**FIND-S learning algorithm**

import csv #importing csv module to read the dataset

attributes = [['Sunny','Rainy'], #storing a list of attributes in a variable

['Warm','Cold'],

['Normal','High'],

['Strong','Weak'],

['Warm','Cool'],

['Same','Change']]

num\_attributes = len(attributes) #storing the length of attributes in a variable

print ("\n The most general hypothesis : ['?','?','?','?','?','?']\n") #printing most general hypothesis

print ("\n The most specific hypothesis : ['0','0','0','0','0','0']\n") #printing most specific hypothesis

a = [] #declaring a list 'a'

print("\n The Given Training Data Set \n")

with open('enjoysport.csv', 'r') as csvFile: #opening the csv file in read mode and calling it csvFile

reader = csv.reader(csvFile) #reading the contents of csvFile and assigning it to reader variable

for row in reader: #looping each row in reader(training dataset)

a.append (row) #adding each row to the list 'a'

print(row) #printing the row(each instance)

print("\n The initial value of hypothesis: ")

hypothesis = ['0'] \* num\_attributes #initiating the variable hypothesis with 6 zeroes(6 is the no. of attributes)

print(hypothesis)

for i in range(0,len(a)):

if a[i][num\_attributes]=='Yes':

print("\ninstance",i)

print("Positive example")

for j in range(0,num\_attributes):

print(a[i][j],end=" ")

else :

print("\ninstance",i)

print("Negative example")

for j in range(0,num\_attributes):

print(a[i][j],end=" ")

print()

#Comparing with First Training Example

for j in range(0,num\_attributes): #looping 6 times to get 6 values of 1st instance

hypothesis[j] = a[0][j]; #assigning each value of 1st instance from list 'a' to list 'hypothesis'

#Comparing with Remaining Training Examples of Given Data Set

print("\n Find S: Finding a Maximally Specific Hypothesis\n")

for i in range(0,len(a)): #looping 4 times(through each row/instance), as list 'a' contains 4 instances

if a[i][num\_attributes]=='Yes': #as the value num\_attributes is 7, it corresponds to the last column which is enjoysport. With this condition, we only consider the instances that give us a positive outcome(Find S algo)

for j in range(0,num\_attributes): #looping through 6 times for each row(each attribute value corresponding to its respective instance)

if a[i][j]!=hypothesis[j]: #if the current value(in list 'a') does not match with the value in hypothesis list

hypothesis[j]='?' #we replace the value in hypothesis list with a '?'

else :

hypothesis[j]= a[i][j] #else, i.e., if both values in the lists 'a' and 'hypothesis' match, we leave it as it is(assign the value in list 'a' to list 'hypothesis')

print(" For Training Example No :{0} the hypothesis is ".format(i),hypothesis) #printing hypothesis for each instance or training example.

print("\n The Maximally Specific Hypothesis for a given Training Examples :\n")

print(hypothesis) #printing the final hypothesis

**Output :**

The most general hypothesis : ['?','?','?','?','?','?']

The most specific hypothesis : ['0','0','0','0','0','0']

The Given Training Data Set

['sky', 'airtemp', 'humidity', 'wind', 'water', 'forcast', 'enjoysport']

['sunny', 'warm', 'normal', 'strong', 'warm', 'same', 'yes']

['sunny', 'warm', 'high', 'strong', 'warm', 'same', 'yes']

['rainy', 'cold', 'high', 'strong', 'warm', 'change', 'no']

['sunny', 'warm', 'high', 'strong', 'cool', 'change', 'yes']

The initial value of hypothesis:

['0', '0', '0', '0', '0', '0']

instance 0

Negative example

sky airtemp humidity wind water forcast

instance 1

Negative example

sunny warm normal strong warm same

instance 2

Negative example

sunny warm high strong warm same

instance 3

Negative example

rainy cold high strong warm change

instance 4

Negative example

sunny warm high strong cool change

Find S: Finding a Maximally Specific Hypothesis

For Training Example No :0 the hypothesis is ['sky', 'airtemp', 'humidity', 'wind', 'water', 'forcast']

For Training Example No :1 the hypothesis is ['sky', 'airtemp', 'humidity', 'wind', 'water', 'forcast']

For Training Example No :2 the hypothesis is ['sky', 'airtemp', 'humidity', 'wind', 'water', 'forcast']

For Training Example No :3 the hypothesis is ['sky', 'airtemp', 'humidity', 'wind', 'water', 'forcast']

For Training Example No :4 the hypothesis is ['sky', 'airtemp', 'humidity', 'wind', 'water', 'forcast']

The Maximally Specific Hypothesis for a given Training Examples :

['sky', 'airtemp', 'humidity', 'wind', 'water', 'forcast']