"Yes"},

{"Outlook":"Rain", "Temp":"Cool", "Humidity":"Normal", "Wind":"Weak", "Play":"Yes"},

{"Outlook":"Rain", "Temp":"Cool", "Humidity":"Normal", "Wind":"Strong", "Play":"No"},

{"Outlook":"Overcast", "Temp":"Cool", "Humidity":"Normal", "Wind":"Strong", "Play":"Yes"},

{"Outlook":"Sunny", "Temp":"Mild", "Humidity":"High", "Wind":"Weak", "Play":"No"},

{"Outlook":"Sunny", "Temp":"Cool", "Humidity":"Normal", "Wind":"Weak", "Play":"Yes"},

{"Outlook":"Rain", "Temp":"Mild", "Humidity":"Normal", "Wind":"Weak", "Play":"Yes"},

]

attributes = ["Outlook", "Temp", "Humidity", "Wind"]

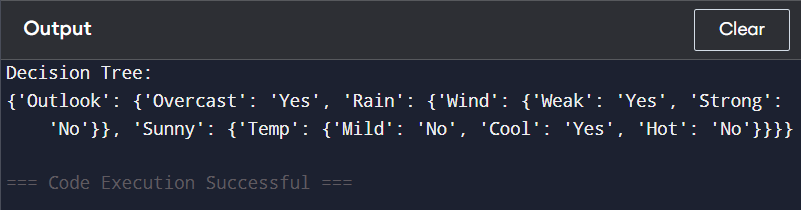
# Build decision tree

tree = id3(dataset, attributes, "Play")

print("Decision Tree:")

print(tree)

**OUTPUT:**

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