Python Lab Assignment-3

Name: Saketh Garuda

ID: 16

Objective:

The main objective for this lab assignment is to know the working of different classification models such Logistic Regression, Linear Discriminant Analysis, Support Vector Machine, KNN and natural language processing in python using NLTK. By using the above methods we met the following objectives,

- Compare contrast logistic regression and linear discriminant analysis
- Calculating best accuracy for the given dataset using the above models
- Applying SVC to different kernels such as Linear and RBF for predicting accuracy
- How KNN algorithm affecting the accuracy of the model

Features:

The code snippets are executed and debugged for purpose of software environment. The code snippets are written in such way that they won't affect the performance of the system when they are executed in multiple environments.

Configuration:

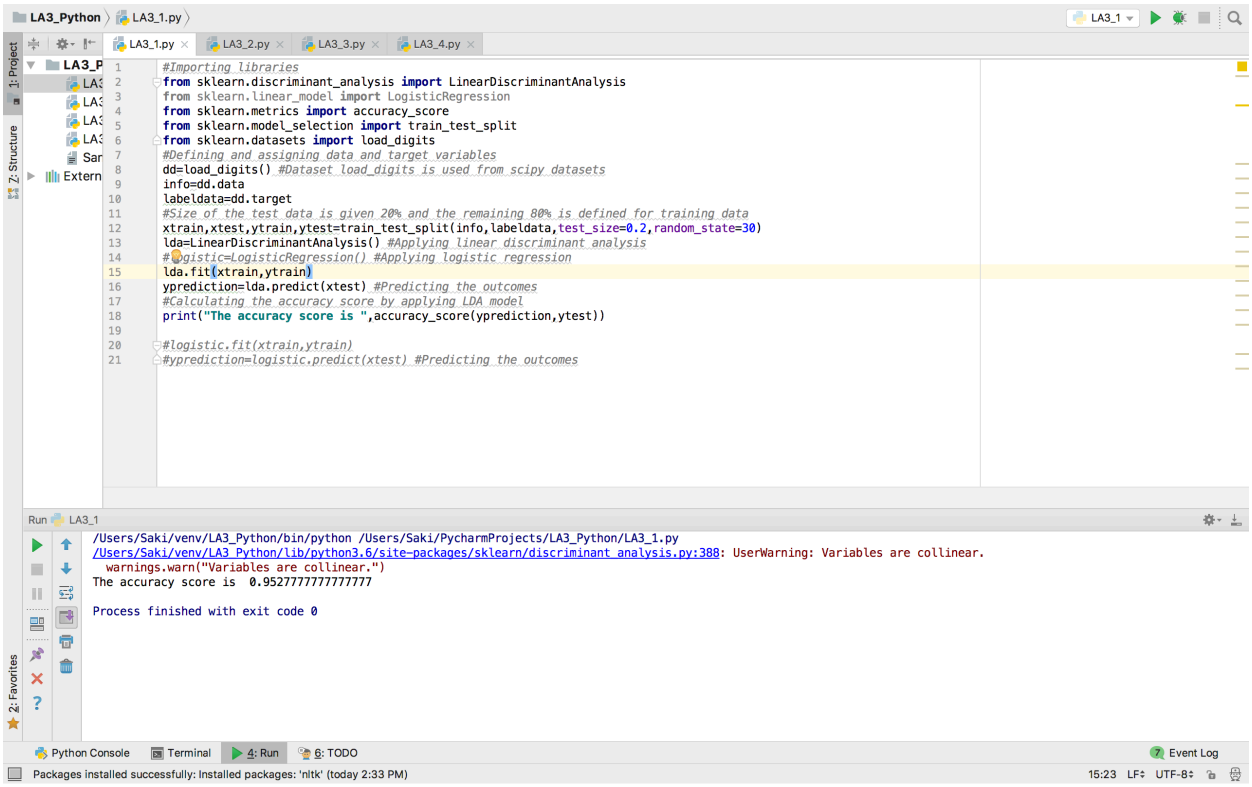
- PyCharm IDE
- Python 3.6.4
- NLTK

Screenshots:

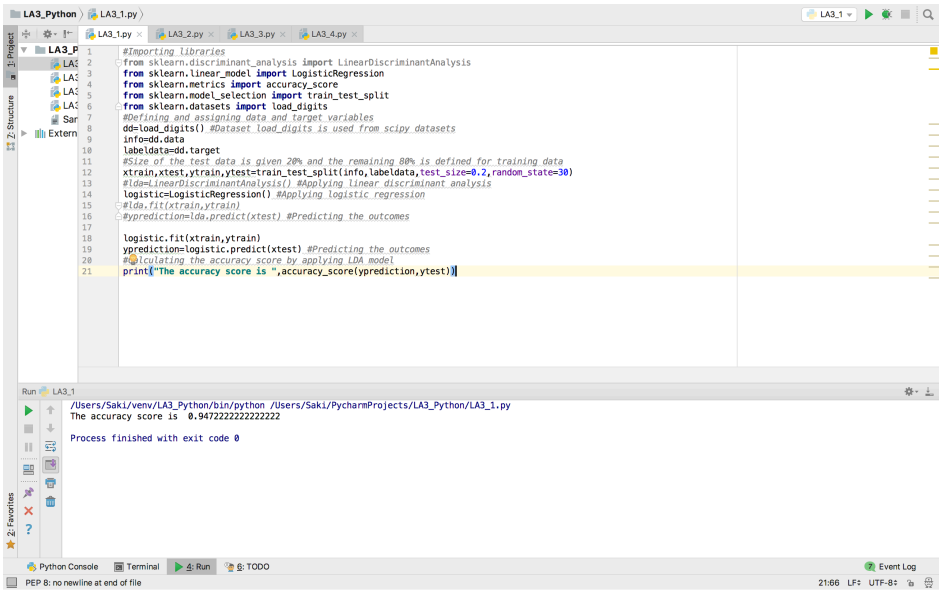
1) Choosing a dataset and making a prediction model using Linear Discriminant Analysis

Output:

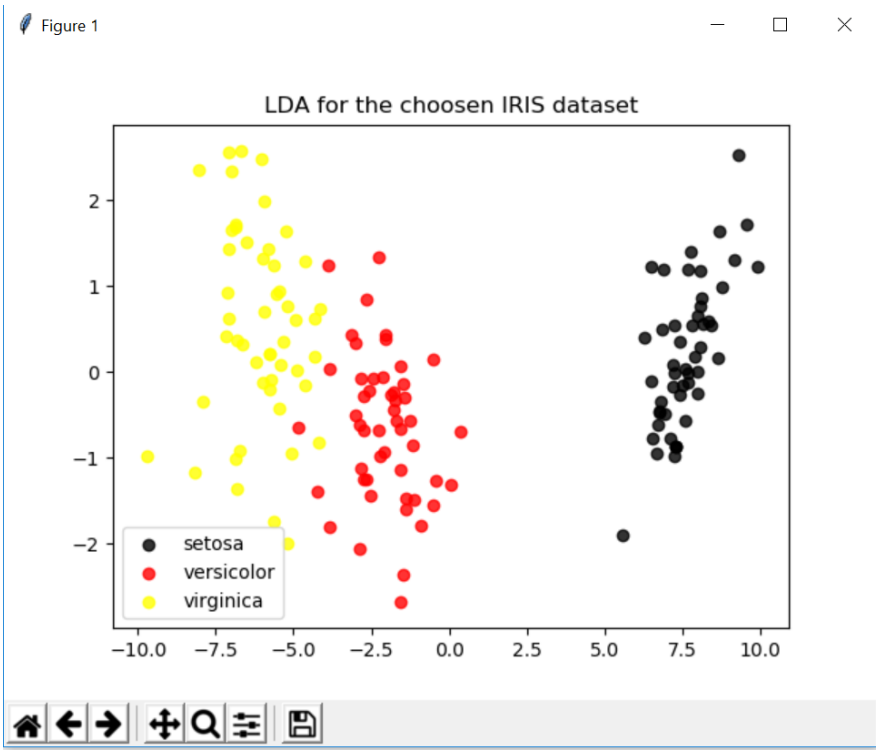
- Accuracy of the model using Linear Discriminant Analysis model



- Accuracy of the model using Logistic Regression model



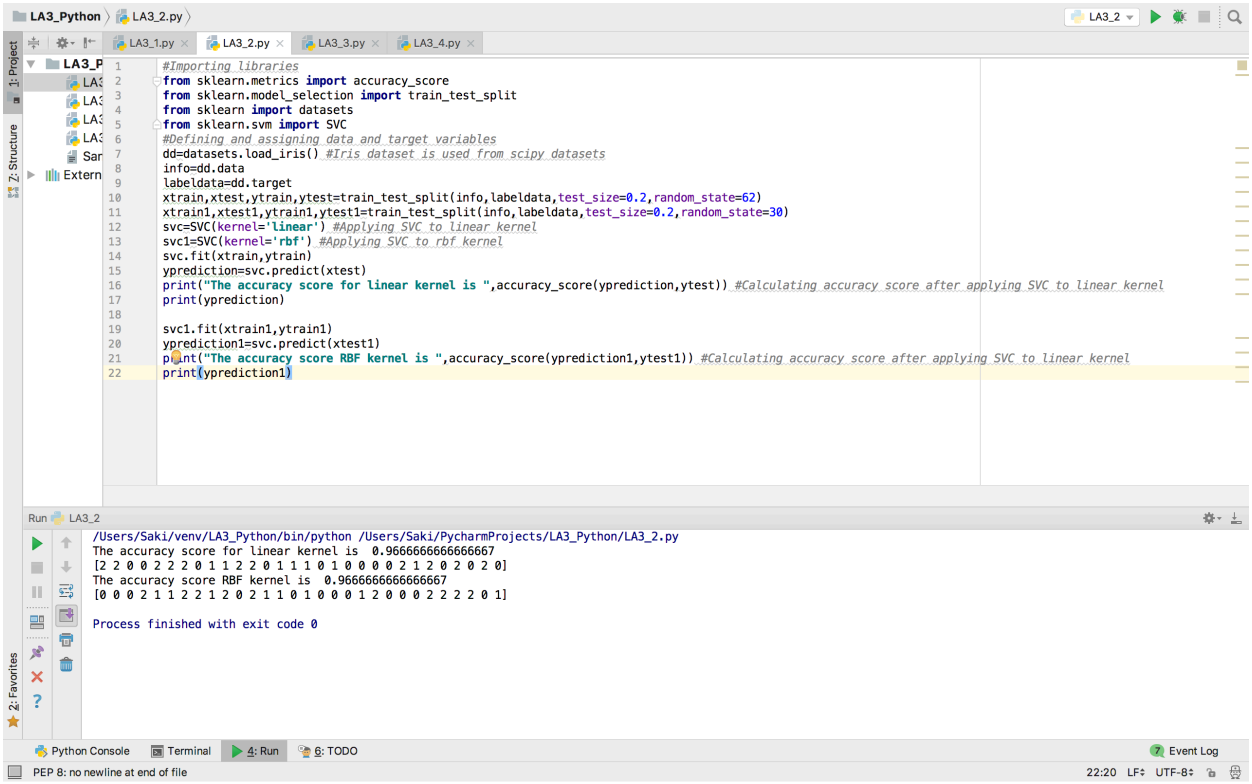
- Scatter plot for LDA model



2) Implementing Support Vector Machine classification model on the given dataset using Linear and RBF kernels.

Output:

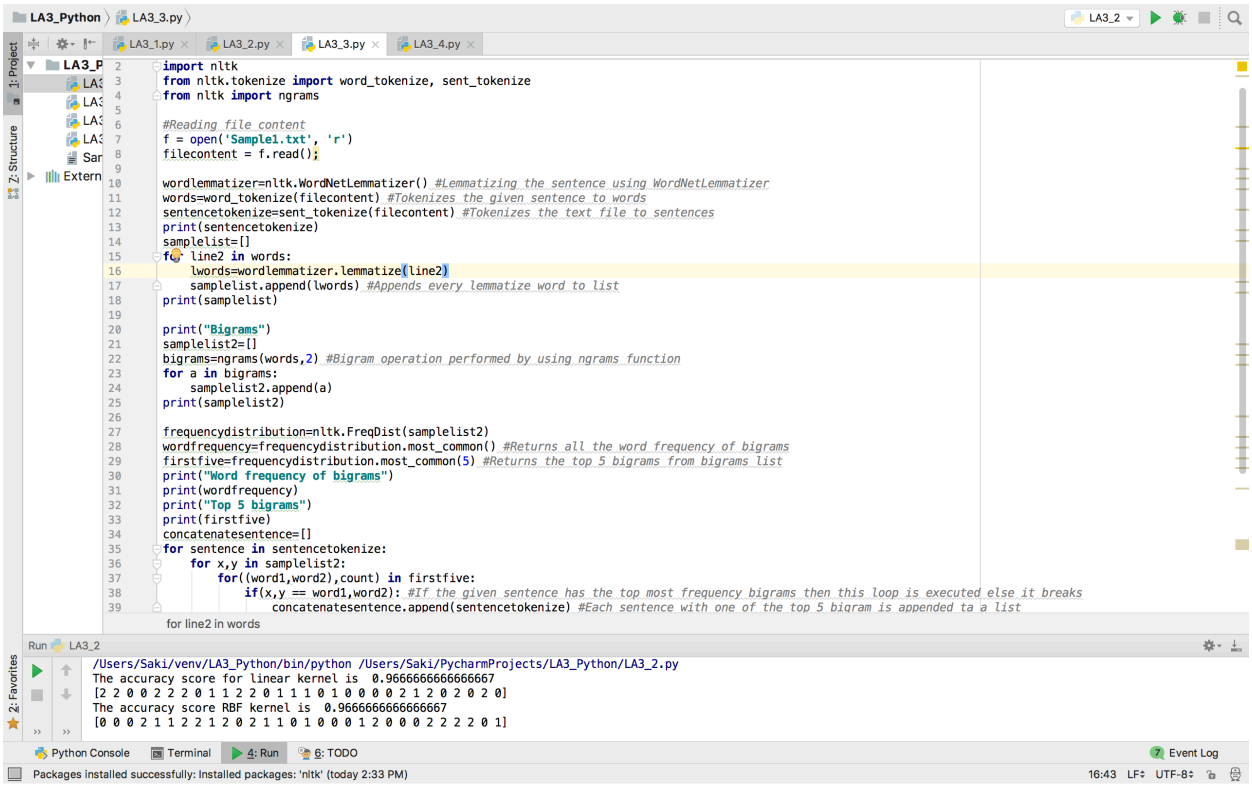
- Accuracy with linear kernel and accuracy with RBF kernel

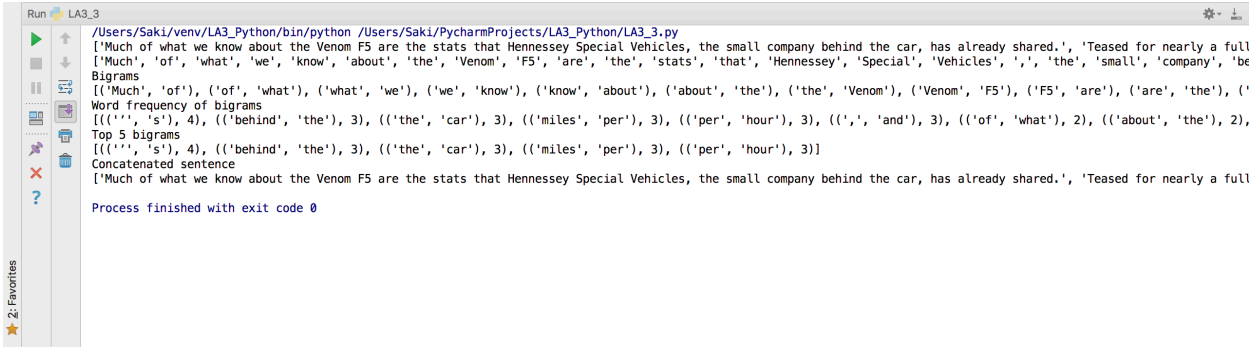


3) Applying lemmatization on a text file and find the word frequency of bi-grams. Also return the top five bigrams from the frequency of bigrams and return the concatenated sentence with the list of top five bigrams.

Output:

- The output file contains the lemmatized words and list of top five bigrams from the word frequency bigrams. The program also produces the concatenated sentence with the top five bigrams in the text content.

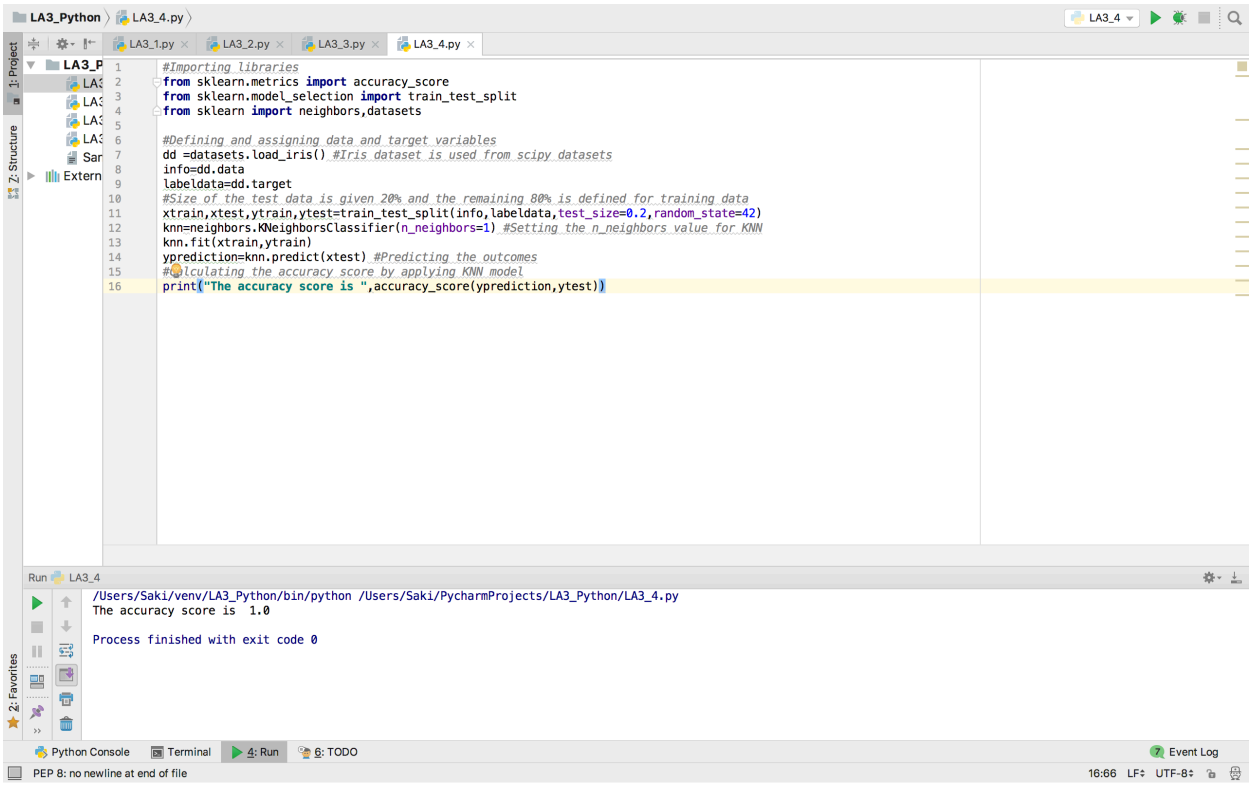




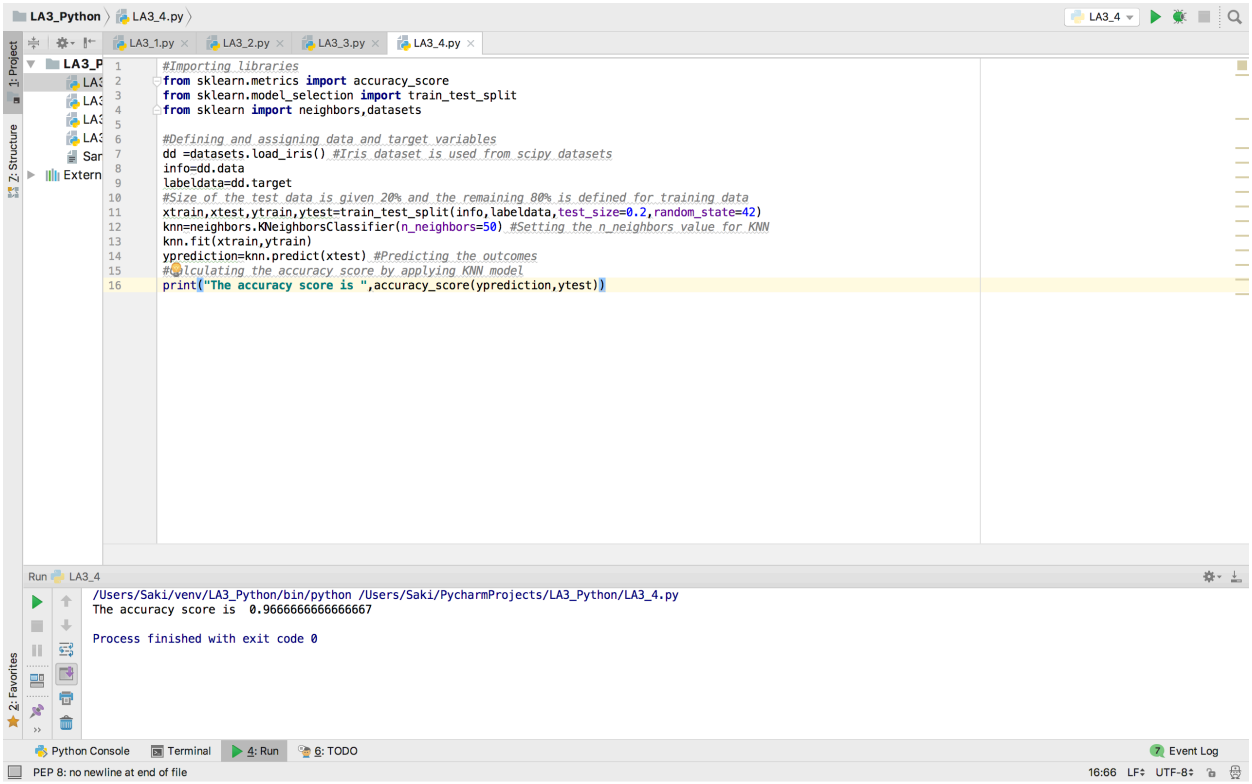
4) Report your views on the k nearest neighbor algorithm and how it affects the accuracy if value of k changes.

Output:

- Accuracy calculated using knn model with neighbors=1



- Accuracy calculated using knn model with neighbors=50



Code Snippets:

Solution for Problem 1:

Linear discriminant analysis LDA is applicable where the condition is mutually exclusive such that a dependent variable has two or more groups. Whereas in logistic regression the model is based on the combination of predictors and it provide only conditional distribution. Both LDA and Logistic regression models are based on linear-odd assumption but they estimate coefficients in different techniques.

Code Snippet 1:

```
#Importing libraries
import matplotlib.pyplot as plt
from sklearn.discriminant_analysis import LinearDiscriminantAnalysis
from sklearn.linear_model import LogisticRegression
from sklearn.metrics import accuracy_score
from sklearn.model_selection import train_test_split
from sklearn.datasets import load_digits
#Defining and assigning data and target variables
dd=load_digits() #Dataset load_digits is used from scipy datasets
info=dd.data
labeldata=dd.target
#Size of the test data is given 20% and the remaining 80% is defined for training data
xtrain,xtest,ytrain,ytest=train_test_split(info,labeldata,test_size=0.2,random_state=30)
lda=LinearDiscriminantAnalysis() #Applying linear discriminant analysis
#logistic=LogisticRegression() #Applying logistic regression
a=lda.fit(xtrain,ytrain)
yprediction=lda.predict(xtest) #Predicting the outcomes

#a=logistic.fit(xtrain,ytrain)
#yprediction=logistic.predict(xtest) #Predicting the outcomes
#Calculating the accuracy score by applying LDA model
print("The accuracy score is ",accuracy_score(yprediction,ytest))

plt.figure()
colours = ['red', 'black', 'yellow']
for x, y, z in zip(colours, [0, 1, 2], dd):
    plt.scatter(a[labeldata == y, 0], a[labeldata == y, 1], alpha=.8, color=x,
                label=z)
plt.legend(loc='best', shadow=False, scatterpoints=1)
```

```
plt.title('LDA for the given dataset is')
plt.show()
```

Solution for Problem 2:

The accuracy for both the models is different where accuracy score for linear kernel is 0.93333333 and accuracy for RBF kernel i.e. non-linear kernel is 1.0. Using linear when number of features is large whereas RBF kernel can be used when number of features is comparably smaller in size and expecting a predictive performance. For given iris dataset if the random state value is set higher for linear model than RBF kernel, then accuracy results of RBF model are best, vice-versa.

Code Snippet 2:

```
#Importing libraries
from sklearn.metrics import accuracy_score
from sklearn.model_selection import train_test_split
from sklearn import datasets
from sklearn.svm import SVC
#Defining and assigning data and target variables
dd=datasets.load_iris() #Iris dataset is used from scipy datasets
info=dd.data
labeldata=dd.target
xtrain,xtest,ytrain,ytest=train_test_split(info,labeldata,test_size=0.2,random_state=62)
xtrain1,xtest1,ytrain1,ytest1=train_test_split(info,labeldata,test_size=0.2,random_state=30)
svc=SVC(kernel='linear') #Applying SVC to linear kernel
svc1=SVC(kernel='rbf') #Applying SVC to rbf kernel
svc.fit(xtrain,ytrain)
yprediction=svc.predict(xtest)
print("The accuracy score for linear kernel is ",accuracy_score(yprediction,ytest)) #Calculating accuracy
score after applying SVC to linear kernel
print(yprediction)

svc1.fit(xtrain1,ytrain1)
yprediction1=svc.predict(xtest1)
print("The accuracy score RBF kernel is ",accuracy_score(yprediction1,ytest1)) #Calculating accuracy
score after applying SVC to linear kernel
print(yprediction1)
```

Code Snippet 3:

```
#Importing libraries
import nltk
from nltk.tokenize import word_tokenize, sent_tokenize
```

```
from nltk import ngrams

#Reading file content
f = open('Sample1.txt', 'r')
filecontent = f.read();

wordlemmatizer=nltk.WordNetLemmatizer() #Lemmatizing the sentence using WordNetLemmatizer
words=word_tokenize(filecontent) #Tokenizes the given sentence to words
sentencetokenize=sent_tokenize(filecontent) #Tokenizes the text file to sentences
print(sentencetokenize)
samplelist=[]
for line2 in words:
   lwords=wordlemmatizer.lemmatize(line2)
   samplelist.append(lwords) #Appends every lemmatize word to list
print(samplelist)

print("Bigrams")
samplelist2=[]
bigrams=ngrams(words,2) #Bigram operation performed by using ngrams function
for a in bigrams:
   samplelist2.append(a)
print(samplelist2)

frequencydistribution=nltk.FreqDist(samplelist2)
wordfrequency=frequencydistribution.most_common() #Returns all the word frequency of bigrams
firstfive=frequencydistribution.most_common(5) #Returns the top 5 bigrams from bigrams list
print("Word frequency of bigrams")
print(wordfrequency)
print("Top 5 bigrams")
print(firstfive)
concatenatesentence=[]
for sentence in sentencetokenize:
   for x,y in samplelist2:
      for((word1,word2),count) in firstfive:
         if(x,y == word1,word2): #If the given sentence has the top most frequency bigrams then this loop
is executed else it breaks
            concatenatesentence.append(sentencetokenize) #Each sentence with one of the top 5 bigram
is appended ta a list

print("Concatenated sentence") #The final concatenated sentence
print(max(concatenatesentence))
```

Solution for Problem 4:

The accuracy is affected whenever the K value is increased or decreased as it affects the test data point that belongs to the same class or different class. When K increases i.e. K=50, the resolution is too fine which makes the model under fit and results in less accuracy. Whereas K decreases i.e. K=1, then the model is said to be over fit and provide correct classification which results in best accuracy.

Code Snippet 4:

```
#Importing libraries
from sklearn.metrics import accuracy_score
from sklearn.model_selection import train_test_split
from sklearn import neighbors,datasets

#Defining and assigning data and target variables
dd =datasets.load_iris() #Iris dataset is used from scipy datasets
info=dd.data
labeldata=dd.target
#Size of the test data is given 20% and the remaining 80% is defined for training data
xtrain,xtest,ytrain,ytest=train_test_split(info,labeldata,test_size=0.2,random_state=42)
knn=neighbors.KNeighborsClassifier(n_neighbors=1) #Setting the n_neighbors value for KNN
knn.fit(xtrain,ytrain)
yprediction=knn.predict(xtest) #Predicting the outcomes
#Calculating the accuracy score by applying KNN model
print("The accuracy score is ",accuracy_score(yprediction,ytest))
```

Deployment:

The code snippets are written using Python IDE and executed with the help of python 3.6.4 interpreter. Outputs are shown in the Python IDE console.

Limitations:

The given code snippets doesn't have any limitations as they have met all rules and conditions.

References:

- http://scikit-learn.org/stable/modules/generated/sklearn.linear_model.LogisticRegression.html
- http://scikit-learn.org/stable/modules/svm.html
- http://scikit-learn.org/stable/modules/neighbors.html
- http://www.nltk.org/book/ch01.html
- http://scikit-learn.org/0.16/modules/generated/sklearn.lda.LDA.html