VISVESVARAYA TECHNOLOGICAL UNIVERSITY

“JnanaSangama”, Belgaum -590014, Karnataka.

LAB REPORT
on

Machine Learning
(20CS6PCMAL)

Submitted by

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in partial fulfillment for the award of the degree of

BACHELOR OF ENGINEERING
in
COMPUTER SCIENCE AND ENGINEERING

B.M.S. COLLEGE OF ENGINEERING
(Autonomous Institution under VTU)
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B. M. S. College of Engineering,

Bull Temple Road, Bangalore 560019

(Affiliated To Visvesvaraya Technological University, Belgaum)

Department of Computer Science and Engineering

CERTIFICATE

This is to certify that the Lab work entitled "**Machine Learning**" carried out by **Ravi Sajjanar (1BM19CS127),** who is bonafide student of **B. M. S. College of Engineering.** It is in partial fulfillment for the award of **Bachelor of Engineering in Computer Science and Engineering** of the Visvesvaraya Technological University, Belgaum during the year 2022. The Lab report has been approved as it satisfies the academic requirements in respect of a **Machine Learning (20CS6PCMAL)** work prescribed for the said degree.

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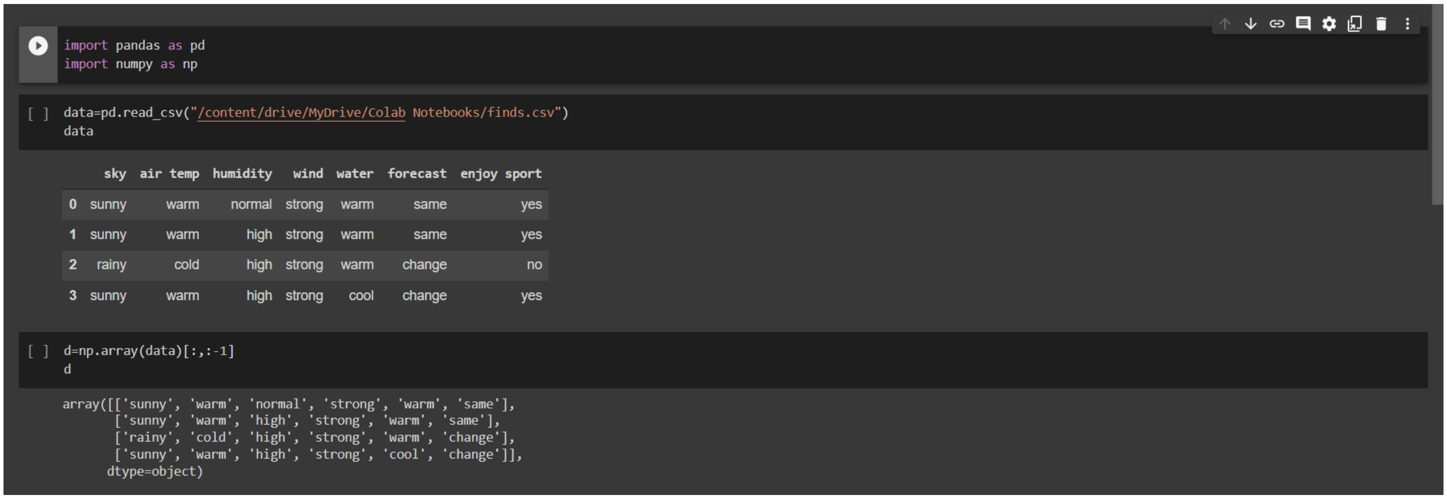
Index Sheet

1. Find S Algorithm



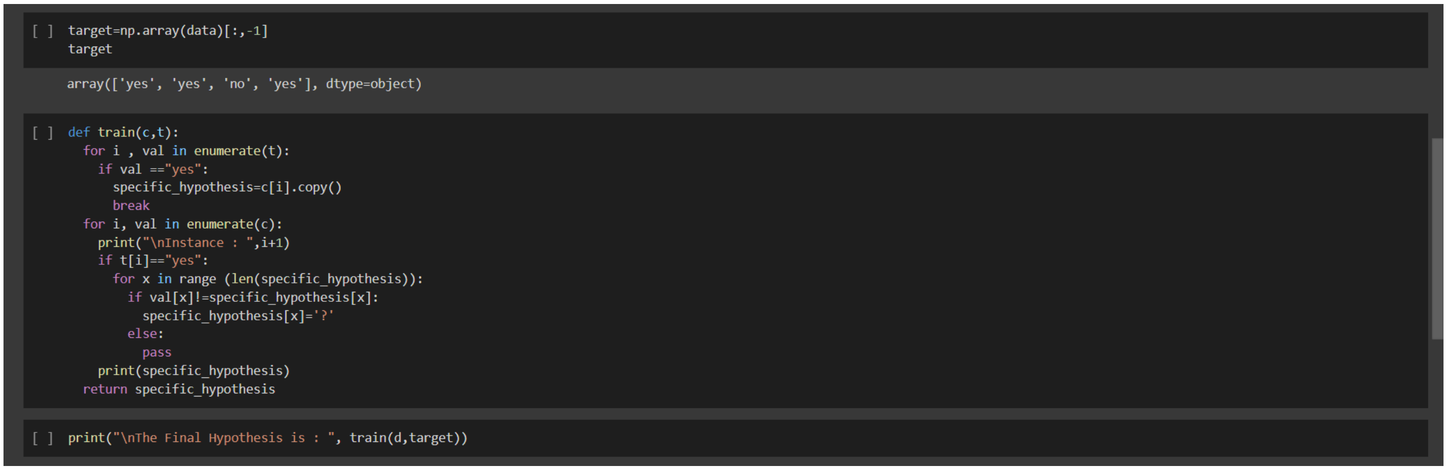
```
import pandas as pd
import numpy as np
```

```
[ ] data=pd.read_csv("/content/drive/MyDrive/Colab Notebooks/finds.csv")
    data
```

	sky	air temp	humidity	wind	water	forecast	enjoy sport
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

```
[ ] d=np.array(data)[:,:-1]
    d
```

```
array([['sunny', 'warm', 'normal', 'strong', 'warm', 'same'],
       ['sunny', 'warm', 'high', 'strong', 'warm', 'same'],
       ['rainy', 'cold', 'high', 'strong', 'warm', 'change'],
       ['sunny', 'warm', 'high', 'strong', 'cool', 'change']],
      dtype=object)
```

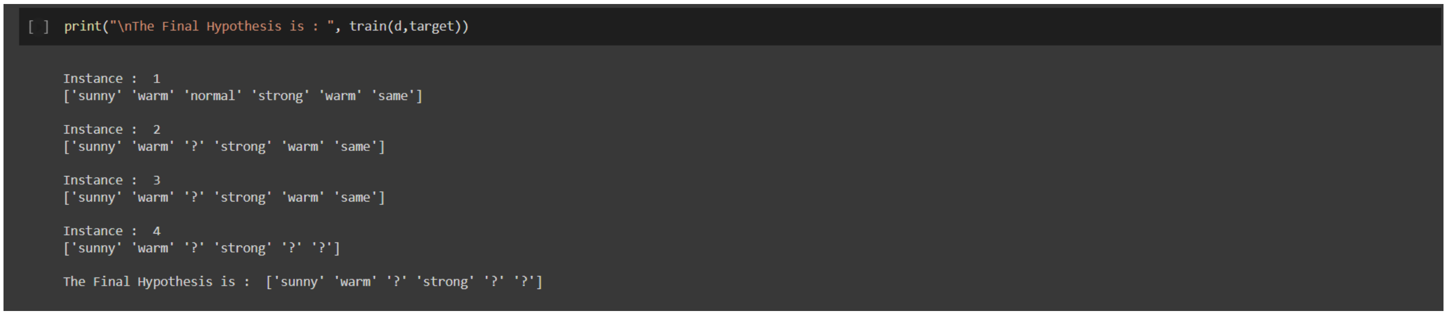


```
[ ] target=np.array(data)[:,-1]
    target
```

```
array(['yes', 'yes', 'no', 'yes'], dtype=object)
```

```
[ ] def train(c,t):
      for i , val in enumerate(t):
        if val =="yes":
          specific_hypothesis=c[i].copy()
          break
      for i, val in enumerate(c):
        print("\nInstance : ",i+1)
        if t[i]=="yes":
          for x in range (len(specific_hypothesis)):
            if val[x]!=specific_hypothesis[x]:
              specific_hypothesis[x]='?'
            else:
              pass
        print(specific_hypothesis)
      return specific_hypothesis
```

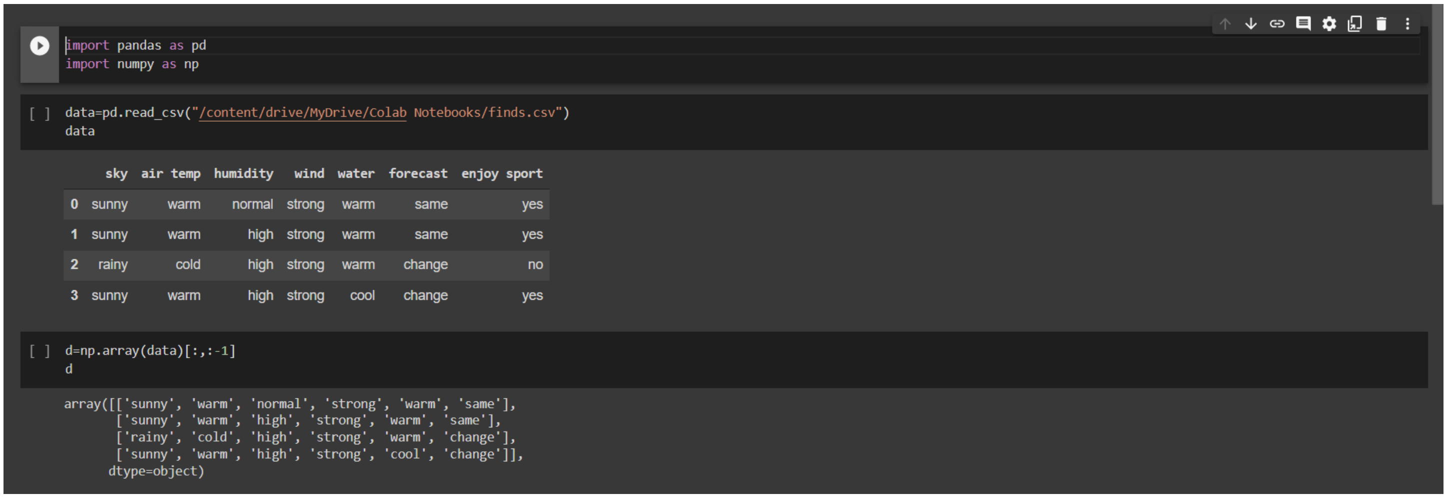
```
[ ] print("\nThe Final Hypothesis is : ", train(d,target))
```



```
[ ] print("\nThe Final Hypothesis is : ", train(d,target))
```

```

Instance :  1
['sunny' 'warm' 'normal' 'strong' 'warm' 'same']

Instance :  2
['sunny' 'warm' '?' 'strong' 'warm' 'same']

Instance :  3
['sunny' 'warm' '?' 'strong' 'warm' 'same']

Instance :  4
['sunny' 'warm' '?' 'strong' '?' '?']

The Final Hypothesis is :  ['sunny' 'warm' '?' 'strong' '?' '?']
```

2.Candidate Elimination Algorithm



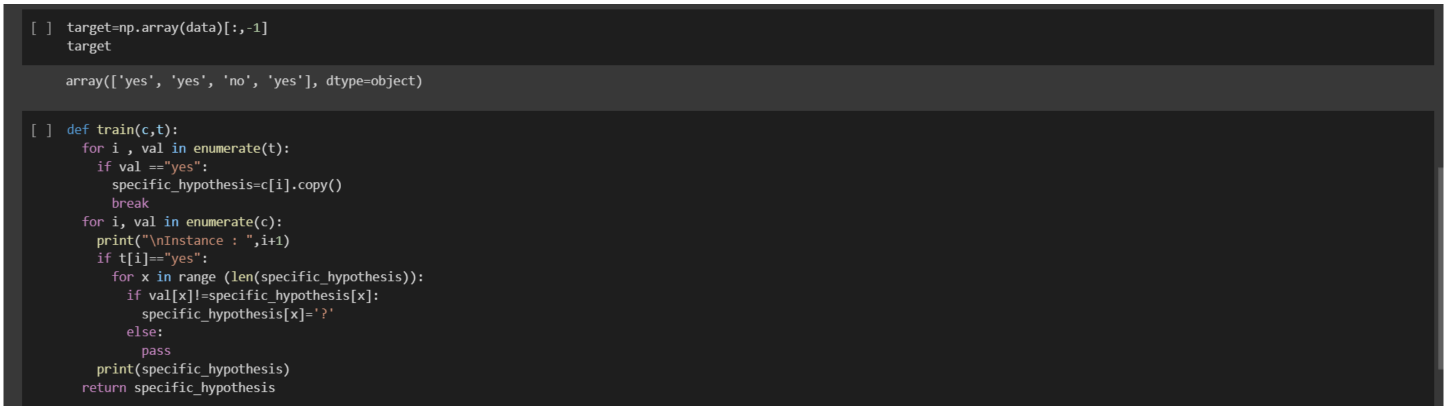
```
import pandas as pd
import numpy as np
```

```
data=pd.read_csv("/content/drive/MyDrive/Colab Notebooks/finds.csv")
data
```

	sky	air temp	humidity	wind	water	forecast	enjoy sport
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

```
d=np.array(data)[:,:-1]
d
```

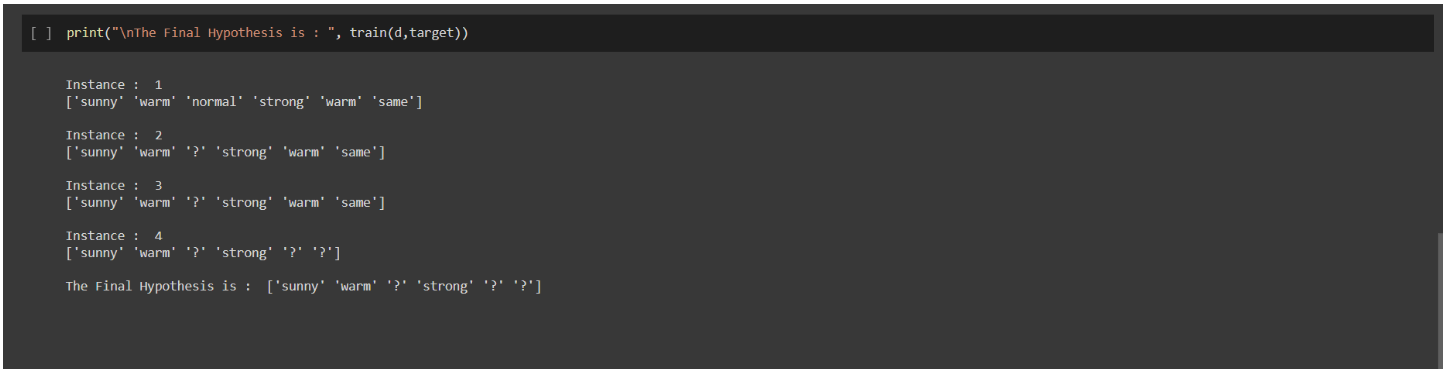
```
array([['sunny', 'warm', 'normal', 'strong', 'warm', 'same'],
       ['sunny', 'warm', 'high', 'strong', 'warm', 'same'],
       ['rainy', 'cold', 'high', 'strong', 'warm', 'change'],
       ['sunny', 'warm', 'high', 'strong', 'cool', 'change']],
      dtype=object)
```



```
target=np.array(data)[:,-1]
target
```

```
array(['yes', 'yes', 'no', 'yes'], dtype=object)
```

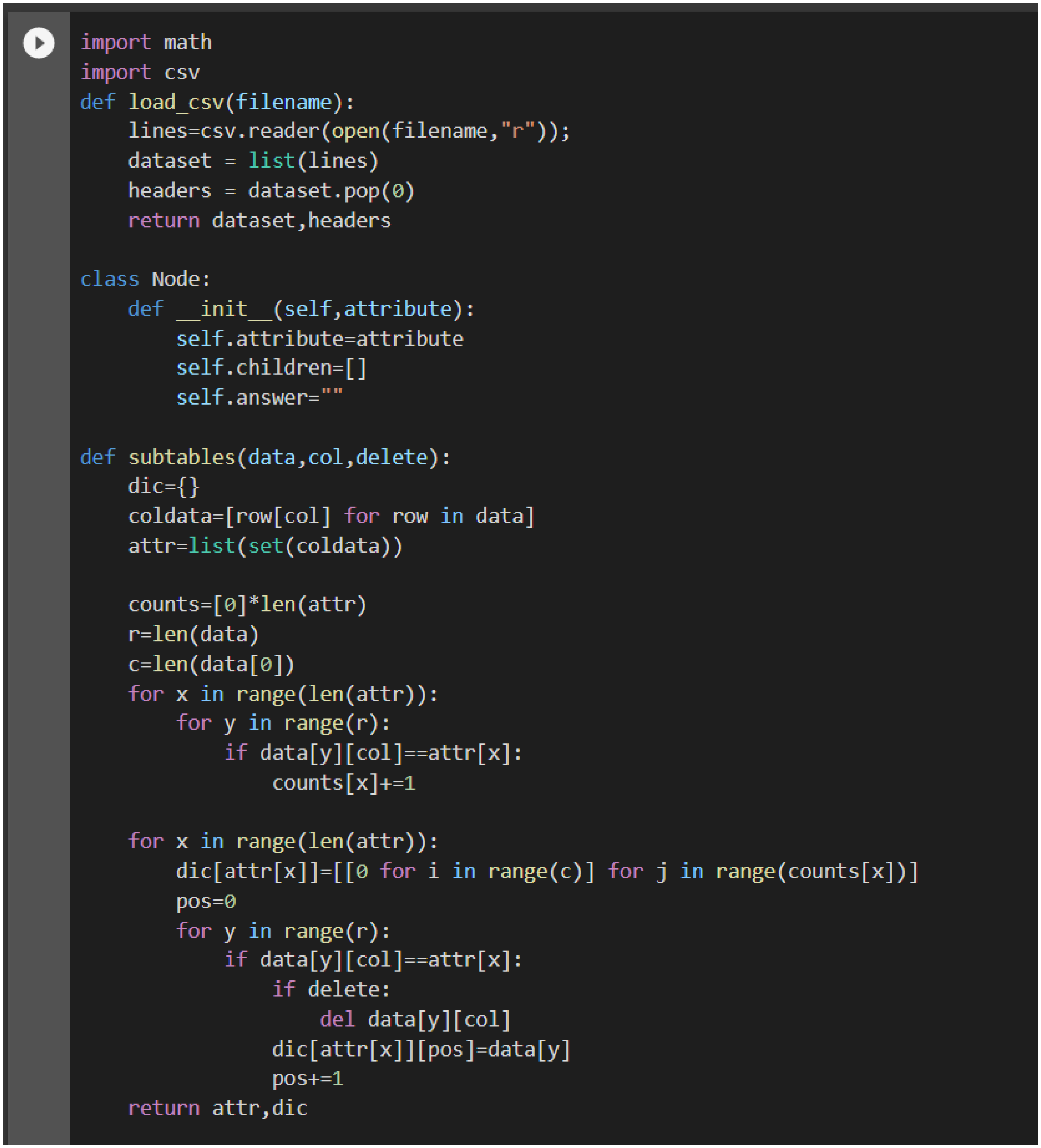
```
def train(c,t):
  for i , val in enumerate(t):
    if val =="yes":
      specific_hypothesis=c[i].copy()
      break
  for i, val in enumerate(c):
    print("\nInstance : ",i+1)
    if t[i]=="yes":
      for x in range (len(specific_hypothesis)):
        if val[x]!=specific_hypothesis[x]:
          specific_hypothesis[x]='?'
        else:
          pass
    print(specific_hypothesis)
  return specific_hypothesis
```



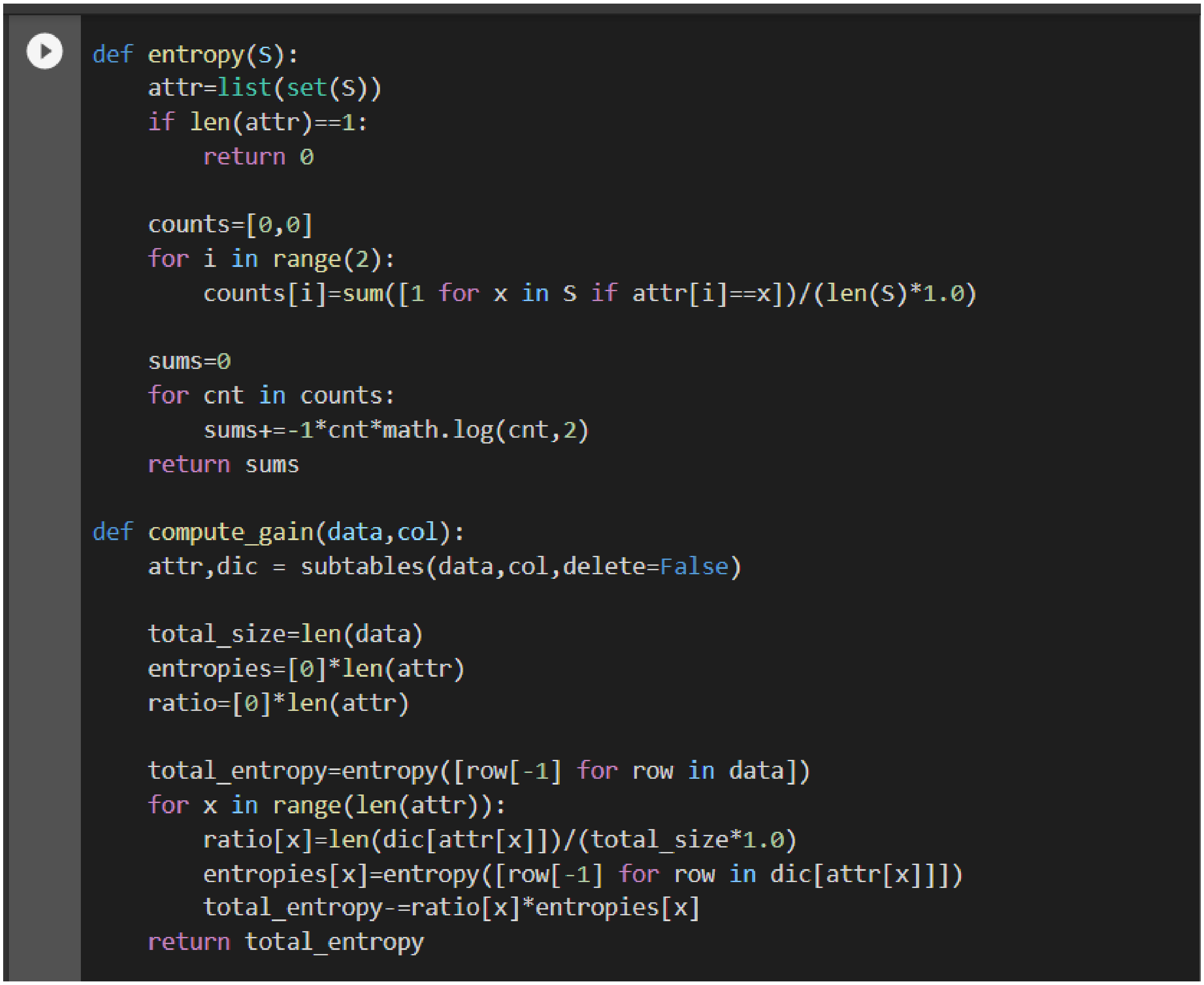
```
print("\nThe Final Hypothesis is : ", train(d,target))
```

```

Instance :  1
['sunny' 'warm' 'normal' 'strong' 'warm' 'same']

Instance :  2
['sunny' 'warm' '?' 'strong' 'warm' 'same']

Instance :  3
['sunny' 'warm' '?' 'strong' 'warm' 'same']

Instance :  4
['sunny' 'warm' '?' 'strong' '?' '?']

The Final Hypothesis is :  ['sunny' 'warm' '?' 'strong' '?' '?']
```

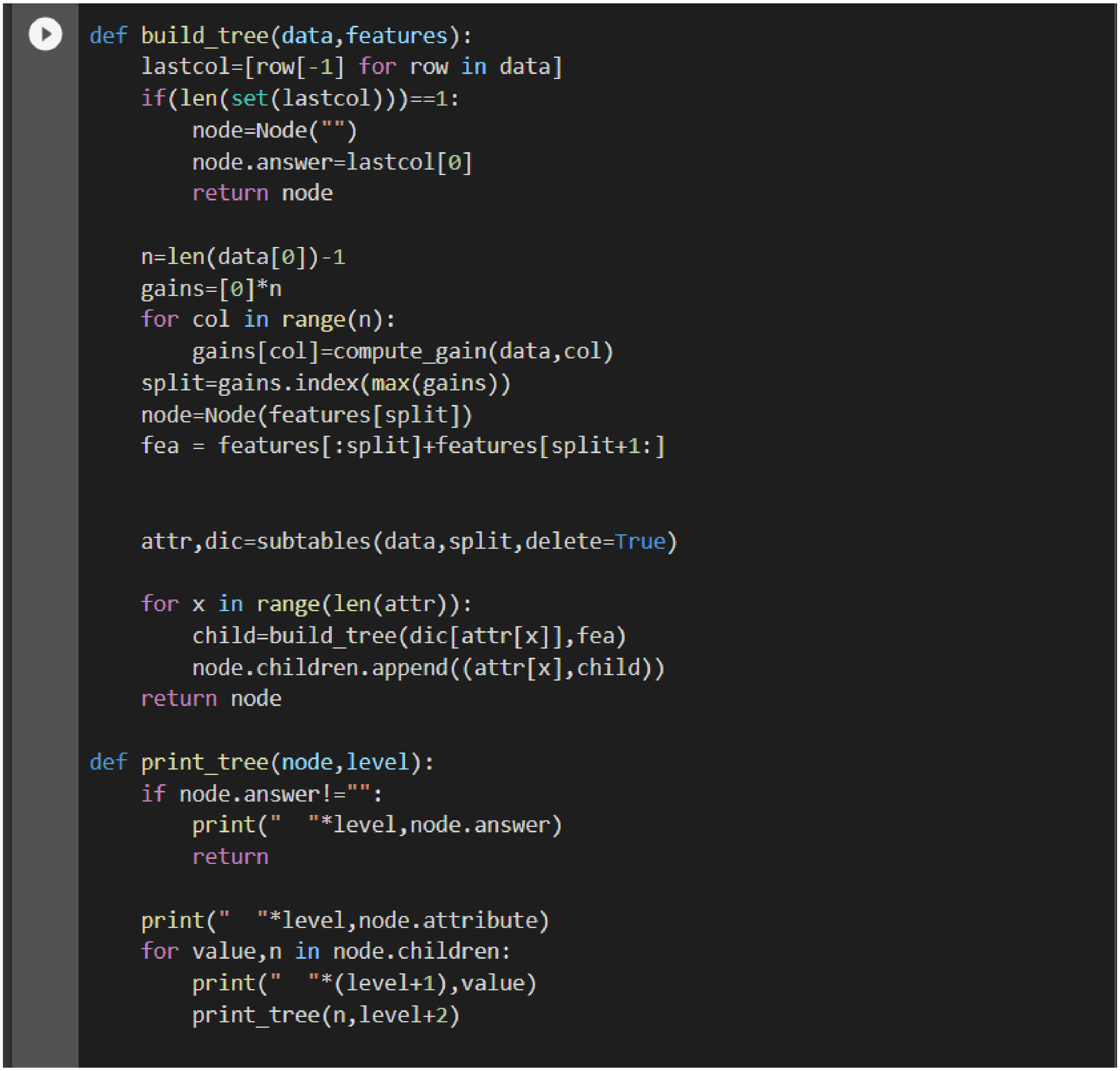
3.ID3 Algorithm (Decision Tree)



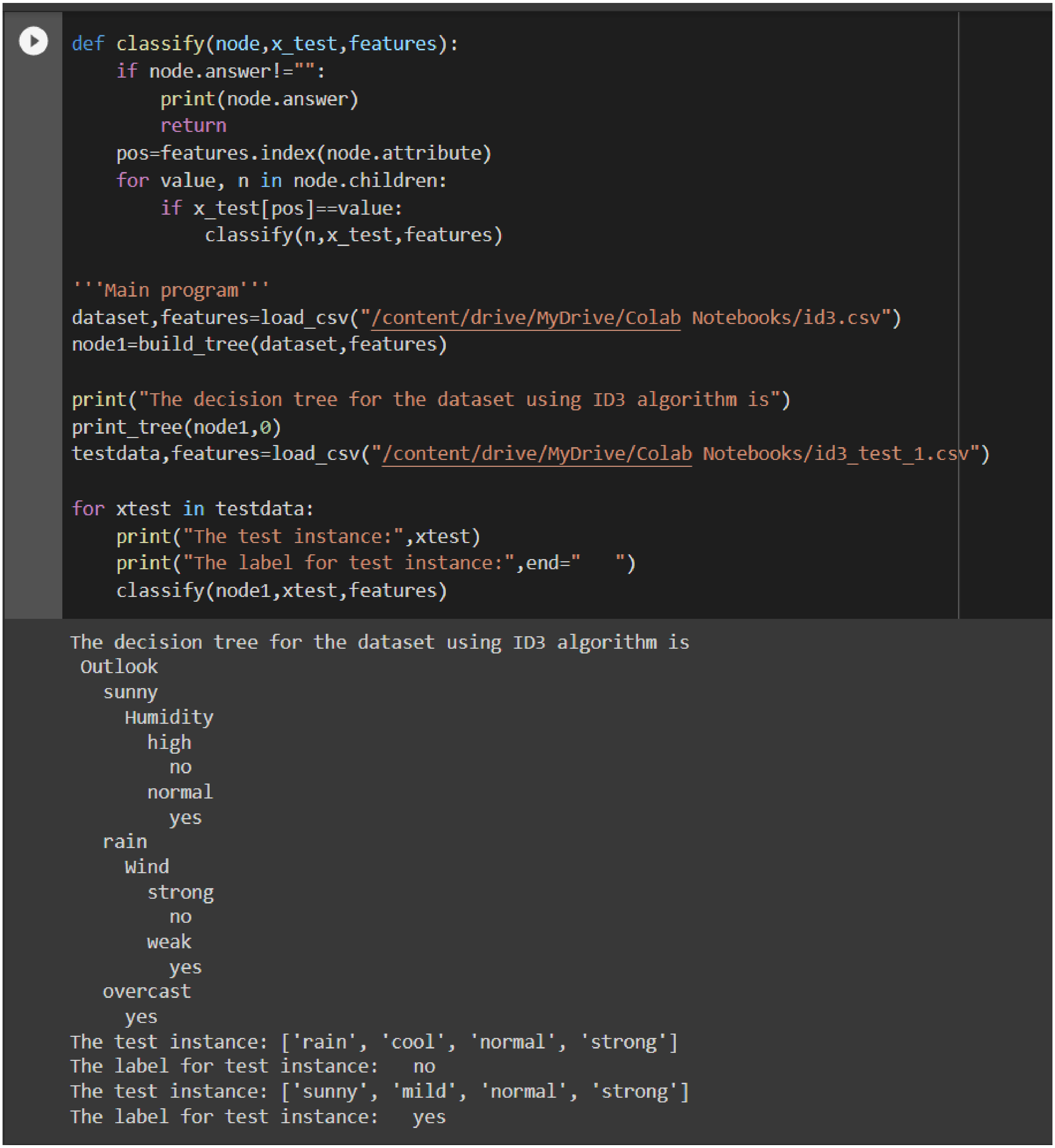
```
import math
import csv
def load_csv(filename):
    lines=csv.reader(open(filename,"r"));
    dataset = list(lines)
    headers = dataset.pop(0)
    return dataset,headers

class Node:
    def __init__(self,attribute):
        self.attribute=attribute
        self.children=[]
        self.answer=""

def subtables(data,col,delete):
    dic={}
    coldata=[row[col] for row in data]
    attr=list(set(coldata))

    counts=[0]*len(attr)
    r=len(data)
    c=len(data[0])
    for x in range(len(attr)):
        for y in range(r):
            if data[y][col]==attr[x]:
                counts[x]+=1

    for x in range(len(attr)):
        dic[attr[x]]=[[0 for i in range(c)] for j in range(counts[x])]
        pos=0
        for y in range(r):
            if data[y][col]==attr[x]:
                if delete:
                    del data[y][col]
                dic[attr[x]][pos]=data[y]
                pos+=1
    return attr,dic
```



```
def entropy(S):
    attr=list(set(S))
    if len(attr)==1:
        return 0

    counts=[0,0]
    for i in range(2):
        counts[i]=sum([1 for x in S if attr[i]==x])/(len(S)*1.0)

    sums=0
    for cnt in counts:
        sums+=-1*cnt*math.log(cnt,2)
    return sums

def compute_gain(data,col):
    attr,dic = subtables(data,col,delete=False)

    total_size=len(data)
    entropies=[0]*len(attr)
    ratio=[0]*len(attr)

    total_entropy=entropy([row[-1] for row in data])
    for x in range(len(attr)):
        ratio[x]=len(dic[attr[x]])/(total_size*1.0)
        entropies[x]=entropy([row[-1] for row in dic[attr[x]]])
        total_entropy-=ratio[x]*entropies[x]
    return total_entropy
```



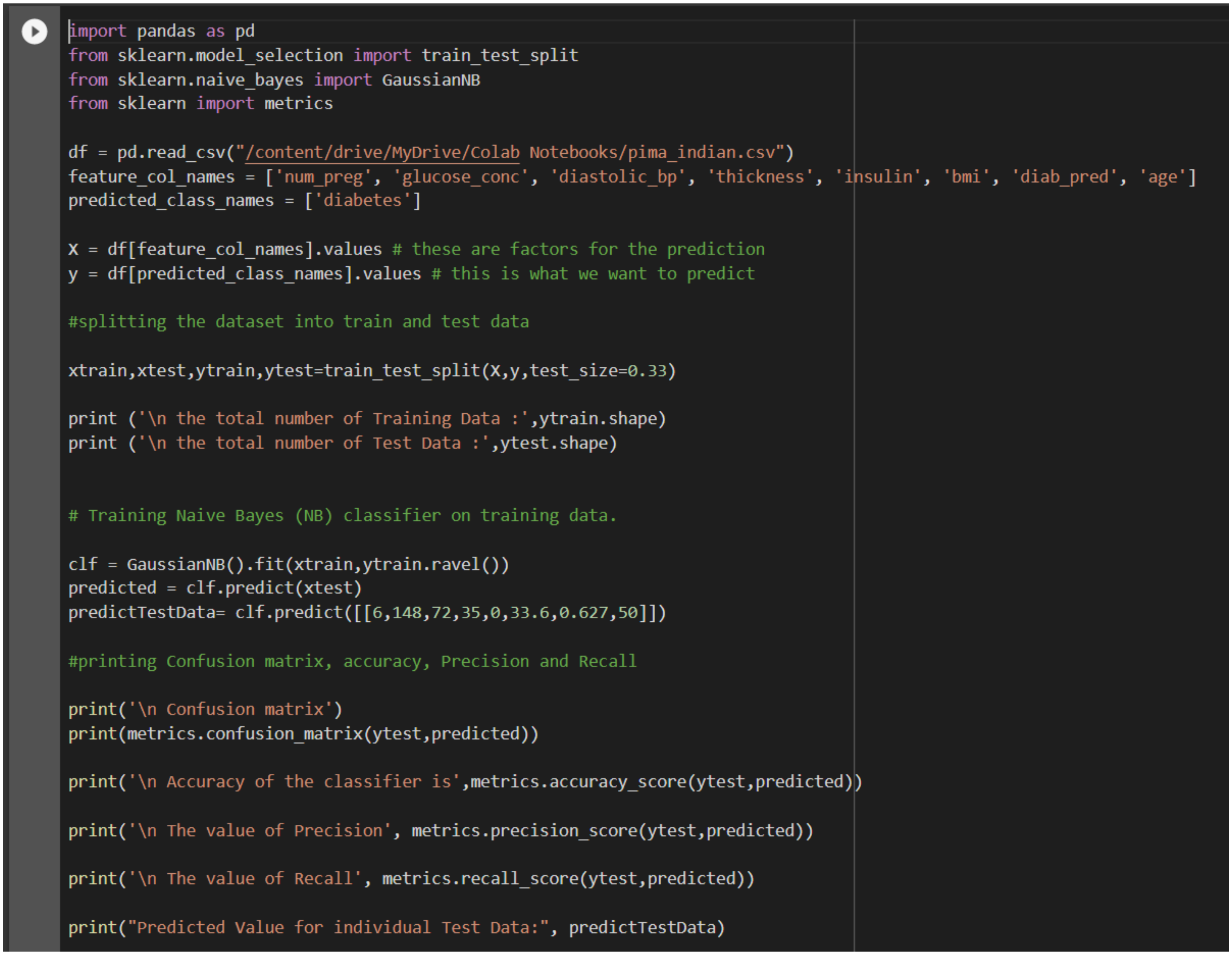
```python
def build_tree(data,features):
    lastcol=[row[-1] for row in data]
    if(len(set(lastcol)))==1:
        node=Node("")
        node.answer=lastcol[0]
        return node

    n=len(data[0])-1
    gains=[0]*n
    for col in range(n):
        gains[col]=compute_gain(data,col)
    split=gains.index(max(gains))
    node=Node(features[split])
    fea = features[:split]+features[split+1:]


    attr,dic=subtables(data,split,delete=True)

    for x in range(len(attr)):
        child=build_tree(dic[attr[x]],fea)
        node.children.append((attr[x],child))
    return node

def print_tree(node,level):
    if node.answer!="":
        print("  "*level,node.answer)
        return

    print("  "*level,node.attribute)
    for value,n in node.children:
        print("  "*(level+1),value)
        print_tree(n,level+2)
```



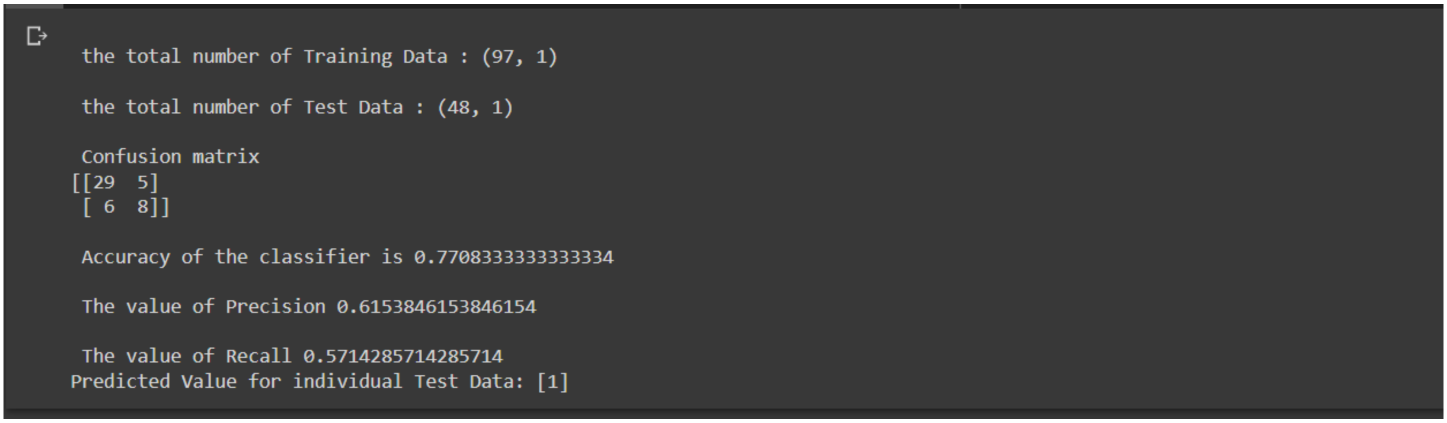
```
def classify(node,x_test,features):
    if node.answer!="":
        print(node.answer)
        return
    pos=features.index(node.attribute)
    for value, n in node.children:
        if x_test[pos]==value:
            classify(n,x_test,features)

'''Main program'''
dataset,features=load_csv("/content/drive/MyDrive/Colab Notebooks/id3.csv")
node1=build_tree(dataset,features)

print("The decision tree for the dataset using ID3 algorithm is")
print_tree(node1,0)
testdata,features=load_csv("/content/drive/MyDrive/Colab Notebooks/id3_test_1.csv")

for xtest in testdata:
    print("The test instance:",xtest)
    print("The label for test instance:",end="   ")
    classify(node1,xtest,features)
```

```
The decision tree for the dataset using ID3 algorithm is
 Outlook
   sunny
     Humidity
       high
         no
       normal
         yes
   rain
     Wind
       strong
         no
       weak
         yes
   overcast
     yes
The test instance: ['rain', 'cool', 'normal', 'strong']
The label for test instance:   no
The test instance: ['sunny', 'mild', 'normal', 'strong']
The label for test instance:   yes
```

4. Naïve Bayesian Classifier

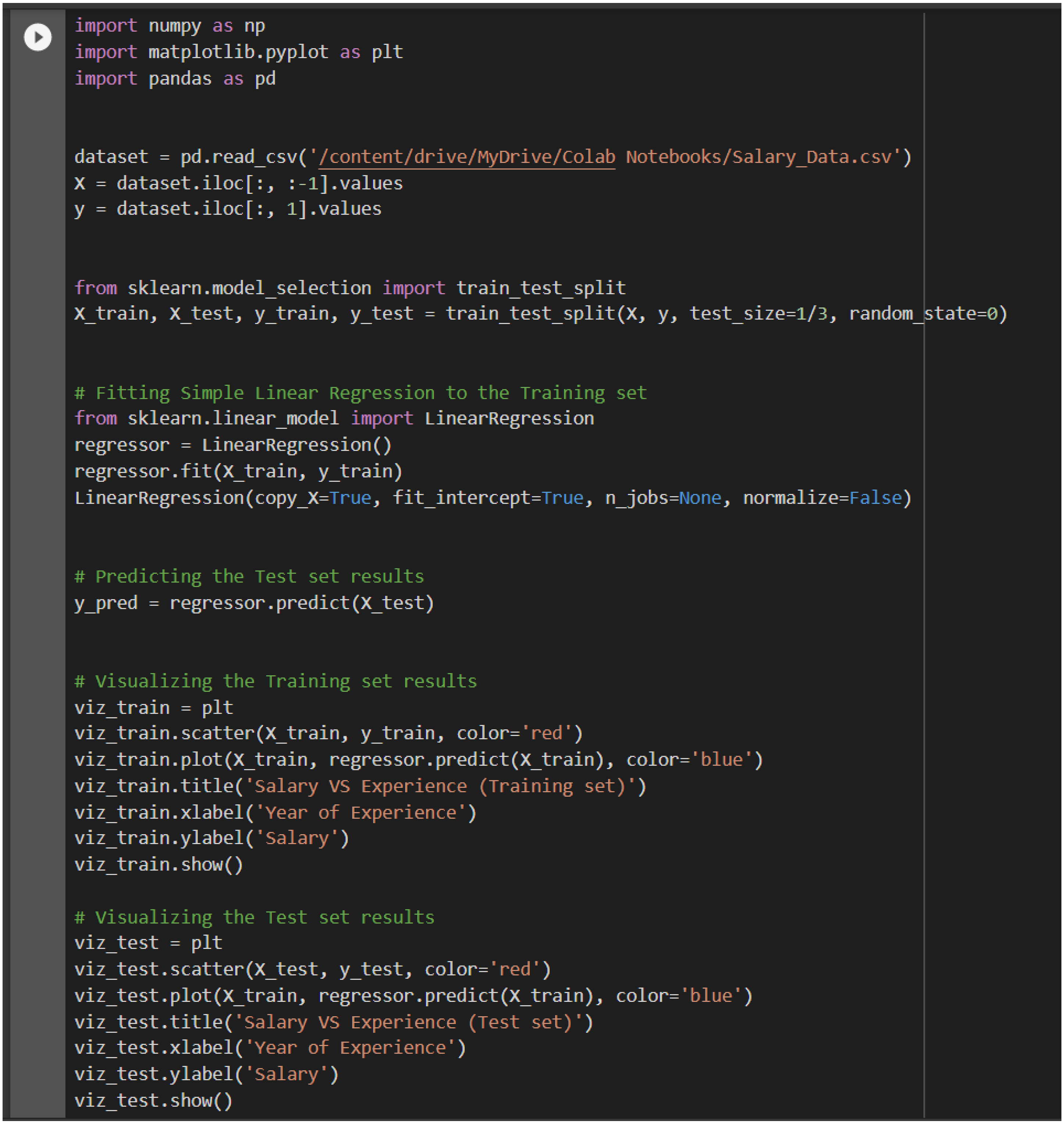


```
import pandas as pd
from sklearn.model_selection import train_test_split
from sklearn.naive_bayes import GaussianNB
from sklearn import metrics

df = pd.read_csv("/content/drive/MyDrive/Colab Notebooks/pima_indian.csv")
feature_col_names = ['num_preg', 'glucose_conc', 'diastolic_bp', 'thickness', 'insulin', 'bmi', 'diab_pred', 'age']
predicted_class_names = ['diabetes']

X = df[feature_col_names].values # these are factors for the prediction
y = df[predicted_class_names].values # this is what we want to predict

#splitting the dataset into train and test data

xtrain,xtest,ytrain,ytest=train_test_split(X,y,test_size=0.33)

print ('\n the total number of Training Data :',ytrain.shape)
print ('\n the total number of Test Data :',ytest.shape)


# Training Naive Bayes (NB) classifier on training data.

clf = GaussianNB().fit(xtrain,ytrain.ravel())
predicted = clf.predict(xtest)
predictTestData= clf.predict([[6,148,72,35,0,33.6,0.627,50]])

#printing Confusion matrix, accuracy, Precision and Recall

print('\n Confusion matrix')
print(metrics.confusion_matrix(ytest,predicted))

print('\n Accuracy of the classifier is',metrics.accuracy_score(ytest,predicted))

print('\n The value of Precision', metrics.precision_score(ytest,predicted))

print('\n The value of Recall', metrics.recall_score(ytest,predicted))

print("Predicted Value for individual Test Data:", predictTestData)
```

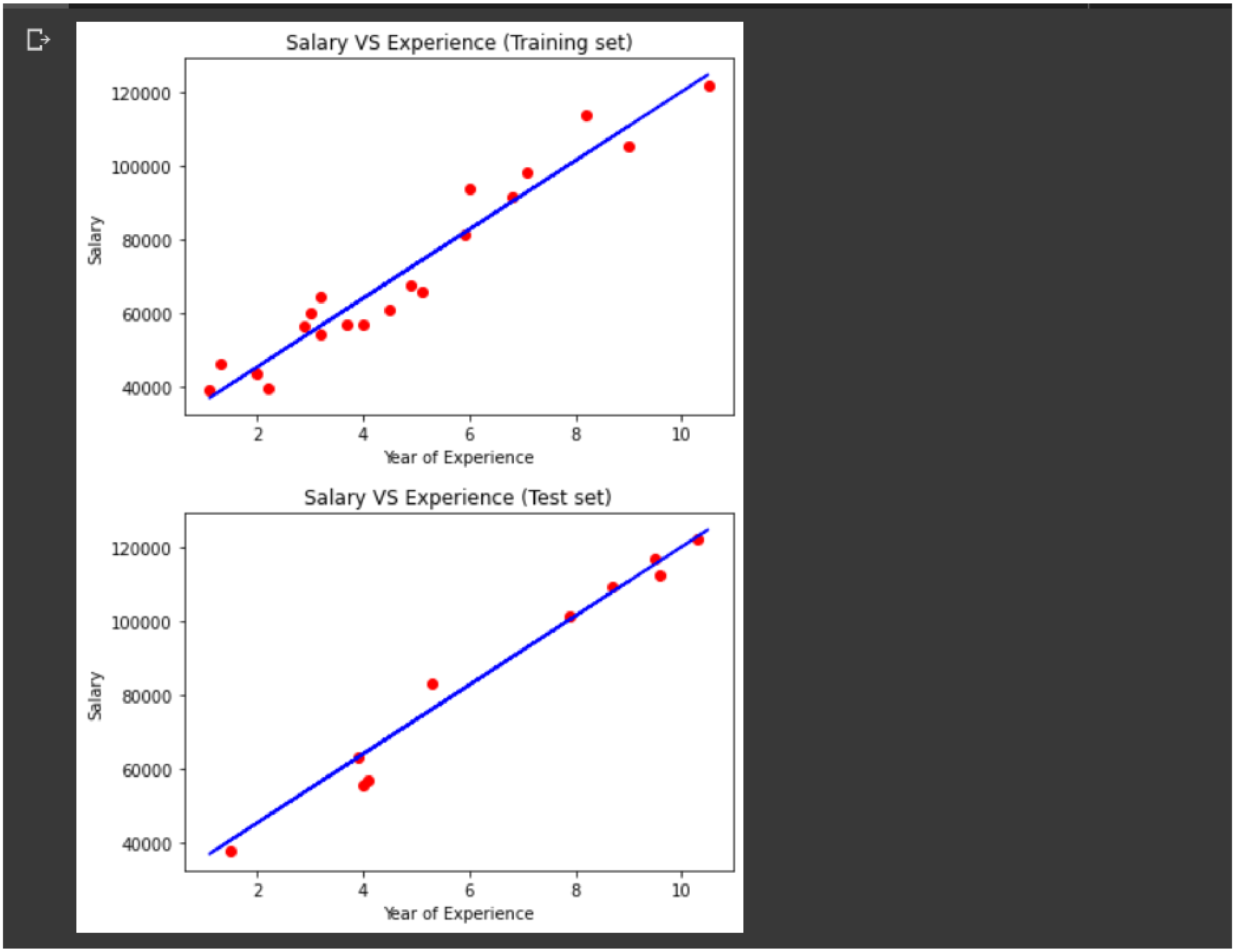


```

 the total number of Training Data : (97, 1)

 the total number of Test Data : (48, 1)

 Confusion matrix
[[29  5]
 [ 6  8]]

 Accuracy of the classifier is 0.7708333333333334

 The value of Precision 0.6153846153846154

 The value of Recall 0.5714285714285714
Predicted Value for individual Test Data: [1]
```

5. Linear Regression



```
import numpy as np
import matplotlib.pyplot as plt
import pandas as pd


dataset = pd.read_csv('/content/drive/MyDrive/Colab Notebooks/Salary_Data.csv')
X = dataset.iloc[:, :-1].values
y = dataset.iloc[:, 1].values


from sklearn.model_selection import train_test_split
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=1/3, random_state=0)


# Fitting Simple Linear Regression to the Training set
from sklearn.linear_model import LinearRegression
regressor = LinearRegression()
regressor.fit(X_train, y_train)
LinearRegression(copy_X=True, fit_intercept=True, n_jobs=None, normalize=False)


# Predicting the Test set results
y_pred = regressor.predict(X_test)


# Visualizing the Training set results
viz_train = plt
viz_train.scatter(X_train, y_train, color='red')
viz_train.plot(X_train, regressor.predict(X_train), color='blue')
viz_train.title('Salary VS Experience (Training set)')
viz_train.xlabel('Year of Experience')
viz_train.ylabel('Salary')
viz_train.show()

# Visualizing the Test set results
viz_test = plt
viz_test.scatter(X_test, y_test, color='red')
viz_test.plot(X_train, regressor.predict(X_train), color='blue')
viz_test.title('Salary VS Experience (Test set)')
viz_test.xlabel('Year of Experience')
viz_test.ylabel('Salary')
viz_test.show()
```



Salary VS Experience (Training set)

Salary VS Experience (Test set)