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Vellore Institute of Technology

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LAB REPORT

CSE4020 – MACHINE LEARNING

(B.Tech. COMPUTER SCIENCE AND ENGINEERING)

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VIT – A Place to Learn; A Chance to Grow

1. Implement and demonstrate the Candidate Elimination algorithm for finding the most consistent version space based on a given set of training data samples. Read the training data from a .CSV file.

Candidate Elimination Algorithms

```
For each training example d, do:

     If d is positive example

          Remove from G any hypothesis h inconsistent with d

          For each hypothesis s in S not consistent with d:

               Remove s from S

               Add to S all minimal generalizations of s
consistent with d and having a generalization in G

               Remove from S any hypothesis with a more
specific h in S

     If d is negative example

           Remove from S any hypothesis h inconsistent with d

           For each hypothesis g in G not consistent with d:

                 Remove g from G

                 Add to G all minimal specializations of g
consistent with d and having a specialization in S

                 Remove from G any hypothesis having a more
general hypothesis in G
```

Training Example:

Example	Sky	AirTemp	Humidity	Wind	Water	Forecast	EnjoySport
1	Sunny	Warm	Normal	Strong	Warm	Same	Yes
2	Sunny	Warm	High	Strong	Warm	Same	Yes
3	Rainy	Cold	High	Strong	Warm	Change	No
4	Sunny	Warm	High	Strong	Cool	Change	Yes

PROGRAM –

```
import pandas as pd
import numpy as np
df = pd.read_csv('data.csv')
print("Given Data Set : \n")
print(df,"\n")
def learn(concepts, target):
    for i in range(len(target)):
        if target[i]=='Yes':
            specific_hypothesis = concepts[i].copy()
            break

    general_hypothesis = [["?" for i in
range(len(specific_hypothesis))]for i in
range(len(specific_hypothesis))]
    print("Initialization of specific_hypothesis and
genearal_hypothesis\n")
    print("Specific Boundary : ",specific_hypothesis,"\n")
    print("General Boundary : ",general_hypothesis,"\n")

    for i in range(len(concepts)):
        if target[i]=="Yes":
            print("Instance is Positive")
            for j in range(len(concepts[i])):
                if concepts[i][j]!=specific_hypothesis[j]:
                    specific_hypothesis[j] = "?"
                    general_hypothesis[j][j] = "?"
```

```
        if target[i]=="No":
            print("Instance is Negative")
            for j in range(len(concepts[i])):
                if concepts[i][j]!=specific_hypothesis[j]:
                    general_hypothesis[j][j] = specific_hypothesis[j]
                else:
                    general_hypothesis[j][j] = "?"
        print("Specific Bundary after ", i+1, "Instance is ", specific_hypothesis)
        print("Generic Boundary after ", i+1, "Instance is ", general_hypothesis)
        print("\n")


    indices = [i for i, val in enumerate(general_hypothesis) if val == ['?', '?', '?', '?', '?', '?']]
    for i in indices:
        general_hypothesis.remove(['?', '?', '?', '?', '?', '?'])



    return specific_hypothesis, general_hypothesis


concepts = np.array(df)[:,:-1]
print("Instances are : \n")
print(concepts)
print("\n")
target = np.array(df)[:,-1]
print("Target Values are : \n")
print(target)
print("\n")
specific_hypothesis_final, general_hypothesis_final = learn(concepts, target)
print("Final Specific Hypothesis : ", specific_hypothesis_final, sep="\n")
print("\n")
```

```
print("Final General Hypothesis : ", general_hypothesis_final,
sep="\n")
```

OUTPUT –

```
Given Data Set :


     Sky  Temp   Humid    Wind Water Forecast EnjoySpt
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


Instances are :


[['Sunny' 'Warm' 'Normal' 'Strong' 'Warm' 'Same']
 ['Sunny' 'Warm' 'High' 'Strong' 'Warm' 'Same']
 ['Rainy' 'Cold' 'High' 'Strong' 'Warm' 'Change']
 ['Sunny' 'Warm' 'High' 'Strong' 'Cool' 'Change']]



Target Values are :


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



Initialization of specific_hypothesis and genearal_hypothesis


Specific Boundary :  ['Sunny' 'Warm' 'Normal' 'Strong' 'Warm' 'Same']


General Boundary :  [['?', '?', '?', '?', '?', '?'], ['?', '?', '?',
'?', '?', '?'], ['?', '?', '?', '?', '?', '?'], ['?', '?', '?', '?',
'?', '?'], ['?', '?', '?', '?', '?', '?'], ['?', '?', '?', '?', '?',
'?']]
```

```
Instance is Positive

Specific Bundary after  1 Instance is  ['Sunny' 'Warm' 'Normal'
'Strong' 'Warm' 'Same']

Generic Boundary after  1 Instance is  [['?', '?', '?', '?', '?', '?'],
['?', '?', '?', '?', '?', '?'], ['?', '?', '?', '?', '?', '?'], ['?',
'?', '?', '?', '?', '?'], ['?', '?', '?', '?', '?', '?'], ['?', '?',
'?', '?', '?', '?']]



Instance is Positive

Specific Bundary after  2 Instance is  ['Sunny' 'Warm' '?' 'Strong'
'Warm' 'Same']

Generic Boundary after  2 Instance is  [['?', '?', '?', '?', '?', '?'],
['?', '?', '?', '?', '?', '?'], ['?', '?', '?', '?', '?', '?'], ['?',
'?', '?', '?', '?', '?'], ['?', '?', '?', '?', '?', '?'], ['?', '?',
'?', '?', '?', '?']]



Instance is Negative

Specific Bundary after  3 Instance is  ['Sunny' 'Warm' '?' 'Strong'
'Warm' 'Same']

Generic Boundary after  3 Instance is  [['Sunny', '?', '?', '?', '?',
'?'], ['?', 'Warm', '?', '?', '?', '?'], ['?', '?', '?', '?', '?',
'?'], ['?', '?', '?', '?', '?', '?'], ['?', '?', '?', '?', '?', '?'],
['?', '?', '?', '?', '?', 'Same']]



Instance is Positive

Specific Bundary after  4 Instance is  ['Sunny' 'Warm' '?' 'Strong' '?'
'?']

Generic Boundary after  4 Instance is  [['Sunny', '?', '?', '?', '?',
'?'], ['?', 'Warm', '?', '?', '?', '?'], ['?', '?', '?', '?', '?',
'?'], ['?', '?', '?', '?', '?', '?'], ['?', '?', '?', '?', '?', '?'],
['?', '?', '?', '?', '?', '?']]



Final Specific Hypothesis :

['Sunny' 'Warm' '?' 'Strong' '?' '?']
```

Final General Hypothesis :

[['Sunny', '?', '?', '?', '?', '?'], ['?', 'Warm', '?', '?', '?', '?']]