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
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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

C ERTIFICATE

This is to certify that the Lab work entitled "**MACHINE LEARNING**" carried out by **ROHAN SIWACH(1BM19CS132),** 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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`

PROGRAM TO IMPLEMENT FIND S ALGORITHM

In [28]:
```
import pandas as pd
import numpy as np
```

In [29]:
```
data=pd.read_csv('file.csv')
```

In [30]:
```
print(data)
```

```
      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
```

In [31]:
```
d=np.array(data)[:,:-1]
```

In [32]:
```
print(d)
```

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

In [33]:
```
target=np.array(data)[:,-1]
```

In [34]:
```
print(target)
```

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

In [35]:
```
h=[]
```

In [36]:
```
for i in range(len(target)):
    if(target[i]=='Yes'):
        h=d[i]
        break
```

In [37]:
```
print(h)
```

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

In [42]:
```
for i in range(len(d)):
    if(target[i]=='Yes'):
        for j in range(len(d[i])):
            if(d[i][j].strip()==h[j]):
                pass
            else:
                h[j]='?'



print(h)
```

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

PROGRAM TO IMPLEMENT CANDIDATE ELIMINATION ALGORITHM

In [121…
```
import numpy as np
```

In [122…
```
data=pd.read_csv('file.csv')
```

In [123…
```
print(data)
```

```
     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
```

In [124…
```
d=np.array(data)[:,:-1]
```

In [125…
```
print(d)
```

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

In [126…
```
target=np.array(data)[:,-1]
```

In [127…
```
print(target)
```

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

In [128…
```
for i in range(len(target)):
    if(target[i].strip()=='Yes'):
        specific_h=d[i].copy();
        break
```

In [129…
```
generic_h=[['?','?','?','?','?','?'],['?','?','?','?','?','?'],['?','?','?','?','?','?'],['?','?','?','?','?','?'],['?','?','?','?','?','
```

In [130…
```
for i in range(len(target)):
    if(target[i].strip()=='Yes'):
        print('INSTANCE IS POSITIVE')
        for j in range(len(d[i])):
            if specific_h[j].strip()!=d[i][j].strip():
                specific_h[j]='?'
                generic_h[j][j]='?'
        print('After Iteration ' + str(i+1) + ' Specific Hypothesis ' + str(specific_h))
        print('After Iteration ' + str(i+1) + ' Generic Hypothesis ' + str(generic_h))
    else:
        print('Instance is negative')
        for j in range(len(d[i])):
            if specific_h[j].strip()!=d[i][j].strip():
                generic_h[j][j]=specific_h[j].strip()
            else:
                generic_h[j][j]='?'
        print('After Iteration ' + str(i+1) + ' Specific Hypothesis ' + str(specific_h))
        print('After Iteration ' + str(i+1) + ' Generic Hypothesis ' + str(generic_h))




ind=[i for i,v in enumerate(generic_h) if v==['?','?','?','?','?','?']]

for i in ind:
    generic_h.remove(['?','?','?','?','?','?'])



print('FINAL SPECIFIC HYPOTHESIS ' + str(specific_h))
print('GENERAL HYPOTHESIS '+ str(generic_h))
```

```
print ( FZNAL SPECZ FIC HYPOTHES IS ' + st r\
specTfic_h ) ) print ( GENERAL HYPOTHESIS '+ str
(generic h) )
```

```
INSTANCE IS POSITIVE
After Iteration 1 Specific Hypothesis ['Sunny' 'Warm' 'Normal' 'Strong' 'Warm' 'Same']
After Iteration 1 Generic Hypothesis [['?', '?', '?', '?', '?', '?'], ['?', 'Warm', '?', '?', '?', '?'], ['?', '?', '?', '?', '?',

INSTANCE IS POSITIVE
After Iteration 2 Specific Hypothesis ['Sunny' 'Warm' '?' 'Strong' 'Warm' 'Same']
After Iteration 2 Generic Hypothesis [['?', '?', '?', '?', '?', '?'], ['?', '?', '?', '?', '?', '?'], ['?', '?', '?', '?', '?', '?'],

Instance is negativ e
After Iteration 3 Specific Hypothesis ['Sunny' 'Warm' '?' 'Strong' 'Warm' 'Same']
After Iteration 3 Generic Hypothesis [['Sunny', '?', '?', '?', '?', '?'], ['?', 'Warm', '?', '?', '?', '?'], ['?', '?', '?', '?', '?',

INSTANCE IS POSITIVE
After Iteration 4 Specific Hypothesis ['Sunny' 'Warm' '?' 'Strong' '?' '?']
After Iteration 4 Generic Hypothesis [['Sunny', '?', '?', '?', '?', '?'], ['?', 'Warm', '?', '?', '?', '?'], ['?', '?', '?', '?', '?',

FINAL SPECIFIC HYPOTHESIS ['Sunny' 'Warm' '?' 'Strong' '?' '?']
GENERAL HYPOTHESIS [['Sunny', '?', '?', '?', '?', '?'], ['?', 'Warm', '?', '?', '?', '?']]
```

PROGRAM TO IMPLEMENT ID-3 ALGORITHM

In [ ]:
```
import numpy as np
```

In [ ]:
```
import pandas as pd
from sklearn.tree import DecisionTreeClassifier # Import Decision Tree Classifier
from sklearn.model_selection import train_test_split # Import train_test_split function
from sklearn import metrics #Import scikit-learn metrics module for accuracy calculation
```

In [4]:
```
col_names = ['pregnant', 'glucose', 'bp', 'skin', 'insulin', 'bmi','pedigree','age','label']
pima = pd.read_csv("/content/drive/MyDrive/diabetes.csv", header=None, names=col_names)
```

In [5]:
```
pima.head()
```

Out[5]:

	pregnant	glucose	bp	skin	insulin	bmi	pedigree	age	label
0	6	148	72	35	0	33.6	0.627	50	1
1	1	85	66	29	0	26.6	0.351	31	0
2	8	183	64	0	0	23.3	0.672	32	1
3	1	89	66	23	94	28.1	0.167	21	0
4	0	137	40	35	168	43.1	2.288	33	1

In [6]:
```
feature_cols = ['pregnant', 'insulin', 'bmi', 'age','glucose','bp','pedigree']
X = pima[feature_cols] # Features
y = pima.label # Target variable
```

In [7]:
```
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2, random_state=2)
```

In [8]:
```
clf = DecisionTreeClassifier()
clf = clf.fit(X_train,y_train)
y_pred = clf.predict(X_test)
print("Accuracy:",metrics.accuracy_score(y_test, y_pred))
```

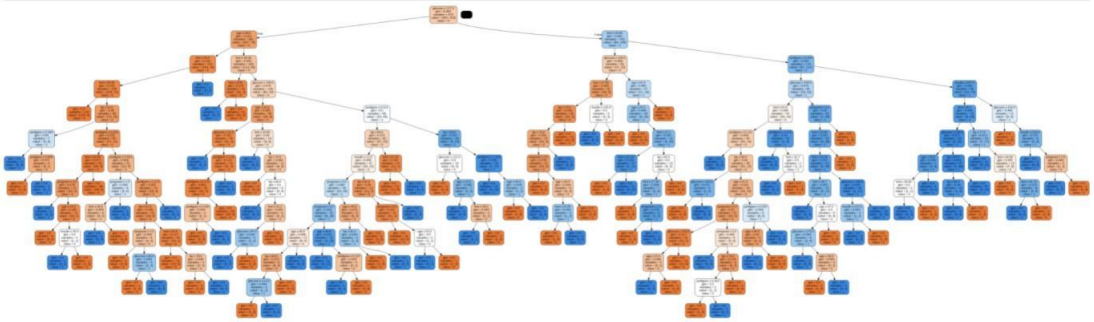
```
clf = clf.fit(X_train,y_train)
y_pred = clf.predict(X_test)
print("Accuracy:",metrics.accuracy_score(y_test, y_pred))
```

```
Accuracy: 0.7467532467532467
```

In [9]:
```
from sklearn.tree import export_graphviz
from six import StringIO
from IPython.display import Image
import pydotplus

dot_data = StringIO()
export_graphviz(clf, out_file=dot_data,
                filled=True, rounded=True,
                special_characters=True,feature_names = feature_cols,class_names=['0','1'])
graph = pydotplus.graph_from_dot_data(dot_data.getvalue())
graph.write_png('diabetes.png')
Image(graph.create_png())
```

Out[9]:



In [ ]:
```
```

PROGRAM TO IMPLEMENT LINEAR REGRESSION

In [1]:
```
import numpy as np
import matplotlib.pyplot as plt
import pandas as pd
```

In [28]:
```
dataset = pd.read_csv('Salary_Data.csv')
dataset.head()
```

Out[28]:

	YearsExperience	Salary
0	1.1	39343.0
1	1.3	46205.0
2	1.5	37731.0
3	2.0	43525.0
4	2.2	39891.0

In [19]:
```
X = dataset.iloc[:, :-1].values
print(X)
```

```
<class 'numpy.ndarray'>
```

In [6]:
```
y = dataset.iloc[:, -1].values
```

In [10]:
```
dataset.head()
```

Out[10]:

	YearsExperience	Salary
0	1.1	39343.0
1	1.3	46205.0
2	1.5	37731.0
3	2.0	43525.0
4	2.2	39891.0

In [11]:
```
from sklearn.model_selection import train_test_split
```

In [12]:
```
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size = 1/3, random_state = 0)
```

In [14]:
```
from sklearn.linear_model import LinearRegression
regressor = LinearRegression()
regressor.fit(X_train, y_train)
```

Out[14]:
```
LinearRegression(copy_X=True, fit_intercept=True, n_jobs=None, normalize=False)
```

In [15]:
```
y_pred = regressor.prplt.scatter(X_train, y_train, color = 'red')
plt.plot(X_train, regressor.predict(X_train), color = 'blue')
plt.title('Salary vs Experience (Training set)')
plt.xlabel('Years of Experience')
plt.ylabel('Salary')
plt.show()edict(X_test)
```

In [16]:
```
pd.DataFrame(data={'Actuals': y_test, 'Predictions': y_pred})
```

Out[16]:

	Actuals	Predictions
0	37731.0	40835.105909
1	122391.0	123079.399408
2	57081.0	65134.556261
3	63218.0	63265.367772
4	116969.0	115602.645454
5	109431.0	108125.891499
6	112635.0	116537.239698
7	55794.0	64199.962017
8	83088.0	76349.687193

```
T
64199T6?0I7 8
8308110 76849 687193
```

```
pit.scatter(X train, y train, color: 're0')
pit.title('Salary vs Experience (Training
set)') pit.xtabel('Years oT Experience')
```

PROGRAM TO IMPLEMENT NAIVE BAYES

```
In [99]:
import csv
import random
import math
import pandas as pd

In [100…
def loadcsv(filename):
    dataset=pd.read_csv(filename)
    n=len(dataset['Pregnancies'].values)
    dataframe=[]
    for i in range (n):
        dataframe.append(dataset.iloc[i].values.tolist())

    return dataframe

In [101…
def splitdataset(dataset, splitratio):
    #67% training size
        trainsize = int(len(dataset) * splitratio);
        trainset = []
        copy = list(dataset);
        while len(trainset) < trainsize:
#generate indices for the dataset list randomly to pic  ted for training data
                index = random.randrange(len(copy));
                trainset.append(copy.pop(index))
        return [trainset, copy]

In [102…
def separatebyclass(dataset):
        separated = {}
        for i in range(len(dataset)):
                vector = dataset[i]
                if (vector[-1] not in separated):
                        separated[vector[-1]] = []
                separated[vector[-1]].append(vector)
        return separated

In [103…
def mean(numbers):
        return sum(numbers)/float(len(numbers))
```

File display

```
def stdev(numbers):
        avg = mean(numbers)
        variance = sum([pow(x-avg,2) for x in numbers])/float(len(numbers)-1)
        return math.sqrt(variance)

In [104…
def summarize(dataset): #creates a dictionary of classes
        summaries = [(mean(attribute), stdev(attribute)) for attribute in zip(*dataset)];
        del summaries[-1]#excluding labels +ve or -ve
        print(summaries[-1])
        return summaries

In [105…
def summarizebyclass(dataset):
        separated = separatebyclass(dataset);
#     print(separated)
        summaries = {}
        for classvalue, instances in separated.items():
                summaries[classvalue] = summarize(instances) #summarize is used to cal to mean and std
        return summaries

In [106…
def calculateprobability(x, mean, stdev):
        exponent = math.exp(-(math.pow(x-mean,2)/(2*math.pow(stdev,2))))
        return (1 / (math.sqrt(2*math.pi) * stdev)) * exponent

In [107…
def calculateclassprobabilities(summaries, inputvector):
        probabilities = {} # probabilities contains the all prob of all class of test data
        for classvalue, classsummaries in summaries.items():#class and attribute information as mean and sd
                probabilities[classvalue] = 1
                for i in range(len(classsummaries)):
                        mean, stdev = classsummaries[i] #take mean and sd of every attribute for class 0 and 1 seperaely
                        x = inputvector[i] #testvector's first attribute
                        probabilities[classvalue] *= calculateprobability(x, mean, stdev);#use normal dist
        return probabilities

In [108…
def predict(summaries, inputvector): #training and test data is passed
        probabilities = calculateclassprobabilities(summaries, inputvector)
#       print(probabilities)
        bestLabel, bestProb = None, -1
```

```
                    if bestLabel is None or' probability > bestProb:

                            bestLabel = classvalue


'"""" del getpredictions(summaries, testset):

                for i in range(len(testset)):
                        result = predict(summaries, testset[i])
                        predictions.append(result)



'"""" dev getaccuracy(testset,        :

                for i in range(len(testset)):

                                correct += 1
                return (correct/float(len(testset))) * 100.0



                splitratio = 0.67
                dataset = loadcsv(filename);

                trainingset, testset = splitdataset(dataset, splitratio)
                print('Split {0} rows into train={1} and test={2} rows'.format(len(dataset), len(trainingset), len(testset)))

                summaries = summarizebyclass(trainingset);
                #print(summaries)

                predictions = getpredictions(summaries, testset) #find the predictions of test data with the training data
                accuracy = getaccuracy(testset, predictions)




''`"'' del" get a ecu racy (te st set , p red Action s ) :

                    i
                "'    "if'testset[i][-1l'=='predictions[il:

                returu (‹orrert/Iloat(len(testset))) * 100.0



                dataset = loadcsv(filename),

                pr  re' 6'r                                                                    1 p 0} rows*int o't ra in={1} and'test={2} rows ' . lornat (len (dataset ) , ten (I rain ingset ) , ten t test set) ) )

                                                                                                s unna ries = summa rizebyct ass (I rainings et  ;
                                                                                               #p r:1 n t (sommarı est

                                                                                                            predictions = getpredictions(summaries, testset) #find the predictions of test
                                                                                                            accuracy = getaccuracy(testset, predictions)



" "' ' mainC

        Split 767 rows into train=513 and test=254 rows
        (37.30107526881721, 10.837657018394614)
        (31.38532110091743, 11.32474481914113)
        Accuracy of the classifier is : 76.37795275590551%
```