PRACTICAL-1

AIM: Study about Python learn following Data Structure : List, Dictionary, Dataframe, Numpy/scipy package in Python.

DESCRIPTION:

Python:

Python is an interpreted high-level general-purpose programming language. Its design philosophy emphasizes code readability with its use of significant indentation. Its language constructs as well as its object-oriented approach aim to help programmers write clear, logical code for small and large-scale projects.

Python is dynamically-typed and garbage-collected. It supports multiple programming paradigms, including structured (particularly, procedural), object-oriented and functional programming. It is often described as a "batteries included" language due to its comprehensive standard library.

Guido van Rossum began working on Python in the late 1980s, as a successor to the ABC programming language, and first released it in 1991 as Python 0.9.0. It supports functional and structured programming methods as well as OOP. It can be used as a scripting language or can be compiled to byte-code for building large applications. It provides very high-level dynamic data types and supports dynamic type checking. It supports automatic garbage collection. It can be easily integrated with C, C++, COM, ActiveX, CORBA, and Java.

List in Python :

Lists are just like dynamically sized arrays, declared in other languages (vector in C++ and ArrayList in Java). Lists need not be homogeneous always which makes it the most powerful tool in Python. A single list may contain DataTypes like Integers, Strings, as well as Objects. Lists are mutable, and hence, they can be altered even after their creation.

List in Python are ordered and have a definite count. The elements in a list are indexed according to a definite sequence and the indexing of a list is done with 0 being the first index. Each element in the list has its definite place in the list, which allows duplicating of elements in the list, with each element having its own distinct place and credibility.

Dictionary in Python :

Dictionary in Python is an unordered collection of data values, used to store data values like a map, which, unlike other Data Types that hold only a single value as an element, Dictionary holds key:value pair. Key-value is provided in the dictionary to make it more optimized.

In Python, a Dictionary can be created by placing a sequence of elements within curly {} braces, separated by ‘comma’. Dictionary holds pairs of values, one being the Key and the other corresponding pair element being its Key:value. Values in a dictionary can be of any data type and can be duplicated, whereas keys can’t be repeated and must be immutable.

DataFrame:

Pandas DataFrame is two-dimensional size-mutable, potentially heterogeneous tabular data structure with labeled axes (rows and columns). A Data frame is a two-dimensional data structure, i.e., data is aligned in a tabular fashion in rows and columns. Pandas DataFrame consists of three principal components, the data**,** rows**,** and columns**.**

Numpy:

NumPy is the fundamental package for scientific computing in Python. It is a Python library that provides a multidimensional array object, various derived objects (such as masked arrays and matrices), and an assortment of routines for fast operations on arrays, including mathematical, logical, shape manipulation, sorting, selecting, I/O, discrete Fourier transforms, basic linear algebra, basic statistical operations, random simulation and much more.

NumPy is a Python library used for working with arrays. It also has functions for working in domain of linear algebra, fourier transform, and matrices. NumPy was created in 2005 by Travis Oliphant. It is an open source project and you can use it freely. NumPy stands for Numerical Python.

Scipy:

SciPy is a free and open-source Python library used for scientific computing and technical computing. SciPy contains modules for optimization, linear algebra, integration, interpolation, special functions, FFT, signal and image processing, ODE solvers and other tasks common in science and engineering.

SciPy is a scientific computation library that uses NumPy underneath. SciPy stands for Scientific Python. It provides more utility functions for optimization, stats and signal processing. Like NumPy, SciPy is open source so we can use it freely. SciPy was created by NumPy's creator Travis Olliphant.

CODE:

```
import numpy as np
from scipy import constants
import pandas as pd

"""List"""

list=["Hello",15,1562.452,'a'] #Creating a List
list[0]
print(list)

"""Dictionary"""

dictionary={1:"A",2:"B",3:"C"} # Creating a Dictionary
print(dictionary[1])
print(dictionary)

"""DataFrame"""

list=["Hello",15,1562.452,'a']
df=pd.DataFrame(list)
print(df)

"""Numpy Use"""

data=np.array([1,2,3,4,5])
for a in data:
  print(a)

"""Scipy Use"""

pi=constants.pi
radius=10
area=pi*radius*radius
print(" Area of Circle is : ",area)
```

OUTPUT:


Practical-1_ML.ipynb
File Edit View Insert Runtime Tools Help Last edited on January 23
Comment Share
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Connect Editing
Importing Numpy and Scipy
import numpy as np
from scipy import constants
import pandas as pd
List
list=["Hi",223.12,45,True,9j] #Creatinglist
print(list)
['Hi', 223.12, 45, True, 9j]
Dictionary
dictionary= { "Model": "Mercedes-Benz", "color": "Black"}
print(dictionary)
{'Model': 'Mercedes-Benz', 'color': 'Black'}
Dataframe


Practical-1_ML.ipynb
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Connect Editing
Dictionary
dictionary= { "Model": "Mercedes-Benz", "color": "Black"}
print(dictionary)
{'Model': 'Mercedes-Benz', 'color': 'Black'}
Dataframe
list=["Hi",223.12,45,True,9j]
df=pd.DataFrame(list)
print(df)
0
0 Hi
1 223.12
2 45
3 True
4 9j
Numpy Use


Practical-1_ML.ipynb
File Edit View Insert Runtime Tools Help Last edited on January 23
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3 True
4 9j
Numpy Use
data= np.array([1,2,3,4,5])
for a in data:
print(a)
1
2
3
4
5
Scipy Use
pi=constants.pi
radius=5
area=pi*radius*radius
print("Area of a circle is " ,area)
Area of a circle is 78.53981633974483

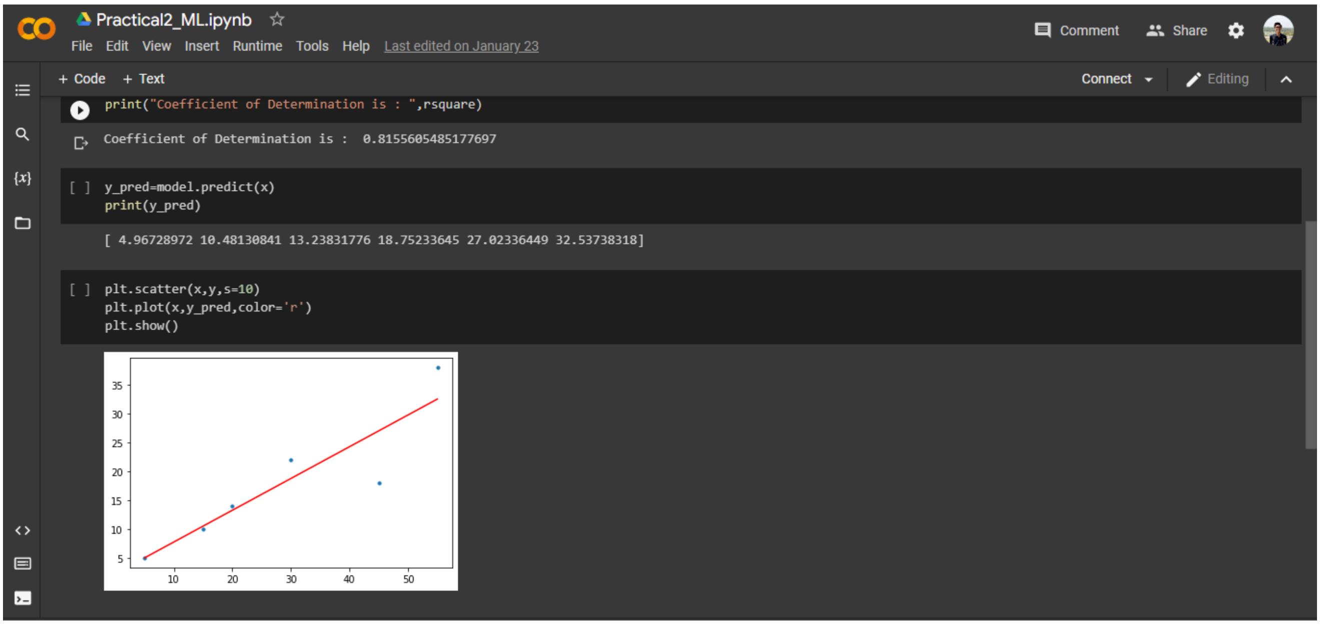
PRACTICAL-2

AIM: Implement Linear Regression in Python

CODE:

```
import numpy as np

from sklearn.linear_model import LinearRegression
import matplotlib.pyplot as plt

x=np.array([5,15,25,35,45,55]).reshape(-1,1)
y=np.array([5,20,14,32,22,38])

model=LinearRegression().fit(x,y)

rsquare=model.score(x,y)

print("Coefficient of Determination is : ",rsquare)

y_pred=model.predict(x)
print(y_pred)

plt.scatter(x,y,s=10)
plt.plot(x,y_pred,color='r')
plt.show()
```

OUTPUT:



PRACTICAL-3

AIM: Implement Logistic Regression in Python

CODE:

Implement Logistic Regression in Python

```
import numpy as np

from sklearn.linear_model import LinearRegression

import matplotlib.pyplot as plt

import pandas as pd

from sklearn import datasets

from sklearn.linear_model import LogisticRegression


iris= datasets.load_iris()

X = iris.data[:, :2]

y = iris.target

model=LogisticRegression()
model.fit(X,y)
model.predict(X[:2,:])
model.predict_proba(X[:2,:])
model.score(X,y)

t=X[:,0]

plt.scatter(t,y,s=10)

plt.show()
```

Logistic Regression using Insurance Dataset

```
data=pd.read_csv("/content/drive/MyDrive/ML/insurance.csv")

data.rename({'\tbought_insurance':'brought_insurance'})

data.shape

data.head()

plt.title(" Insurance vs Age ")

plt.scatter(data['age'],data['bought_insurance'],marker='+',color='red')
```

plt.xlabel(" Age ")

plt.ylabel(" Insurance ")

from sklearn.model_selection import train_test_split

Xtrain,Xtest,ytrain,ytest=train_test_split(data[['age']],data[['bought_insurance']],test_size=0.2)
model.fit(Xtrain,ytrain)

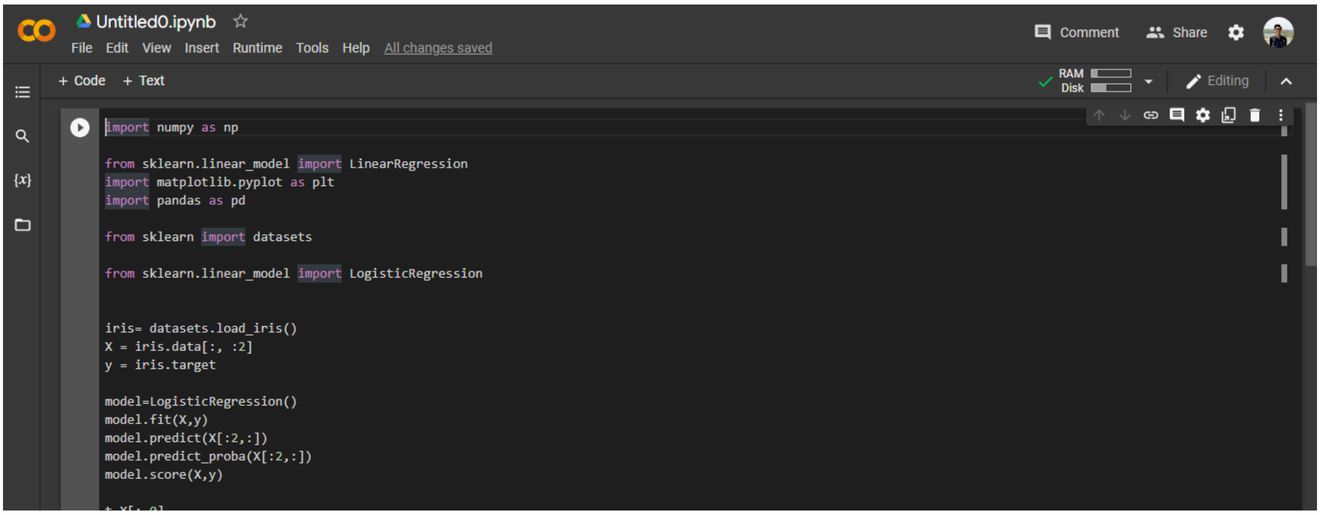
y_pred=model.predict(Xtest)

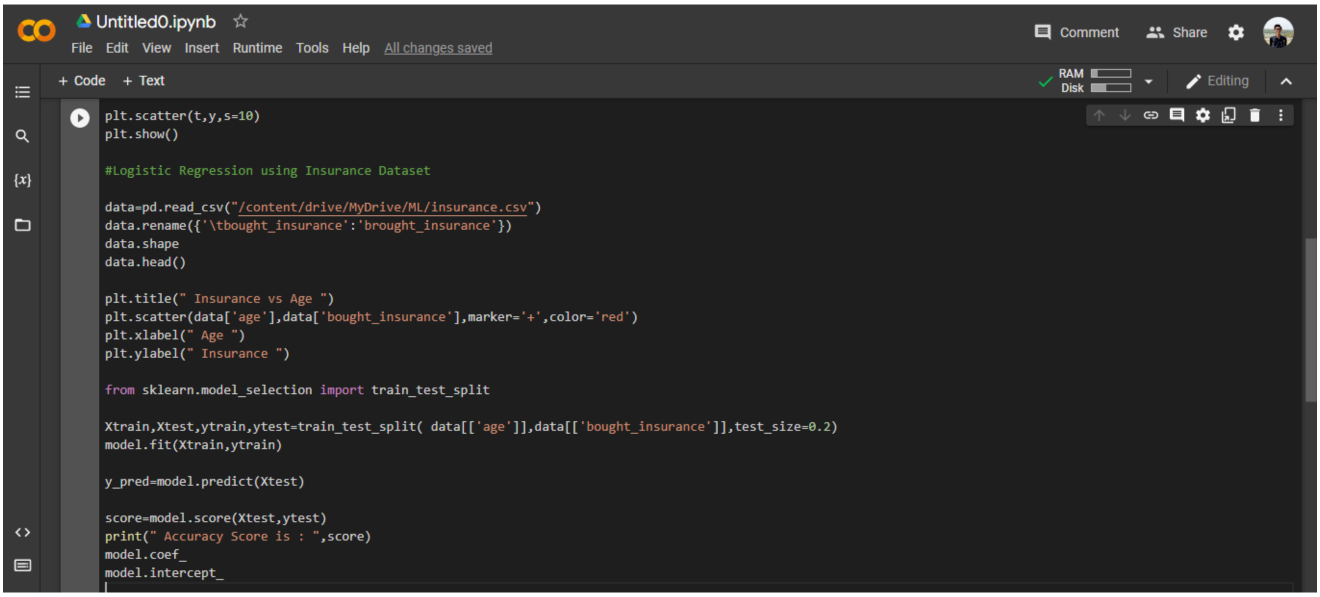
score=model.score(Xtest,ytest)

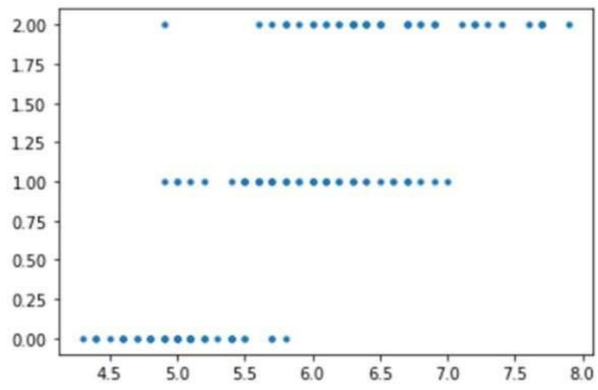
print(" Accuracy Score is : ",score)

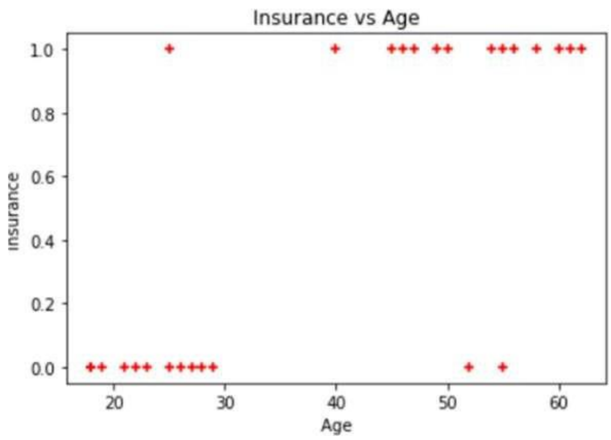
model.coef_
model.intercept_

OUTPUT:






2.00
1.75
1.50
1.25
1.00
0.75
0.50
0.25
0.00
4.5
5.0
5.5
6.0
6.5
7.0
7.5
8.0


Insurance vs Age
insurance
Age
1.0
0.8
0.6
0.4
0.2
0.0
20
30
40
50
60

PRACTICAL-4

AIM: Implement SVM Classifier in python

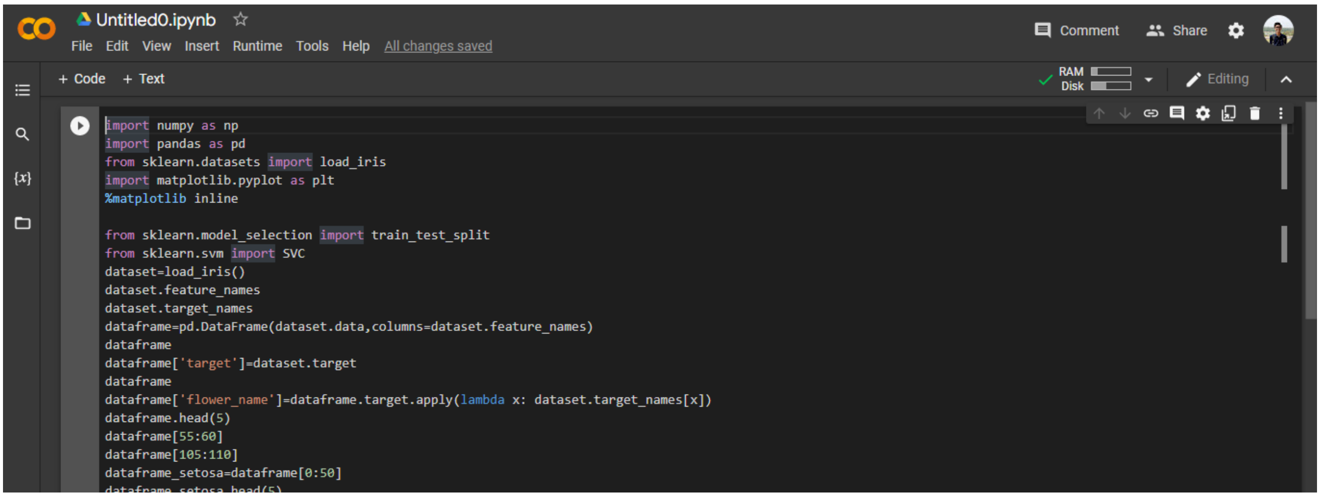
CODE:

Implement SVM Classifier in python

```
import numpy as np

import pandas as pd

from sklearn.datasets import load_iris

import matplotlib.pyplot as plt

%matplotlib inline

from sklearn.model_selection import train_test_split

from sklearn.svm import SVC

dataset=load_iris()

dataset.feature_names

dataset.target_names

dataframe=pd.DataFrame(dataset.data,columns=dataset.feature_names)

dataframe

dataframe['target']=dataset.target

dataframe

dataframe['flower_name']=dataframe.target.apply(lambda x: dataset.target_names[x])

dataframe.head(5)dataframe[55:60]

dataframe[105:110]

dataframe_setosa=dataframe[0:50]

dataframe_setosa.head(5)datafram

e_versicolor=dataframe[50:100]

dataframe_versicolor.head(5)

dataframe_virginica=dataframe[100:150]
```

```
dataframe_virginica.head(5)

plt.title('Setosa Vs Versicolor ')

plt.xlabel('Sepal Length')

plt.ylabel('Sepal Width')

plt.scatter(dataframe_setosa['sepal length (cm)'], dataframe_setosa['sepal width (cm)'],color="green",marker='+')

plt.scatter(dataframe_versicolor['sepal length (cm)'], dataframe_versicolor['sepal width (cm)'],color="blue",marker='.')

plt.title('Setosa Vs Virginica ')

plt.xlabel('Sepal Length')

plt.ylabel('Sepal Width')

plt.scatter(dataframe_setosa['sepal length (cm)'], dataframe_setosa['sepal width (cm)'],color="green",marker='+')

plt.scatter(dataframe_virginica['sepal length (cm)'], dataframe_virginica['sepal width (cm)'],color="red",marker='*')

X = dataframe.drop(['target','flower_name'], axis='columns')

y = dataframe['target']

X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2)

svmModel=SVC()

svmModel.fit(X_train,y_train)

svmModel.score(X_test,y_test)
```

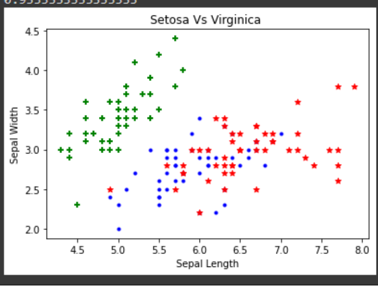
OUTPUT:



```
dataframe['flower_name']=dataframe.target.apply(lambda x: dataset.target_names[x])
dataframe.head(5)
dataframe[55:60]
dataframe[105:110]
dataframe_setosa=dataframe[0:50]
dataframe_setosa.head(5)
dataframe_versicolor=dataframe[50:100]
dataframe_versicolor.head(5)

dataframe_virginica=dataframe[100:150]
dataframe_virginica.head(5)
plt.title('Setosa Vs Versicolor ')
plt.xlabel('Sepal Length')
plt.ylabel('Sepal Width')
plt.scatter(dataframe_setosa['sepal length (cm)'], dataframe_setosa['sepal width (cm)'],color="green",marker='+')
plt.scatter(dataframe_versicolor['sepal length (cm)'], dataframe_versicolor['sepal width (cm)'],color="blue",marker='.')

plt.title('Setosa Vs Virginica ')
plt.xlabel('Sepal Length')
plt.ylabel('Sepal Width')
```

```
plt.ylabel('Sepal Width')
plt.scatter(dataframe_setosa['sepal length (cm)'], dataframe_setosa['sepal width (cm)'],color="green",marker='+')
plt.scatter(dataframe_virginica['sepal length (cm)'], dataframe_virginica['sepal width (cm)'],color="red",marker='*')
X = dataframe.drop(['target','flower_name'], axis='columns')
y = dataframe['target']
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2)
svmModel=SVC()
svmModel.fit(X_train,y_train)
svmModel.score(X_test,y_test)
```

```
0.9333333333333333
```



PRACTICAL-5

AIM: To implement KNN classifier in Python

CODE:

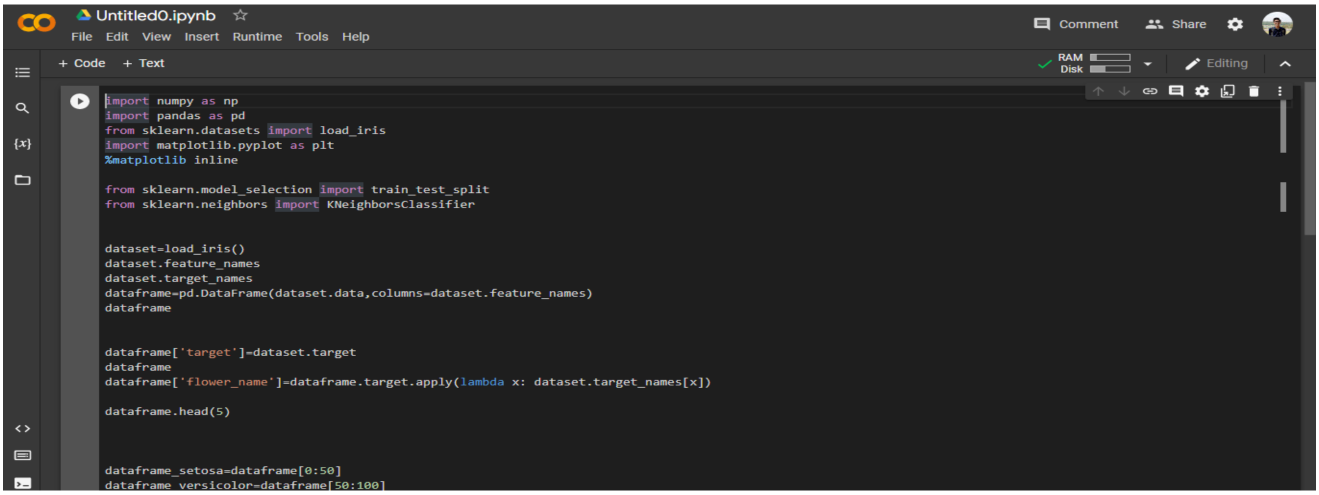
Practical5_ML.ipynb

Implement KNN Classifier in python

```
import numpy as np
import pandas as pd
from sklearn.datasets import load_iris
import matplotlib.pyplot as plt
%matplotlib inline
from sklearn.model_selection import train_test_split
from sklearn.neighbors import KNeighborsClassifier

dataset=load_iris()
dataset.feature_names
dataset.target_names
dataframe=pd.DataFrame(dataset.data,columns=dataset.feature_names)
dataframe

dataframe['target']=dataset.target
dataframe
dataframe['flower_name']=dataframe.target.apply(lambda x: dataset.target_names[x])
```

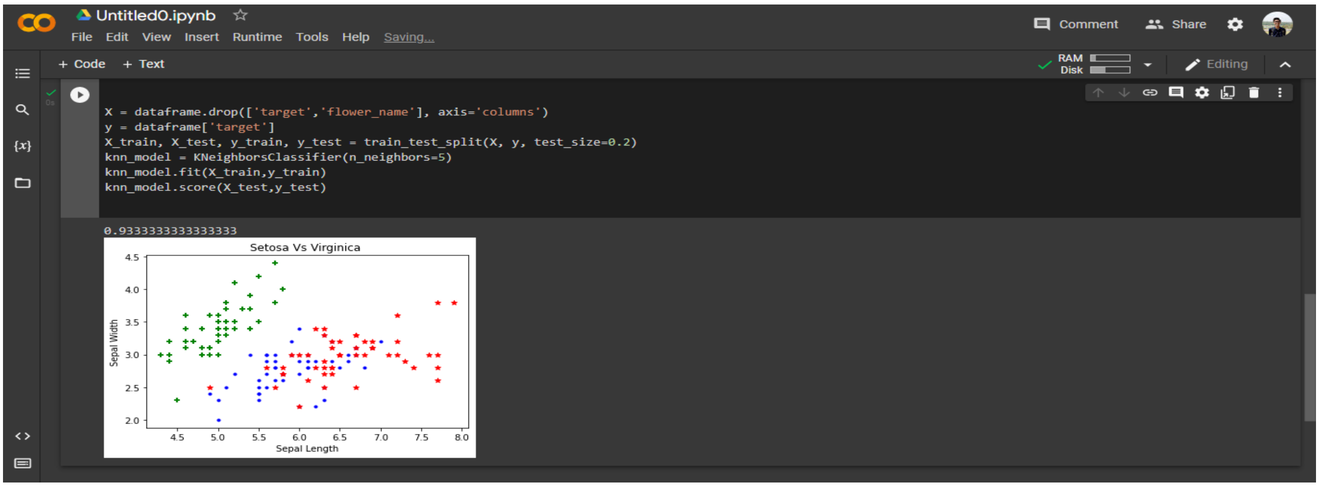
```
dataframe.head(5)


dataframe_setosa=dataframe[0:50]

dataframe_versicolor=dataframe[50:100]

dataframe_virginica=dataframe[100:150]


plt.title('Setosa Vs Versicolor ')

plt.xlabel('Sepal Length')

plt.ylabel('Sepal Width')

plt.scatter(dataframe_setosa['sepal length (cm)'], dataframe_setosa['sepal width (cm)'],color="green",marker='+')

plt.scatter(dataframe_versicolor['sepal length (cm)'], dataframe_versicolor['sepal width (cm)'],color="blue",marker='.')


plt.title('Setosa Vs Virginica ')

plt.xlabel('Sepal Length')

plt.ylabel('Sepal Width')

plt.scatter(dataframe_setosa['sepal length (cm)'], dataframe_setosa['sepal width (cm)'],color="green",marker='+')

plt.scatter(dataframe_virginica['sepal length (cm)'], dataframe_virginica['sepal width (cm)'],color="red",marker='*')


X = dataframe.drop(['target','flower_name'], axis='columns')

y = dataframe['target']

X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2)

knn_model = KNeighborsClassifier(n_neighbors=5)

knn_model.fit(X_train,y_train)

knn_model.score(X_test,y_test)
```

OUTPUT:



Untitled0.ipynb
File Edit View Insert Runtime Tools Help
+ Code + Text
import numpy as np
import pandas as pd
from sklearn.datasets import load_iris
import matplotlib.pyplot as plt
%matplotlib inline
from sklearn.model_selection import train_test_split
from sklearn.neighbors import KNeighborsClassifier
dataset=load_iris()
dataset.feature_names
dataset.target_names
dataframe=pd.DataFrame(dataset.data,columns=dataset.feature_names)
dataframe
dataframe['target']=dataset.target
dataframe
dataframe['flower_name']=dataframe.target.apply(lambda x: dataset.target_names[x])
dataframe.head(5)
dataframe_setosa=dataframe[0:50]
dataframe_versicolor=dataframe[50:100]

Untitled0.ipynb
File Edit View Insert Runtime Tools Help
+ Code + Text
dataframe_virginica=dataframe[100:150]
plt.title('Setosa Vs Versicolor ')
plt.xlabel('Sepal Length')
plt.ylabel('Sepal Width')
plt.scatter(dataframe_setosa['sepal length (cm)'], dataframe_setosa['sepal width (cm)'],color="green",marker='+')
def scatter(x, y, s=None, c=None, marker=None, cmap=None, norm=None, vmin=None, vmax=None, alpha=None, linewidths=None, verts=cbook.deprecation._deprecated_parameter, edgecolors=None, *, plotnonfinite=False, data=None, **kwargs)
Open in tab View source
A scatter plot of *y* vs. *x* with varying marker size and/or color.
Parameters
x, y : scalar or array-like, shape (n,)
The data positions.
s : scalar or array-like, shape (n,), optional
The marker size in points**2.
X = dataframe.drop(['target','flower_name'], axis='columns')
y = dataframe['target']
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2)
knn_model = KNeighborsClassifier(n_neighbors=5)
knn_model.fit(X_train,y_train)



Untitled0.ipynb
File Edit View Insert Runtime Tools Help Saving...
+ Code + Text
X = dataframe.drop(['target','flower_name'], axis='columns')
y = dataframe['target']
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2)
knn_model = KNeighborsClassifier(n_neighbors=5)
knn_model.fit(X_train,y_train)
knn_model.score(X_test,y_test)
0.9333333333333333
Setosa Vs Virginica
Sepal Width
Sepal Length

PRACTICAL-6

AIM: Study and Implement K-Fold cross validation and ROC

CODE:

ML_P6.ipynb

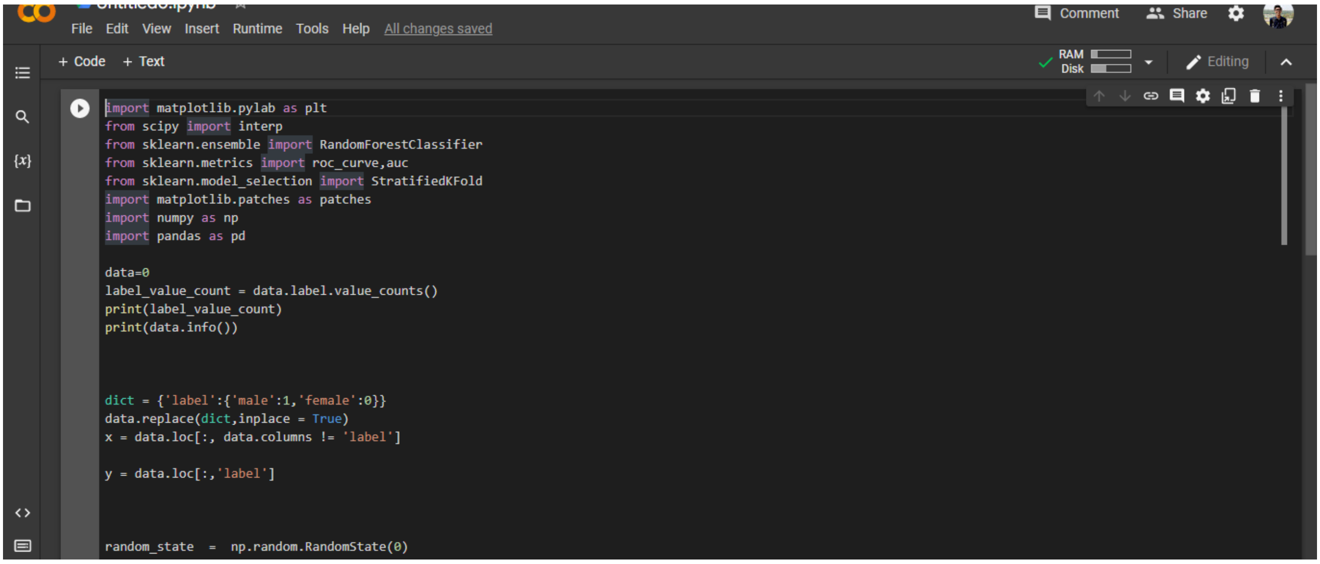
Implement K-Fold cross validation and ROC

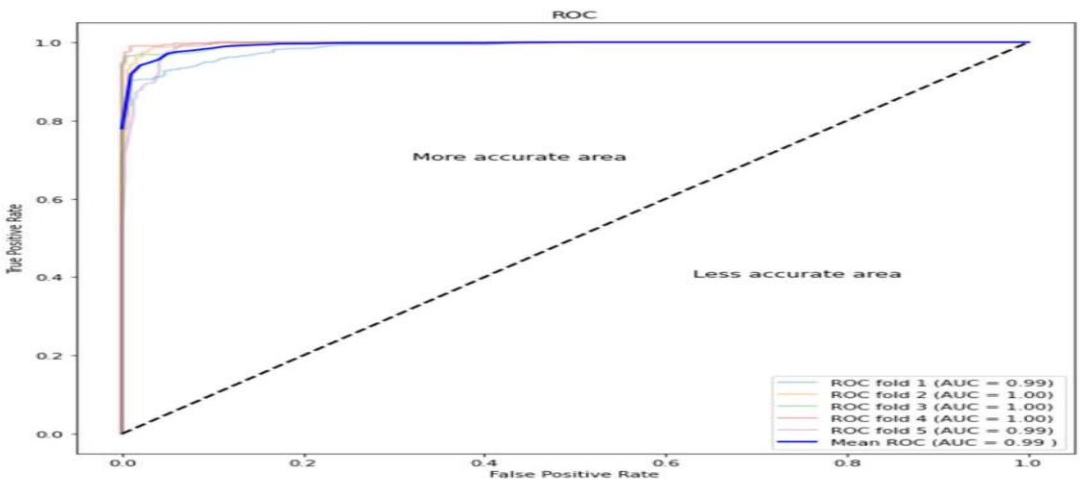
```
import matplotlib.pylab as plt

from scipy import interp

from sklearn.ensemble import RandomForestClassifier

from sklearn.metrics import roc_curve,auc

from sklearn.model_selection import StratifiedKFold

import matplotlib.patches as patches

import numpy as np

import pandas as pd


data = pd .read_csv('/content/drive/MyDrive/ML/voice.csv')

print(data.columns)

label_value_count = data.label.value_counts()

print(label_value_count)

print(data.info())


dict = {'label':{'male':1,'female':0}}

data.replace(dict,inplace = True)

x = data.loc[:, data.columns != 'label']
```

```
y = data.loc[:,'label']

random_state  =  np.random.RandomState(0)
clf = RandomForestClassifier(random_state=random_state)
cv = StratifiedKFold(n_splits=5,shuffle=False)

fig1 = plt.figure(figsize=[12,12])
ax1 = fig1.add_subplot(111,aspect = 'equal')

tprs = []
aucs = []
mean_fpr = np.linspace(0,1,100)
i = 1
for train,test in cv.split(x,y):
    prediction = clf.fit(x.iloc[train],y.iloc[train]).predict_proba(x.iloc[test])
    fpr, tpr, t = roc_curve(y[test], prediction[:, 1])
    tprs.append(interp(mean_fpr, fpr, tpr))
    roc_auc = auc(fpr, tpr)
    aucs.append(roc_auc)
    plt.plot(fpr, tpr, lw=2, alpha=0.3, label='ROC fold %d (AUC = %0.2f)' % (i, roc_auc))
    i= i+1

plt.plot([0,1],[0,1],linestyle = '--',lw = 2,color = 'black')
mean_tpr = np.mean(tprs, axis=0)
mean_auc = auc(mean_fpr, mean_tpr)
plt.plot(mean_fpr, mean_tpr, color='blue',
```

```
    label=r'Mean ROC (AUC = %0.2f )' % (mean_auc),lw=2, alpha=1)
plt.xlabel('False Positive Rate')
plt.ylabel('True Positive Rate')
plt.title('ROC')
plt.legend(loc="lower right")
plt.text(0.32,0.7,'More accurate area',fontsize = 12)
plt.text(0.63,0.4,'Less accurate area',fontsize = 12)
plt.show()
```

OUTPUT:





PRACTICAL-7

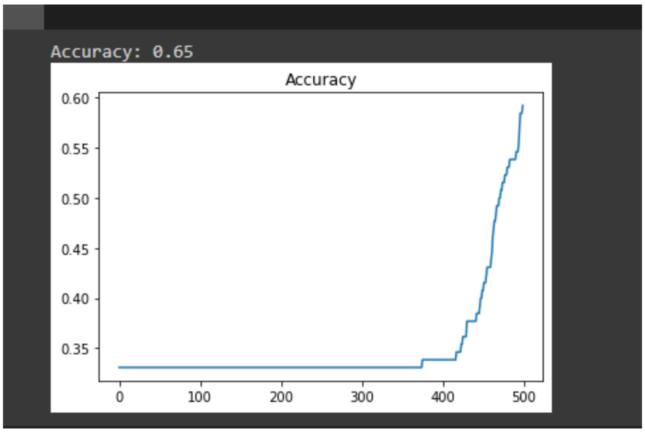
AIM: Implement BPNN Classifier in python

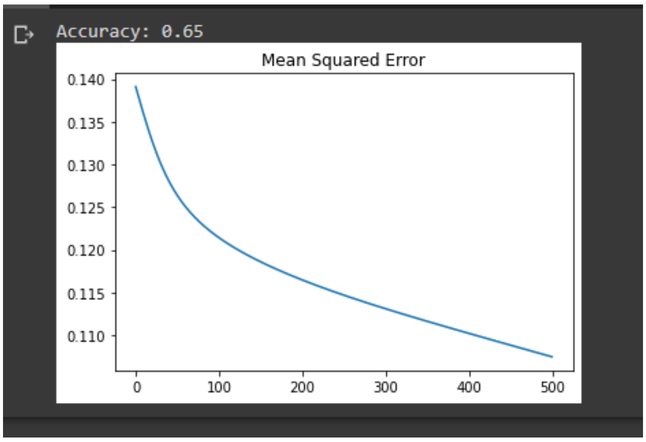
CODE:

```
import numpy as np

import pandas as pd

from sklearn.datasets import load_iris

from sklearn.model_selection import train_test_split

import matplotlib.pyplot as plt

data = load_iris()
X=data.data

y=data.target

y = pd.get_dummies(y).values

y[:3]

X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=20, random_state=4)

learning_rate = 0.1

iterations = 500

N=y_train.size

input_size = 4

hidden_size = 2
output_size = 3
results = pd.DataFrame(columns=["mse", "accuracy"])
np.random.seed(10)

W1 = np.random.normal(scale=0.5, size=(input_size, hidden_size))
W2 = np.random.normal(scale=0.5, size=(hidden_size , output_size))
def sigmoid(x):
   return 1 / (1 + np.exp(-x))

def mean_squared_error(y_pred, y_true):
   return ((y_pred - y_true)**2).sum() / (2*y_pred.size)

def accuracy(y_pred, y_true):
   acc = y_pred.argmax(axis=1) == y_true.argmax(axis=1)

   return acc.mean()
```

```
for itr in range(iterations):
    Z1 = np.dot(X_train, W1)
    A1 =sigmoid(Z1)
    Z2 = np.dot(A1, W2)
    A2 = sigmoid(Z2)
    mse = mean_squared_error(A2, y_train)
    acc = accuracy(A2, y_train)
    results=results.append({"mse":mse, "accuracy":acc},ignore_index=True )
    E1 = A2 - y_train
    dW1 = E1 * A2 * (1 - A2)
    E2 = np.dot(dW1, W2.T)
    dW2 = E2 * A1 * (1 - A1)
    W2_update = np.dot(A1.T, dW1) / N
    W1_update = np.dot(X_train.T, dW2) / N
    W2 = W2 - learning_rate * W2_update
    W1 = W1 - learning_rate * W1_update
results.mse.plot(title="Mean Squared Error")
results.accuracy.plot(title="Accuracy")
Z1 = np.dot(X_test, W1)
A1 =sigmoid(Z1)
Z2 = np.dot(A1, W2)
A2 = sigmoid(Z2)
acc = accuracy(A2, y_test)
print("Accuracy: {}".format(acc))
```

OUTPUT:


Accuracy: 0.65
Accuracy
0.60
0.55
0.50
0.45
0.40
0.35
0
100
200
300
400
500


Accuracy: 0.65
Mean Squared Error
0.140
0.135
0.130
0.125
0.120
0.115
0.110
0
100
200
300
400
500

PRACTICAL-8

AIM: Study and Implement various Ensemble method of classifier : Bagging,Boosting and Stacking

CODE:

ML_P8.ipynb

Study and Implement various Ensemble method of classifier : Bagging, Boosting, Stacking

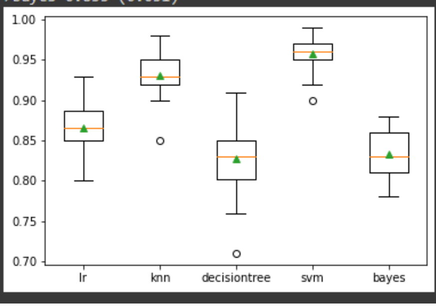
```
from numpy import mean
from numpy import std
from sklearn.datasets import make_classification
from sklearn.model_selection import cross_val_score
from sklearn.model_selection import RepeatedStratifiedKFold
from sklearn.ensemble import BaggingClassifier
from sklearn.linear_model import LogisticRegression
from sklearn.neighbors import KNeighborsClassifier
from sklearn.tree import DecisionTreeClassifier
from sklearn.svm import SVC
from sklearn.naive_bayes import GaussianNB
from matplotlib import pyplot


#Bagging
X, y = make_classification(n_samples=1000, n_features=20, n_informative=15, n_redundant=5,
random_state=5)

model = BaggingClassifier()
```

```
cv = RepeatedStratifiedKFold(n_splits=10, n_repeats=3, random_state=1)
n_scores = cross_val_score(model, X, y, scoring='accuracy', cv=cv, n_jobs=-1, error_score='raise')
print('Accuracy: %.3f (%.3f)' % (mean(n_scores), std(n_scores)))




#Boosting
from sklearn.ensemble import GradientBoostingClassifier
X, y = make_classification(n_samples=1000, n_features=20, n_informative=15, n_redundant=5,
random_state=7)

model = GradientBoostingClassifier()

cv = RepeatedStratifiedKFold(n_splits=10, n_repeats=3, random_state=1)

n_scores = cross_val_score(model, X, y, scoring='accuracy', cv=cv, n_jobs=-1)

print('Mean Accuracy: %.3f (%.3f)' % (mean(n_scores), std(n_scores)))

def evaluate_model(model, X, y):
cv = RepeatedStratifiedKFold(n_splits=10, n_repeats=3, random_state=1)
scores = cross_val_score(model, X, y, scoring='accuracy', cv=cv, n_jobs=-1, error_score='raise')
return scores

#Stacking
```

```
X, y = make_classification(n_samples=1000, n_features=20, n_informative=15, n_redundant=5, random_state=1)


models = dict()

models['lr'] = LogisticRegression()

models['knn'] = KNeighborsClassifier()

models['decisiontree'] = DecisionTreeClassifier()

models['svm'] = SVC()

models['bayes'] = GaussianNB()


results, names = list(), list()

for name, model in models.items():

scores=evaluate_model(model,X,y)

results.append(scores)

names.append(name)

print('>%s %.3f (%.3f)' % (name, mean(scores), std(scores)))


pyplot.boxplot(results, labels=names, showmeans=True)

pyplot.show()
```

OUTPUT:

```
Accuracy: 0.860 (0.033)
Mean Accuracy: 0.898 (0.030)
>lr 0.866 (0.029)
>knn 0.931 (0.025)
>decisiontree 0.827 (0.041)
>svm 0.957 (0.020)
>bayes 0.833 (0.031)
```



PRACTICAL-9

AIM: Implement various Clustering algorithm in python.

CODE:

```
from numpy import where

from sklearn.datasets import make_classification

from matplotlib import pyplot

from numpy import unique

X, y = make_classification(n_samples=1000, n_features=2, n_informative=2, n_redundant=0,
n_clusters_per_class=1, random_state=4)

for class_value in range(2):
row_ix = where(y == class_value)
pyplot.scatter(X[row_ix, 0], X[row_ix, 1])
pyplot.show()

#KMeans
from sklearn.cluster import KMeans

model = KMeans(n_clusters=2)

model.fit(X)

ypredicted = model.predict(X)

clusters = unique(ypredicted)

for cluster in clusters:

row_ix = where(ypredicted == cluster)

pyplot.scatter(X[row_ix, 0], X[row_ix, 1])

pyplot.show()


#BIRCH

from sklearn.cluster import Birch

model = Birch(threshold=0.01, n_clusters=2)

model.fit(X)

ypredicted = model.predict(X)

clusters = unique(ypredicted)
```

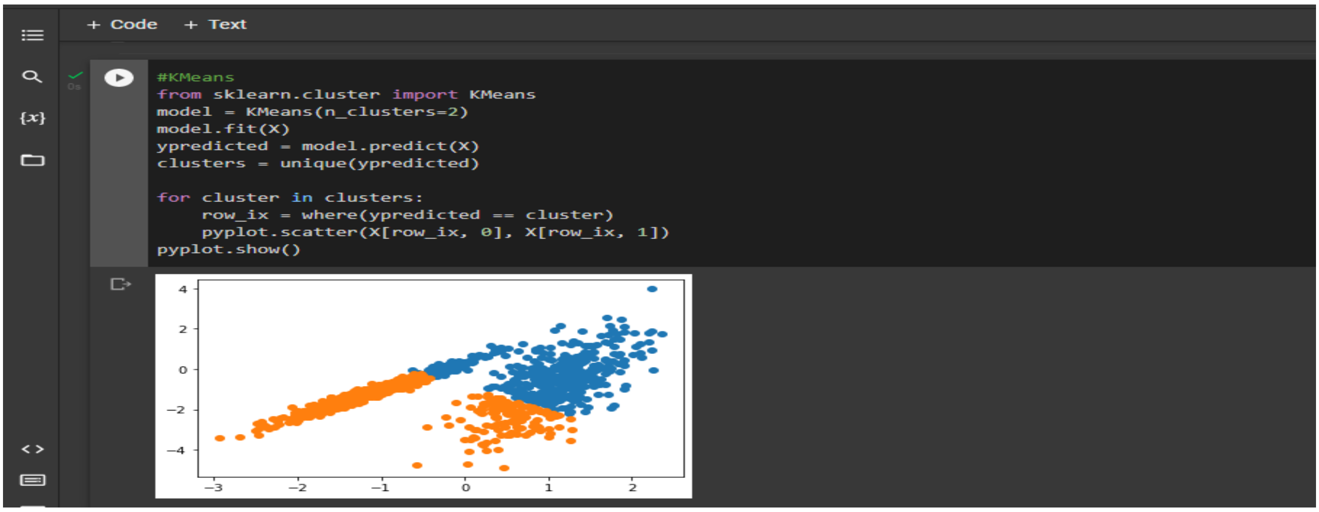
```
for cluster in clusters:

row_ix = where(ypredicted == cluster)

pyplot.scatter(X[row_ix, 0], X[row_ix, 1])

pyplot.show()

#DBSCAN
from sklearn.cluster import DBSCAN
model = DBSCAN(eps=0.30, min_samples=9)
ypredicted = model.fit_predict(X)

clusters = unique(ypredicted)

for cluster in clusters:
row_ix = where(ypredicted == cluster)

pyplot.scatter(X[row_ix, 0], X[row_ix, 1])

pyplot.show()


#MiniBatchKMeans
from sklearn.cluster import MiniBatchKMeans

model = MiniBatchKMeans(n_clusters=2)

model.fit(X)

ypredicted = model.fit_predict(X)

clusters = unique(ypredicted)

for cluster in clusters:

row_ix = where(ypredicted == cluster)

pyplot.scatter(X[row_ix, 0], X[row_ix, 1])

pyplot.show()

#MeanShift

from sklearn.cluster import MeanShift

model = MeanShift()

ypredicted = model.fit_predict(X)

clusters = unique(ypredicted)

for cluster in clusters:
```

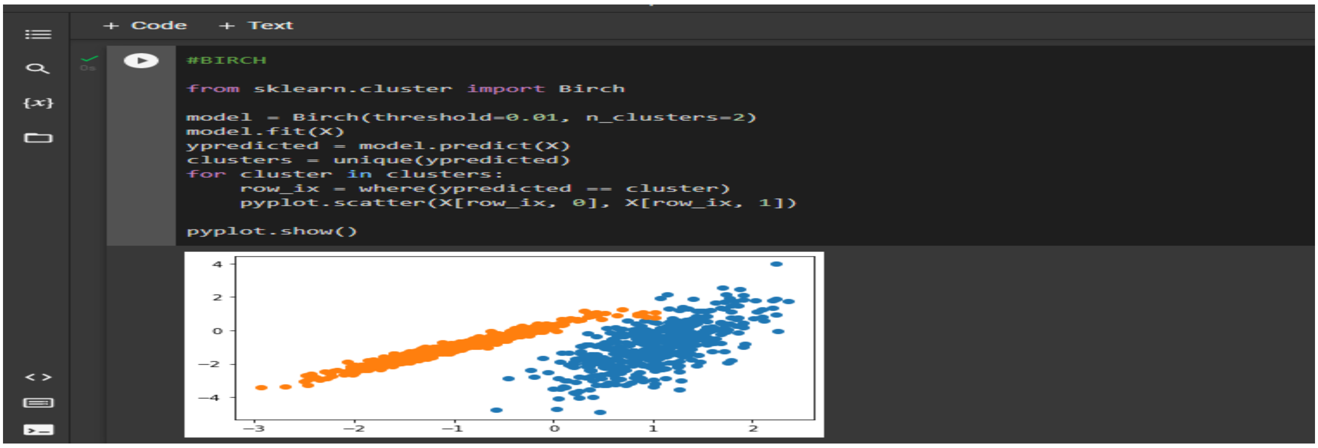
row_ix = where(ypredicted == cluster)

pyplot.scatter(X[row_ix, 0], X[row_ix, 1])

pyplot.show()

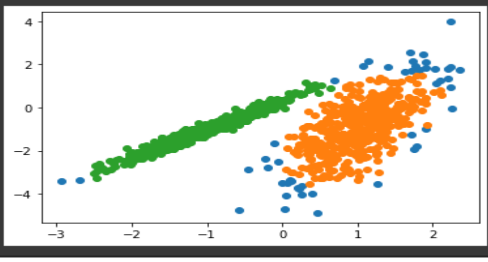
OUTPUT:





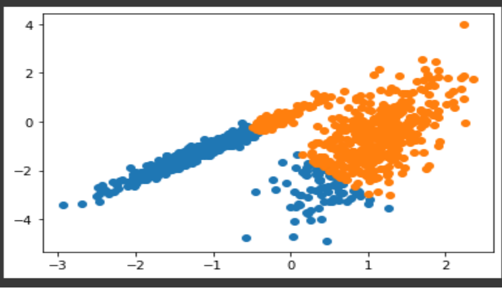
+ Code + Text

```
#DBSCAN
from sklearn.cluster import DBSCAN
model = DBSCAN(eps=0.30, min_samples=9)
ypredicted = model.fit_predict(X)
clusters = unique(ypredicted)
for cluster in clusters:
    row_ix = where(ypredicted == cluster)
    pyplot.scatter(X[row_ix, 0], X[row_ix, 1])
pyplot.show()
```

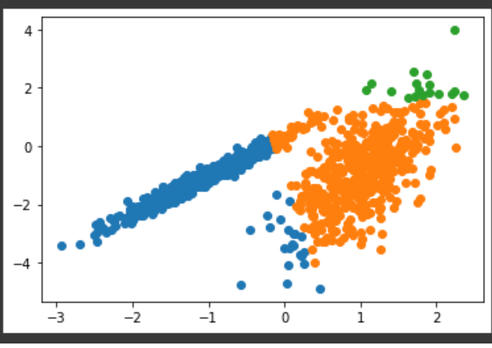


+ Code + Text

```
#MiniBatchKMeans
from sklearn.cluster import MiniBatchKMeans
model = MiniBatchKMeans(n_clusters=2)
model.fit(X)
ypredicted = model.fit_predict(X)
clusters = unique(ypredicted)
for cluster in clusters:
    row_ix = where(ypredicted == cluster)
    pyplot.scatter(X[row_ix, 0], X[row_ix, 1])
pyplot.show()
```




```
#MeanShift

from sklearn.cluster import MeanShift
model = MeanShift()
ypredicted = model.fit_predict(X)
clusters = unique(ypredicted)
for cluster in clusters:
    row_ix = where(ypredicted == cluster)
    pyplot.scatter(X[row_ix, 0], X[row_ix, 1])
pyplot.show()
```



PRACTICAL-10

AIM: Study and Implement various Dimensionality technique like PCA and LDA

CODE:

```
import numpy as np

import matplotlib.pyplot as plt

import pandas as pd

#PCA

dataset = pd.read_csv('/content/drive/MyDrive/ML/WineQT.csv')

dataset.head(5)

X=dataset.iloc[:, 0:11].values

y=dataset.iloc[:, 11].values

from sklearn.model_selection import train_test_split

X_train, X_test, y_train, y_test = train_test_split(X, y, test_size = 0.2, random_state = 0)

from sklearn.preprocessing import StandardScaler

sc = StandardScaler()

X_train = sc.fit_transform(X_train)

X_test = sc.transform(X_test)

from sklearn.decomposition import PCA

pca = PCA(n_components = 2)

X_train = pca.fit_transform(X_train)

X_test = pca.transform(X_test)

explained_variance = pca.explained_variance_ratio_
```

```
from sklearn.linear_model import LogisticRegression
classifier = LogisticRegression(random_state = 0)
classifier.fit(X_train, y_train)

y_pred = classifier.predict(X_test)
classifier.score(X_test,y_test)
```

#LDA:

```
dataset = pd.read_csv('/content/drive/MyDrive/ML/WineQT.csv')
dataset.head(5)
X = dataset.iloc[:, 0:11].values
y = dataset.iloc[:, 11].values
from sklearn.model_selection import train_test_split
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size = 0.2, random_state = 0)
from sklearn.discriminant_analysis import LinearDiscriminantAnalysis as LDA
lda = LDA(n_components = 2)
X_train = lda.fit_transform(X_train, y_train)
X_test = lda.transform(X_test)
from sklearn.linear_model import LogisticRegression
classifier = LogisticRegression(random_state = 0)
classifier.fit(X_train, y_train)
classifier = LogisticRegression(random_state = 0)
classifier.fit(X_train, y_train)

y_pred = classifier.predict(X_test)
classifier.score(X_test,y_test)
```

OUTPUT:

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

#PCA

dataset = pd.read_csv('Wine.csv')
dataset.head(5)
X = dataset.iloc[:, 0:11].values
y = dataset.iloc[:, 11].values
from sklearn.model_selection import train_test_split

X_train, X_test, y_train, y_test = train_test_split(X, y, test_size = 0.2, random_state = 0)
from sklearn.preprocessing import StandardScaler
sc = StandardScaler()

X_train = sc.fit_transform(X_train)
X_test = sc.transform(X_test)
from sklearn.decomposition import PCA
pca = PCA(n_components = 2)
X_train = pca.fit_transform(X_train)
X_test = pca.transform(X_test)
explained_variance = pca.explained_variance_ratio_
```

```
dataset = pd.read_csv('Wine.csv')
dataset.head(5)
X = dataset.iloc[:, 0:11].values
y = dataset.iloc[:, 11].values
from sklearn.model_selection import train_test_split

X_train, X_test, y_train, y_test = train_test_split(X, y, test_size = 0.2, random_state = 0)
from sklearn.discriminant_analysis import LinearDiscriminantAnalysis as LDA
lda = LDA(n_components = 2)

from sklearn.linear_model import LogisticRegression
classifier = LogisticRegression(random_state = 0)
classifier = LogisticRegression(random_state = 0)
```

PRACTICAL-11

AIM: Course project on Recommender System, Sentiment Analysis, Image Captioning, Object detection

Recommendation engines are a subclass of machine learning which generally deal with ranking or rating products / users. Loosely defined, a recommender system is a system which predicts ratings a user might give to a specific item. These predictions will then be ranked and returned back to the user.

Sentiment analysis can help you determine the ratio of positive to negative engagements about a specific topic. You can analyze bodies of text, such as comments, tweets, and product reviews, to obtain insights from your audience.

Image Captioning is the process of generating textual description of an image. It uses both Natural Language Processing and Computer Vision to generate the captions. The dataset will be in the form **[**image → captions**]**. The dataset consists of input images and their corresponding output captions.

Object Recognition is a technology that lies under the broader domain of Computer Vision. This technology is capable of identifying objects that exist in images and videos and tracking them. Object Recognition also known as Object Detection, has various applications like face recognition, vehicle recognition, pedestrian counting, self-driving vehicles, security systems, and a lot more.

CODE:

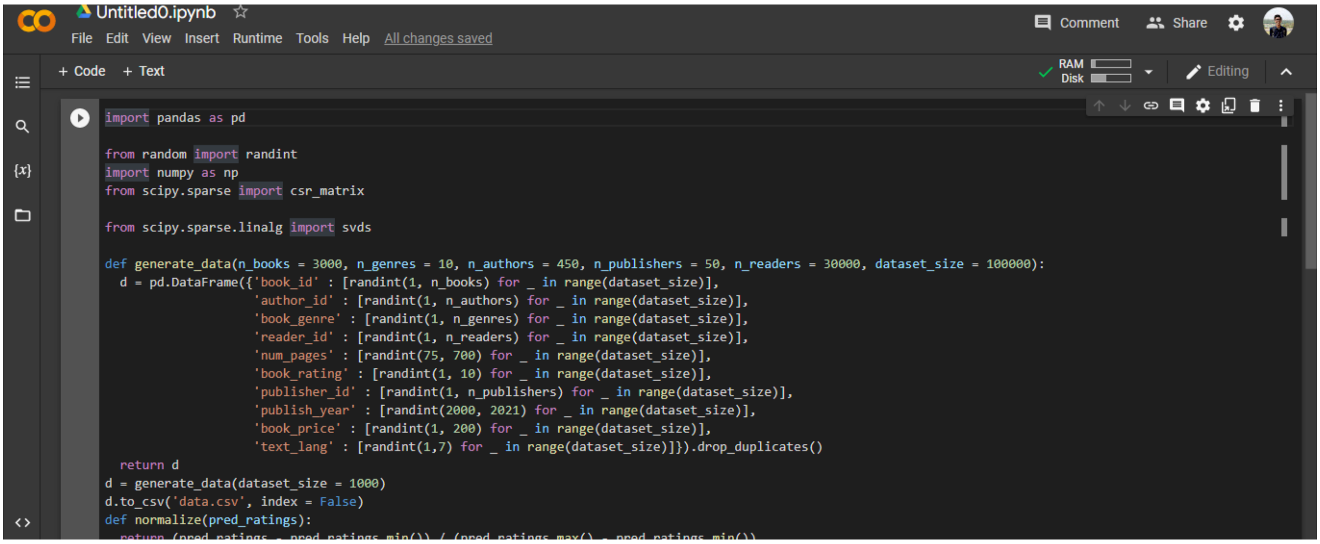
ML_P11.ipynb

```
import pandas as pd

from random import randint

import numpy as np

from scipy.sparse import csr_matrix
```

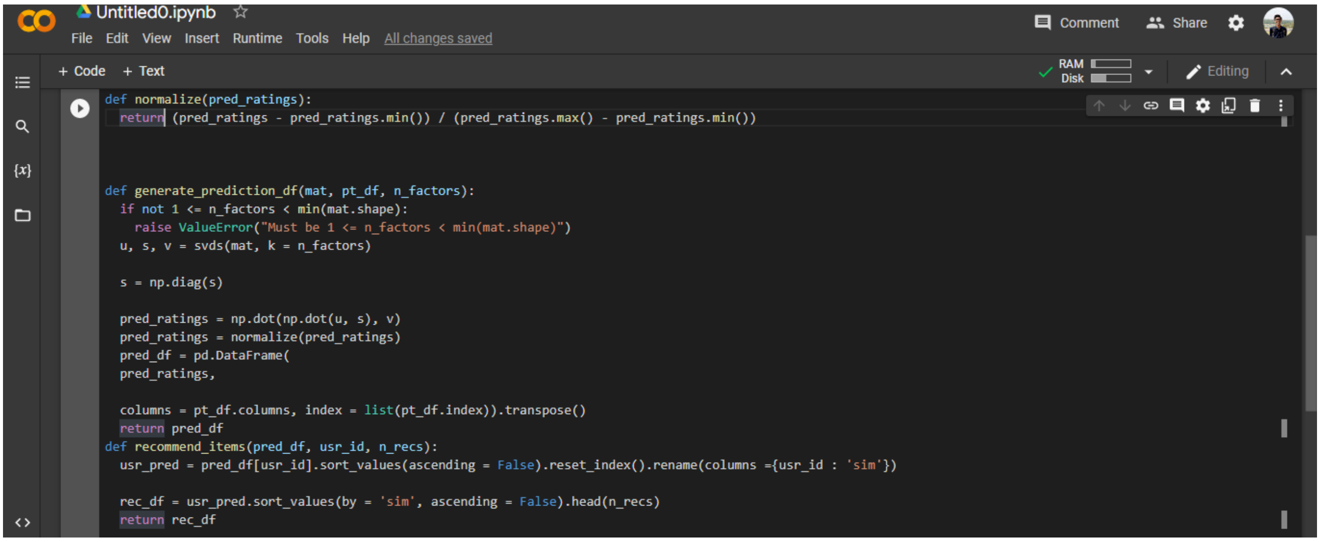
```
from scipy.sparse.linalg import svds

def generate_data(n_books = 3000, n_genres = 10, n_authors = 450, n_publishers = 50, n_readers = 30000, dataset_size = 100000):

  d = pd.DataFrame(

    {

      'book_id' : [randint(1, n_books) for _ in range(dataset_size)],

      'author_id' : [randint(1, n_authors) for _ in range(dataset_size)],

      'book_genre' : [randint(1, n_genres) for _ in range(dataset_size)],

      'reader_id' : [randint(1, n_readers) for _ in range(dataset_size)],

      'num_pages' : [randint(75, 700) for _ in range(dataset_size)],

      'book_rating' : [randint(1, 10) for _ in range(dataset_size)],

      'publisher_id' : [randint(1, n_publishers) for _ in range(dataset_size)],

      'publish_year' : [randint(2000, 2021) for _ in range(dataset_size)],

      'book_price' : [randint(1, 200) for _ in range(dataset_size)],

      'text_lang' : [randint(1,7) for _ in range(dataset_size)]

    }

  ).drop_duplicates()

  return d

d = generate_data(dataset_size = 1000)

d.to_csv('data.csv', index = False)

def normalize(pred_ratings):

  return (pred_ratings - pred_ratings.min()) / (pred_ratings.max() - pred_ratings.min())


def generate_prediction_df(mat, pt_df, n_factors):

  if not 1 <= n_factors < min(mat.shape):

    raise ValueError("Must be 1 <= n_factors < min(mat.shape)")

  u, s, v = svds(mat, k = n_factors)
```

```
    s = np.diag(s)
    pred_ratings = np.dot(np.dot(u, s), v)
    pred_ratings = normalize(pred_ratings)
    pred_df = pd.DataFrame(
        pred_ratings,
        columns = pt_df.columns,
        index = list(pt_df.index)
    ).transpose()
    return pred_df
def recommend_items(pred_df, usr_id, n_recs):
    usr_pred = pred_df[usr_id].sort_values(ascending = False).reset_index().rename(columns = 
{usr_id : 'sim'})
    rec_df = usr_pred.sort_values(by = 'sim', ascending = False).head(n_recs)
    return rec_df
if __name__== '_main_':
    PATH ='/content/data.csv'
    df = pd.read_csv(PATH)
    print(df.shape)
    pt_df = df.pivot_table(
        columns = 'book_id',
        index = 'reader_id',
        values = 'book_rating'
    ).fillna(0)
    mat = pt_df.values
    mat = csr_matrix(mat)
    pred_df = generate_prediction_df(mat, pt_df, 10)
    print(recommend_items(pred_df, 5, 5))
```

OUTPUT:




```python
import pandas as pd

from random import randint
import numpy as np
from scipy.sparse import csr_matrix

from scipy.sparse.linalg import svds

def generate_data(n_books = 3000, n_genres = 10, n_authors = 450, n_publishers = 50, n_readers = 30000, dataset_size = 100000):
  d = pd.DataFrame({'book_id' : [randint(1, n_books) for _ in range(dataset_size)],
                    'author_id' : [randint(1, n_authors) for _ in range(dataset_size)],
                    'book_genre' : [randint(1, n_genres) for _ in range(dataset_size)],
                    'reader_id' : [randint(1, n_readers) for _ in range(dataset_size)],
                    'num_pages' : [randint(75, 700) for _ in range(dataset_size)],
                    'book_rating' : [randint(1, 10) for _ in range(dataset_size)],
                    'publisher_id' : [randint(1, n_publishers) for _ in range(dataset_size)],
                    'publish_year' : [randint(2000, 2021) for _ in range(dataset_size)],
                    'book_price' : [randint(1, 200) for _ in range(dataset_size)],
                    'text_lang' : [randint(1,7) for _ in range(dataset_size)]}).drop_duplicates()
  return d
d = generate_data(dataset_size = 1000)
d.to_csv('data.csv', index = False)
def normalize(pred_ratings):
  return (pred_ratings - pred_ratings.min()) / (pred_ratings.max() - pred_ratings.min())
```




```python
def normalize(pred_ratings):
  return (pred_ratings - pred_ratings.min()) / (pred_ratings.max() - pred_ratings.min())



def generate_prediction_df(mat, pt_df, n_factors):
  if not 1 <= n_factors < min(mat.shape):
    raise ValueError("Must be 1 <= n_factors < min(mat.shape)")
  u, s, v = svds(mat, k = n_factors)

  s = np.diag(s)

  pred_ratings = np.dot(np.dot(u, s), v)
  pred_ratings = normalize(pred_ratings)
  pred_df = pd.DataFrame(
  pred_ratings,

  columns = pt_df.columns, index = list(pt_df.index)).transpose()
  return pred_df
def recommend_items(pred_df, usr_id, n_recs):
  usr_pred = pred_df[usr_id].sort_values(ascending = False).reset_index().rename(columns ={usr_id : 'sim'})

  rec_df = usr_pred.sort_values(by = 'sim', ascending = False).head(n_recs)
  return rec_df
```