```
import warnings
warnings.filterwarnings('ignore')
```

K-Nearest-Neighbors

KNN falls in the supervised learning family of algorithms. Informally, this means that we are given a labelled data would like to capture the relationship between x and y. More formally, our goal is to learn a function h:X→Y so tha confidently predict the corresponding output y.

In this module we will explore the inner workings of KNN, choosing the optimal K values and using KNN from scil

Overview

1.Read the problem statement.

2.Get the dataset.

3.Explore the dataset.

4.Pre-processing of dataset.

5.Visualization

6.Transform the dataset for building machine learning model.

7.Split data into train, test set.

7.Build Model.

8.Apply the model.

9.Evaluate the model.

10.Finding Optimal K value

11.Repeat 7,8,9 steps.

Problem statement

Dataset

The data set we'll be using is the Iris Flower Dataset which was first introduced in 1936 by the famous statisticia from each of three species of Iris (Iris setosa, Iris virginica and Iris versicolor). Four features were measured from sepals and petals.

Attributes of the dataset: https://archive.ics.uci.edu/ml/datasets/Iris

Train the KNN algorithm to be able to distinguish the species from one another given the measurements of the

Saved successfully!

Question 1

Import the data set and print 10 random rows from the data set

```
import numpy as np
import pandas as pd
from sklearn.neighbors import KNeighborsClassifier,NearestNeighbors
from sklearn.model_selection import train_test_split,cross_val_score
```

```
from scipy.stats import zscore
from sklearn.preprocessing import Imputer
from sklearn import preprocessing
from sklearn.metrics import accuracy_score
import seaborn as sns
import os
import matplotlib.pyplot as plt
%matplotlib inline
```

```
from google.colab import drive
drive.mount('/content/drive')
file = '/content/drive/My Drive/PGML/supervisedlearning/Residency-III-lab/Iris.csv'
```

```
Go to this URL in a browser: https://accounts.google.com/o/oauth2/auth?client_

Enter your authorization code:
··········
Mounted at /content/drive
```

```
df = pd.read_csv(file)
randRows = df.sample(n=10, random_state=1)
randRows
```

	SepalLengthInCm	SepalWidthInCm	PetallengthInCm	PetalwidthInCm	Cla
14	5.8	4.0	1.2	0.2	Iris-setc
98	5.1	2.5	3.0	1.1	Iris-versicc
75	6.6	3.0	4.4	1.4	Iris-versicc
16	5.4	3.9	1.3	0.4	Iris-setc
131	7.9	3.8	6.4	2.0	Iris-virgin
56	6.3	3.3	4.7	1.6	Iris-versicc
141	6.9	3.1	5.1	2.3	Iris-virgin
44	5.1	3.8	1.9	0.4	Iris-setc
29	4.7	3.2	1.6	0.2	Iris-setc
120	6.9	3.2	5.7	2.3	Iris-virgin

Data Pre-processing

Saved successfully!

ing values

*its not good to remove the records having missing values all the time. We may end up loosing some data points missing values with some estimated values (median) *

```
df.isnull().values.any()
# there is n ot null value so ignoring this step but we can achieve using df = df.groupby
```

```
False
```

Question 3 - Dealing with categorical data

Change all the classes to numericals (0to2).

```
LabelEncoder = preprocessing.LabelEncoder()
df['Class'] = LabelEncoder.fit_transform(df['Class'])
df.head()
```

	SepalLengthInCm	SepalWidthInCm	PetallengthInCm	PetalwidthInCm	Class
0	5.1	3.5	1.4	0.2	0
1	4.9	3.0	1.4	0.2	0
2	4.7	3.2	1.3	0.2	0
3	4.6	3.1	1.5	0.2	0
4	5.0	3.6	1.4	0.2	0

Question 4

Observe the association of each independent variable with target variable and drop variables from feature set havir

```
df.corr()
```

	SepalLengthInCm	SepalWidthInCm	PetallengthInCm	PetalwidthIn
SepalLengthInCm	1.000000	-0.109369	0.871754	0.8179
SepalWidthInCm	-0.109369	1.000000	-0.420516	-0.3565
PetallengthInCm	0.871754	-0.420516	1.000000	0.9627
PetalwidthInCm	0.817954	-0.356544	0.962757	1.0000
Class	0.782561	-0.419446	0.949043	0.9564

```
#as SepalWidthin(cm) is not corelating with target field class, droping the same
df.drop('SepalWidthInCm', axis=1, inplace=True)
```

Saved successfully!

	SepalLengthInCm	PetallengthInCm	PetalwidthInCm	Class
0	5.1	1.4	0.2	0
1	4.9	1.4	0.2	0
2	4.7	1.3	0.2	0
3	4.6	1.5	0.2	0
4	5.0	1.4	0.2	0

Question 5

Observe the independent variables variance and drop such variables having no variance or almost zero variance(va influence on the classification.

```
df.var()
# there is not fecture which could be drop as variance is >0.1 for all features
```

```
SepalLengthInCm    0.685694
PetallengthInCm    3.113179
PetalwidthInCm     0.582414
Class              0.671141
dtype: float64
```

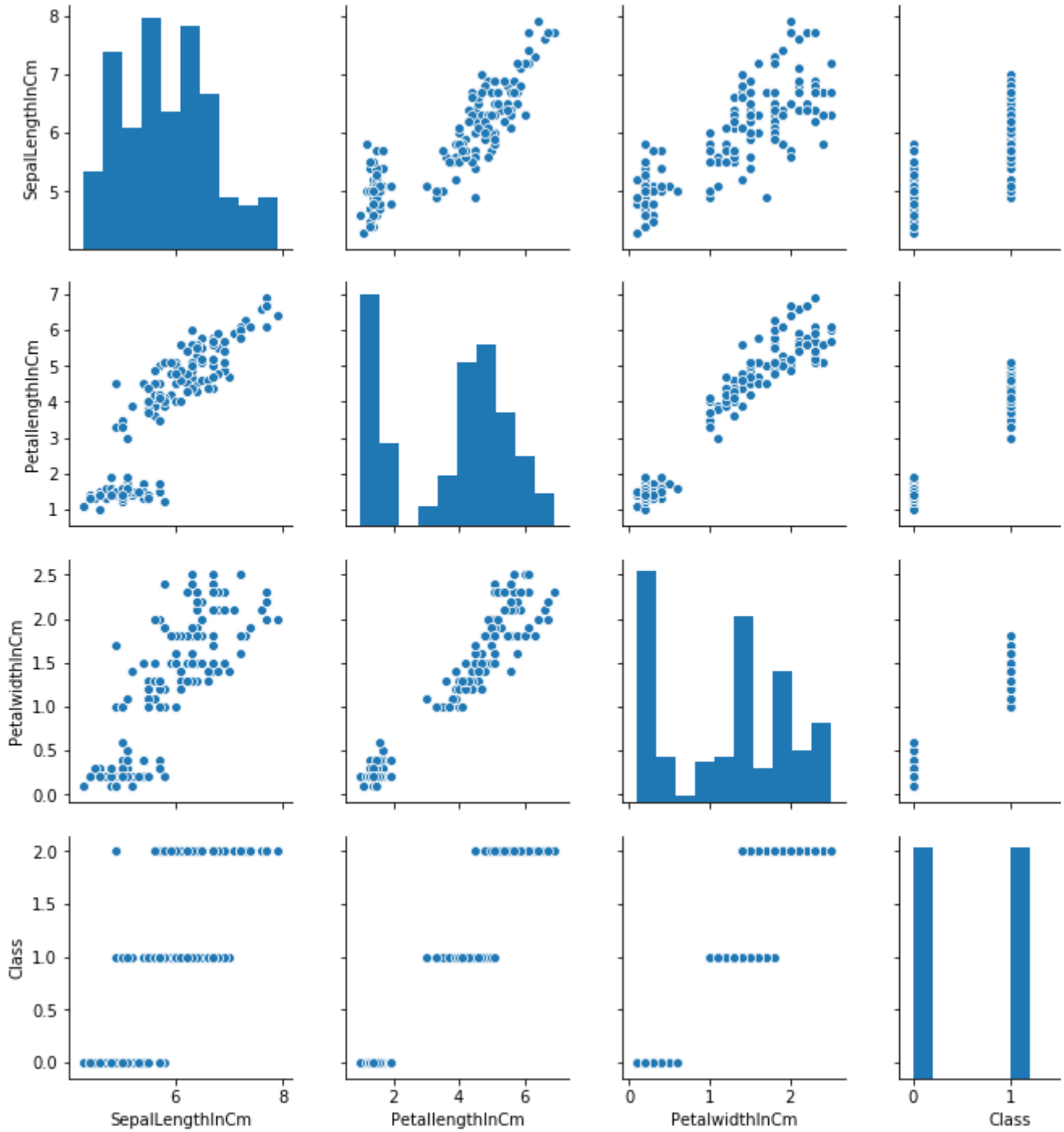
Question 6

Plot the scatter matrix for all the variables.

```
sns.pairplot(df)
```

Saved successfully!

```
<seaborn.axisgrid.PairGrid at 0x7f0d87620cc0>
```



Split the dataset into training and test sets

Question 7

th 80-20 ratio.

Saved successfully!

```
x = df.drop(['Class'], axis=1)

y = df[['Class']]

X train, X test, y train, y test = train_test_split(x, y, test_size=0.2, random_state=1)
y_train = y_train.values.ravel()
```

Question 8 - Model

*Build the model and train and test on training and test sets respectively using **scikit-learn**. Print the Accuracy of the*

Hint: For accuracy you can check **accuracy_score()** in scikit-learn

```
listK = [3,5,9]

for i in listK:
  Model = KNeighborsClassifier(n_neighbors = i, weights = 'uniform', metric = 'euclidean'
  Model.fit(X_train, y_train)
  pridict = pd.DataFrame(Model.predict(X_test))
  aquracy = accuracy_score(y_test, pridict)
  print(aquracy)
```

```
1.0
1.0
0.9666666666666667
```

Question 9 - Cross Validation

Run the KNN with no of neighbours to be 1,3,5..19 and *Find the* *optimal number of neighbours** from the above

Hint:

Misclassification error (MSE) = 1 - Test accuracy score. Calculated MSE for each model with neighbours = 1,3,5..

```
listN = [1,3,5,7,9,11,13,15,17,19]
cv_scores = []
for i in listN:
  Model = KNeighborsClassifier(n_neighbors = i)
  scores = cross_val_score(Model, X_train, y_train, cv=10, scoring='accuracy')
  cv_scores.append(scores.mean())

MSE = [1 - x for x in cv_scores]

# determining best k
optimal_k = listN[MSE.index(min(MSE))]
print("The optimal number of neighbors is %d" % optimal_k)
```

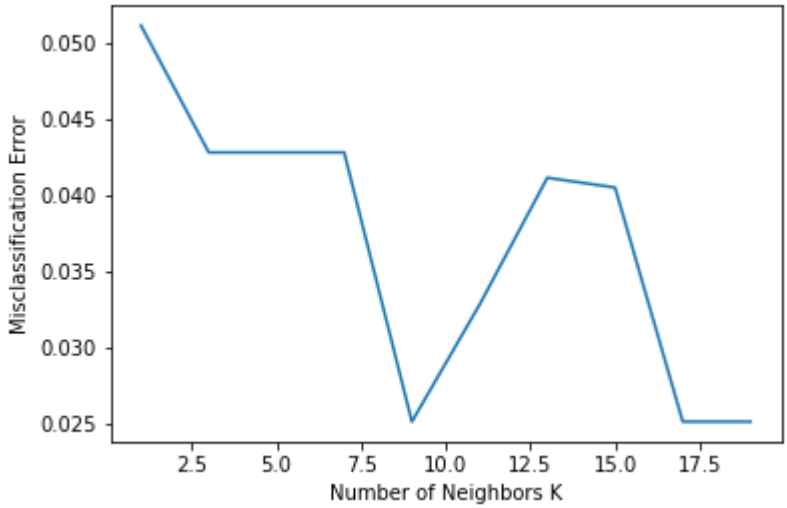
```
The optimal number of neighbors is 9
```

Question 10

Plot misclassification error vs k (with k value on X-axis) using matplotlib.

Saved successfully!

```
plt.plot(listN, MSE)
plt.xlabel('Number of Neighbors K')
plt.ylabel('Misclassification Error')
plt.show()
```



Naive Bayes with Iris Data

```
#Load all required library
import pandas as pd
import numpy as np
from matplotlib import pyplot as plt
%matplotlib inline
from sklearn import datasets
from sklearn.decomposition import PCA
from sklearn.preprocessing import MinMaxScaler
```

Slice Iris data set for Independent variables and dependent variables

Please note 'Species' is my dependent variables, name it y and independent set data as X

```
df = pd.read_csv(file)
LabelEncoder = preprocessing.LabelEncoder()
df['Class'] = LabelEncoder.fit_transform(df['Class'])


#as SepalWidthin(cm) is not corelating with target field class, droping the same
df.drop('SepalWidthInCm', axis=1, inplace=True)



X = df.drop(['Class'], axis=1)

#doing fetaure scaling here rather than in step 13(question-13)
scaler = MinMaxScaler()
X = pd.DataFrame(scaler.fit_transform(X), columns=X.columns)

y = df[['Class']]
```

Saved successfully!

```
print(y.head(5))
print(X.head(5))
```

```
   Class
0      0
1      0
2      0
3      0
4      0
   SepalLengthInCm  PetallengthInCm  PetalwidthInCm
0         0.222222         0.067797        0.041667
1         0.166667         0.067797        0.041667
2         0.111111         0.050847        0.041667
3         0.083333         0.084746        0.041667
4         0.194444         0.067797        0.041667
```

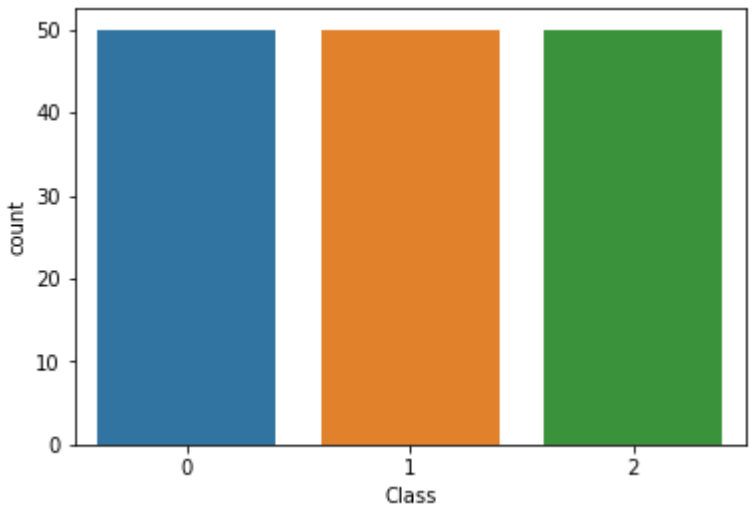
Question 11

Find the distribution of target variable (Class)

And, Plot the distribution of target variable using histogram

```
import seaborn as sns
sns.countplot(x='Class',data=df)
```

```
<matplotlib.axes._subplots.AxesSubplot at 0x7f0d849d4e80>
```




```
#Drop Id variable from data
# there is no Id variable in the current dataframe
```

Question 12

Saved successfully!

e your insights

```
#Please note, it's Require to remove correlated features because they are voted twice in
## it can lead to over inflating importance.We will ignore it here
```

```
# I have done the same in step 10 (question 10),as SepalWidthin(cm) is not corelating wit
```

Split data in Training and test set in 80:20.

```
X_train, X_test,Y_train,Y_test = train_test_split(X,y, test_size = 0.2)
Y_train = Y_train.values.ravel()
```

Question 13

Do Feature Scaling

```
# Use StandardScaler or similar methods
```

```
# I have done the same in step 10 (question 10)
```

Question 14

Train and Fit NaiveBayes Model

```
#Fit the model
from sklearn.naive_bayes import GaussianNB

clf_GNB = GaussianNB()
clf_GNB = clf_GNB.fit(X_train, Y_train)
```

```
#Predict
y_pred_GNB=clf_GNB.predict(X_test)
y_pred_GNB
```

```
array([1, 1, 2, 2, 2, 0, 2, 2, 2, 1, 2, 0, 2, 0, 1, 1, 1, 0, 1, 2, 0, 0,
       2, 0, 2, 1, 1, 2, 2, 2])
```

Question 15

Print Accuracy and Confusion Matrix and Conclude your findings

```
# show Confusion Matrix
from sklearn.metrics import confusion_matrix
confusion_matrix = confusion_matrix(Y_test, y_pred_GNB)
print(confusion_matrix)
```

```
[[ 7  0  0]
 [ 0  8  1]
 [ 0  1 13]]
```

Saved successfully!

```
y_score
```

```
0.9333333333333333
```

```
#Show precision and Recall metrics
```

```
from sklearn.metrics import classification_report
```

```
print(classification_report(Y_test, y_pred_GNB))
```

```
              precision    recall  f1-score   support

           0       1.00      1.00      1.00         7
           1       0.89      0.89      0.89         9
           2       0.93      0.93      0.93        14

    accuracy                           0.93        30
   macro avg       0.94      0.94      0.94        30
weighted avg       0.93      0.93      0.93        30
```

Saved successfully!