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## 2. AI AND MACHINE LEARNING VTU LAB | READ NOW

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### MACHINE LEARNING VTU LAB

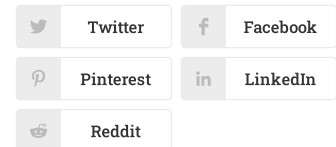
Program 2. FOR A GIVEN SET OF TRAINING DATA EXAMPLES STORED IN A .CSV FILE, IMPLEMENT AND DEMONSTRATE THE CANDIDATE-ELIMINATION ALGORITHM TO OUTPUT A DESCRIPTION OF THE SET OF ALL HYPOTHESES CONSISTENT WITH THE TRAINING EXAMPLES

#### Program Code – lab2.py

```
1. import numpy as np
2. import pandas as pd
3.
4. # Loading Data from a CSV File
5. data = pd.DataFrame(data=pd.read_csv('trainingdata.csv'))
6. print(data)
7.
8. # Separating concept features from Target
9. concepts = np.array(data.iloc[:,0:-1])
10. print(concepts)
11.
12. # Isolating target into a separate DataFrame
13. # copying last column to target array
14. target = np.array(data.iloc[:, -1])
15. print(target)
16.
17. def learn(concepts, target):
18.
19.     '''
20.     learn() function implements the learning method of the Candidate elimination algorithm
21.     Arguments:
22.         concepts - a data frame with all the features
23.         target - a data frame with corresponding output values
24.     '''
25.
26.     # Initialise S0 with the first instance from concepts
27.     # .copy() makes sure a new list is created instead of just pointing to the same memory
28.     specific_h = concepts[0].copy()
```



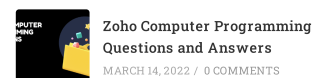
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```

29.     print("\nInitialization of specific_h and general_h")
30.     print(specific_h)
31.     #h=["#" for i in range(0,5)]
32.     #print(h)
33.
34.     general_h = [["?" for i in range(len(specific_h))] for i in range(len(specific_h))]
35.     print(general_h)
36.     # The learning iterations
37.     for i, h in enumerate(concepts):
38.
39.         # Checking if the hypothesis has a positive target
40.         if target[i] == "Yes":
41.             for x in range(len(specific_h)):
42.
43.                 # Change values in S & G only if values change
44.                 if h[x] != specific_h[x]:
45.                     specific_h[x] = '?'
46.                     general_h[x][x] = '?'
47.
48.         # Checking if the hypothesis has a positive target
49.         if target[i] == "No":
50.             for x in range(len(specific_h)):
51.                 # For negative hypothesis change values only in G
52.                 if h[x] != specific_h[x]:
53.                     general_h[x][x] = specific_h[x]
54.                 else:
55.                     general_h[x][x] = '?'
56.
57.         print("\nSteps of Candidate Elimination Algorithm",i+1)
58.         print(specific_h)
59.         print(general_h)
60.
61.         # find indices where we have empty rows, meaning those that are unchanged
62.         indices = [i for i, val in enumerate(general_h) if val == ['?', '?', '?', '?', '?']
63.         for i in indices:
64.             # remove those rows from general_h
65.             general_h.remove(['?', '?', '?', '?', '?', '?'])
66.         # Return final values
67.         return specific_h, general_h
68.
69.     s_final, g_final = learn(concepts, target)
70.     print("\nFinal Specific_h:", s_final, sep="\n")
71.     print("\nFinal General_h:", g_final, sep="\n")

```

## MACHINE LEARNING Program Execution – lab2.ipynb

Jupyter Notebook program execution.

```

1. import numpy as np
2. import pandas as pd

```

Raw Copy Extern

```

1. # Loading Data from a CSV File
2. data = pd.DataFrame(data=pd.read_csv('trainingdata.csv'))
3. print(data)

```

Raw Copy Extern

sky airTemp humidity wind water forecast enjoySport

0 Sunny Warm Normal Strong Warm Same Yes

1 Sunny Warm High Strong Warm Same Yes

2 Rainy Cold High Strong Warm Change No

3 Sunny Warm High Strong Cool Change Yes

```

1. # Separating concept features from Target
2. concepts = np.array(data.iloc[:,0:-1])
3. print(concepts)

```

Raw Copy Extern

[[‘Sunny’ ‘Warm’ ‘Normal’ ‘Strong’ ‘Warm’ ‘Same’]

[‘Sunny’ ‘Warm’ ‘High’ ‘Strong’ ‘Warm’ ‘Same’]

[‘Rainy’ ‘Cold’ ‘High’ ‘Strong’ ‘Warm’ ‘Change’]

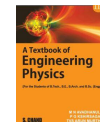
[‘Sunny’ ‘Warm’ ‘High’ ‘Strong’ ‘Cool’ ‘Change’]]

```

1. # Isolating target into a separate DataFrame
2. # copying last column to target array
3. target = np.array(data.iloc[:,~1])
4. print(target)

```

Raw Copy Extern



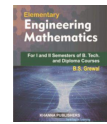
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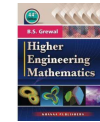
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['Yes' 'Yes' 'No' 'Yes']\

```
1. def learn(concepts, target):
2.
3.     '''
4.     learn() function implements the learning method of the Candidate elimination algorithm
5.     Arguments:
6.     concepts - a data frame with all the features
7.     target - a data frame with corresponding output values
8.     '''
9.
10.    # Initialise S0 with the first instance from concepts
11.    # .copy() makes sure a new list is created instead of just pointing to the same memory
12.    specific_h = concepts[0].copy()
13.    print("\nInitialization of specific_h and general_h")
14.    print(specific_h)
15.    #h=["#" for i in range(0,5)]
16.    #print(h)
17.
18.    general_h = [["?" for i in range(len(specific_h))] for i in range(len(specific_h))]
19.    print(general_h)
20.    # The learning iterations
21.    for i, h in enumerate(concepts):
22.
23.        # Checking if the hypothesis has a positive target
24.        if target[i] == "Yes":
25.            for x in range(len(specific_h)):
26.
27.                # Change values in S & G only if values change
28.                if h[x] != specific_h[x]:
29.                    specific_h[x] = '?'
30.                    general_h[x][x] = '?'
31.
32.        # Checking if the hypothesis has a positive target
33.        if target[i] == "No":
34.            for x in range(len(specific_h)):
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37.                    general_h[x][x] = specific_h[x]
38.            else:
39.                general_h[x][x] = '?'
40.
41.        print("\nSteps of Candidate Elimination Algorithm",i+1)
42.        print(specific_h)
43.        print(general_h)
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45.        # find indices where we have empty rows, meaning those that are unchanged
46.        indices = [i for i, val in enumerate(general_h) if val == ['?', '?', '?', '?', '?', '?']]
47.        for i in indices:
48.            # remove those rows from general_h
49.            general_h.remove(['?', '?', '?', '?', '?', '?'])
50.        # Return final values
51.        return specific_h, general_h
```

```
1. s_final, g_final = learn(concepts, target)
2. print("\nFinal Specific_h:", s_final, sep="\n")
3. print("\nFinal General_h:", g_final, sep="\n")
```

Initialization of specific\_h and general\_h

['Sunny' 'Warm' 'Normal' 'Strong' 'Warm' 'Same']

[[ '?', '?', '?', '?', '?', '?' ], [ '?', '?', '?', '?', '?', '?' ], [ '?', '?', '?', '?', '?', '?' ], [ '?', '?', '?', '?', '?', '?' ], [ '?', '?', '?', '?', '?', '?' ], [ '?', '?', '?', '?', '?', '?' ]]

Steps of Candidate Elimination Algorithm 1

['Sunny' 'Warm' 'Normal' 'Strong' 'Warm' 'Same']

[[ '?', '?', '?', '?', '?', '?' ], [ '?', '?', '?', '?', '?', '?' ], [ '?', '?', '?', '?', '?', '?' ], [ '?', '?', '?', '?', '?', '?' ], [ '?', '?', '?', '?', '?', '?' ], [ '?', '?', '?', '?', '?', '?' ]]

Steps of Candidate Elimination Algorithm 2

['Sunny' 'Warm' '?' 'Strong' 'Warm' 'Same']

[[ '?', '?', '?', '?', '?', '?' ], [ '?', '?', '?', '?', '?', '?' ], [ '?', '?', '?', '?', '?', '?' ], [ '?', '?', '?', '?', '?', '?' ], [ '?', '?', '?', '?', '?', '?' ], [ '?', '?', '?', '?', '?', '?' ]]

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