Title: Enhancing the prediction of seeds using Support Vector Machine (SVM) and Naive Bayes.

Objective: The objective of this study is to apply SVM and Naive Bayes to the Seeds dataset to improve prediction accuracy and provide valuable insights.

Theory:

SVM (Support Vector Machine):

SVM is a supervised learning algorithm that can be used for both classification and regression tasks. It works by finding a hyperplane in the feature space that separates the data points into two classes with the largest margin possible. The hyperplane is defined by a set of support vectors, which are the data points that lie closest to the hyperplane. To classify a new data point, SVM first projects the data point into the feature space. Then, it finds the distance between the data point and the hyperplane. If the distance is less than the margin, the data point is classified as belonging to the class that is on the same side of the hyperplane as the support vectors. Otherwise, the data point is classified as belonging to the other class.

Naive Bayes:

Naive Bayes is a probabilistic classifier that is based on Bayes' theorem. It works by assuming that the features of the data are independent of each other. This assumption is often not true, but it can still be an effective classifier for many tasks. To classify a new data point, Naive Bayes first calculates the probability of each class given the values of the features. Then, it classifies the data point to the class with the highest probability.

Conclusion:

SVM and Naive Bayes are two popular classification algorithms that can be used to classify the seeds dataset. SVM is a more powerful classifier, but it can be computationally expensive to train. Naive Bayes is a simpler and more efficient classifier, but it can be sensitive to the assumption of independence between the features.

```
# preprocessing includes collection,cleaning,transforming,splitting
#training includes model selection, ml,testing,accuracy
#remodeling for better result


#step 1: importing libararies
import pandas as pd
import numpy as np
import sklearn
import matplotlib.pyplot as plt #--->data visualization (it is a library which returns some
%matplotlib inline
print("Imported!")
```

```
     Imported!
```

```
#collection of data --> using pandas

file=pd.read_csv("/content/seeds_dataset (2).csv")

file.head(20)
```

	Area	Perimeter	Compactness	Length of kernel	Width of kernel	Asymmetry coefficient	Length of kernel groove	Unnamed: 7	Unna
0	15.26	14.84	0.8710	5.763	3.312	2.221	5.220	NaN	
1	14.88	14.57	0.8811	NaN	3.333	1.018	4.956	NaN	
2	14.29	14.09	0.9050	5.291	3.337	2.699	4.825	NaN	
3	13.84	13.94	0.8955	5.324	NaN	2.259	4.805	NaN	
4	NaN	NaN	0.9034	5.658	3.562	NaN	5.175	NaN	
5	14.38	14.21	0.8951	5.386	3.312	2.462	4.956	NaN	
6	NaN	14.49	NaN	5.563	3.259	3.586	5.219	NaN	
7	14.11	14.10	0.8911	5.420	3.302	2.700	NaN	NaN	
8	16.63	15.46	0.8747	6.053	3.465	NaN	5.877	NaN	
9	16.44	NaN	0.8880	5.884	3.505	1.969	5.533	NaN	
10	NaN	14.85	0.8696	NaN	3.242	4.543	5.314	NaN	
11	14.03	14.16	0.8796	5.438	3.201	1.717	5.001	NaN	
12	13.89	14.02	0.8880	5.439	3.199	3.986	4.738	NaN	
13	13.78	14.06	0.8759	5.479	3.156	3.136	4.872	NaN	
14	13.74	14.05	0.8744	5.482	NaN	2.932	4.825	NaN	
15	14.59	14.28	0.8993	NaN	3.333	4.185	4.781	NaN	
16	13.99	13.83	NaN	5.119	3.383	5.234	4.781	NaN	
17	15.69	14.75	0.9058	5.527	3.514	1.599	5.046	NaN	

```
#finding for missing values
file.isna().sum()
```

```
Area                      16
Perimeter                 14
Compactness               11
Length of kernel          15
Width of kernel           11
Asymmetry coefficient     10
Length of kernel groove   11
Unnamed: 7               208
```

```
Unnamed: 8                209
dtype: int64
```

```
#look for datatypes
print(file.info())
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 210 entries, 0 to 209
Data columns (total 9 columns):
 #   Column                   Non-Null Count  Dtype  
---  ------                   --------------  -----  
 0   Area                     194 non-null    float64
 1   Perimeter                196 non-null    float64
 2   Compactness              199 non-null    float64
 3   Length of kernel         195 non-null    float64
 4   Width of kernel          199 non-null    float64
 5   Asymmetry coefficient    200 non-null    float64
 6   Length of kernel groove  199 non-null    float64
 7   Unnamed: 7               2 non-null      object 
 8   Unnamed: 8               1 non-null      object 
dtypes: float64(7), object(2)
memory usage: 14.9+ KB
None
```

```
file=file.drop("Unnamed: 7",axis=1)
file=file.drop("Unnamed: 8",axis=1)
```

```
file
```

	Area	Perimeter	Compactness	Length of kernel	Width of kernel	Asymmetry coefficient	Length of kernel groove
0	15.26	14.84	0.8710	5.763	3.312	2.221	5.220
1	14.88	14.57	0.8811	NaN	3.333	1.018	4.956
2	14.29	14.09	0.9050	5.291	3.337	2.699	4.825
3	13.84	13.94	0.8955	5.324	NaN	2.259	4.805
4	NaN	NaN	0.9034	5.658	3.562	NaN	5.175
...	...	...	...	...	...	...	...
205	12.19	13.20	0.8783	5.137	2.981	3.631	4.870
206	11.23	12.88	NaN	5.140	NaN	4.325	5.003
207	13.20	13.66	0.8883	5.236	3.232	8.315	NaN
208	11.84	13.21	0.8521	NaN	2.836	3.598	5.044
209	12.30	NaN	0.8684	5.243	2.974	5.637	5.063

```
file
```

	Area	Perimeter	Compactness	Length of kernel	Width of kernel	Asymmetry coefficient	Length of kernel groove
0	15.26	14.84	0.8710	5.763	3.312	2.221	5.220
1	14.88	14.57	0.8811	NaN	3.333	1.018	4.956
2	14.29	14.09	0.9050	5.291	3.337	2.699	4.825
3	13.84	13.94	0.8955	5.324	NaN	2.259	4.805
4	NaN	NaN	0.9034	5.658	3.562	NaN	5.175
...	...	...	...	...	...	...	...
205	12.19	13.20	0.8783	5.137	2.981	3.631	4.870
206	11.23	12.88	NaN	5.140	NaN	4.325	5.003
207	13.20	13.66	0.8883	5.236	3.232	8.315	NaN
208	11.84	13.21	0.8521	NaN	2.836	3.598	5.044
209	12.30	NaN	0.8684	5.243	2.974	5.637	5.063

```
print(file.info())
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 210 entries, 0 to 209
Data columns (total 7 columns):
 #   Column                  Non-Null Count  Dtype  
---  ------                  --------------  -----  
 0   Area                    194 non-null    float64
 1   Perimeter               196 non-null    float64
 2   Compactness             199 non-null    float64
 3   Length of kernel        195 non-null    float64
 4   Width of kernel         199 non-null    float64
 5   Asymmetry coefficient   200 non-null    float64
 6   Length of kernel groove  199 non-null    float64
dtypes: float64(7)
memory usage: 11.6 KB
None
```

```
#WE have missing values and all numbers in dataset
#now removing missing values
#IMPUTING-->filling missing values by number.

file=file.fillna(file.mean()) #-->filling the file data means filling NaN with the mean


file.head(20)
```

	Area	Perimeter	Compactness	Length of kernel	Width of kernel	Asymmetry co
0	15.260000	14.840000	0.871000	5.763000	3.312000	
1	14.880000	14.570000	0.881100	5.630097	3.333000	
2	14.290000	14.090000	0.905000	5.291000	3.337000	
3	13.840000	13.940000	0.895500	5.324000	3.260231	
4	14.888454	14.550918	0.903400	5.658000	3.562000	
5	14.380000	14.210000	0.895100	5.386000	3.312000	
6	14.888454	14.490000	0.870873	5.563000	3.259000	
7	14.110000	14.100000	0.891100	5.420000	3.302000	
8	16.630000	15.460000	0.874700	6.053000	3.465000	
9	16.440000	14.550918	0.888000	5.884000	3.505000	
10	14.888454	14.850000	0.869600	5.630097	3.242000	
11	14.030000	14.160000	0.879600	5.438000	3.201000	
12	13.890000	14.020000	0.888000	5.439000	3.199000	
13	13.780000	14.060000	0.875900	5.479000	3.156000	
14	13.740000	14.050000	0.874400	5.482000	3.260231	
15	14.590000	14.280000	0.899300	5.630097	3.333000	
16	13.990000	13.830000	0.870873	5.119000	3.383000	
17	15.690000	14.750000	0.905800	5.527000	3.514000	

```
file.isna().sum()
```

```
Area                      0
Perimeter                 0
Compactness               0
Length of kernel          0
Width of kernel           0
Asymmetry coefficient     0
Length of kernel groove   0
dtype: int64
```

```
# done with preprocessing
```

```
#now training part

# vertical split(betw x and y)-->splitting data into features(i/p)[what should u learn to p
#and labels(o/p)[what u want to do]

x=file.drop("Area",axis=1)
y=file["Area"]
```

x

	Perimeter	Compactness	Length of kernel	Width of kernel	Asymmetry coefficient
0	14.840000	0.871000	5.763000	3.312000	2.221000
1	14.570000	0.881100	5.630097	3.333000	1.018000
2	14.090000	0.905000	5.291000	3.337000	2.699000
3	13.940000	0.895500	5.324000	3.260231	2.259000
4	14.550918	0.903400	5.658000	3.562000	3.712436
...	...	...	...	...	...
205	13.200000	0.878300	5.137000	2.981000	3.631000
206	12.880000	0.870873	5.140000	3.260231	4.325000
207	13.660000	0.888300	5.236000	3.232000	8.315000
208	13.210000	0.852100	5.630097	2.836000	3.598000
209	14.550918	0.868400	5.243000	2.974000	5.637000

210 rows × 6 columns

y

```
0      15.260000
1      14.880000
2      14.290000
3      13.840000
4      14.888454
         ...
205    12.190000
206    11.230000
207    13.200000
208    11.840000
209    12.300000
Name: Area, Length: 210, dtype: float64
```

```
#horizontal split done using sklearn
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)
```

x_train

	Perimeter	Compactness	Length of kernel	Width of kernel	Asymmetry coefficient
135	14.660000	0.8990	5.477	3.465000	3.600000
64	13.570000	0.8716	5.262	3.026000	1.176000
98	16.260000	0.8637	6.271	3.512000	2.853000
45	14.040000	0.8794	5.376	3.155000	1.560000
76	15.910000	0.8599	6.064	3.403000	3.824000
...	...	...	...	...	...
112	16.310000	0.9035	6.183	3.902000	2.109000
105	16.290000	0.8917	6.037	3.260231	2.553000
111	16.720000	0.8716	6.303	3.791000	3.678000
4	14.550918	0.9034	5.658	3.562000	3.712436
89	17.050000	0.9031	6.450	4.032000	5.016000

168 rows × 6 columns

```
x_test
```

	Perimeter	Compactness	Length of kernel	Width of kernel	Asymmetry coefficient	Length of kernel groove
70	15.980000	0.867300	6.191	3.561000	4.076000	6.06000
50	14.400000	0.875100	5.585	3.272000	3.712436	5.14400
131	16.320000	0.894200	6.144	3.260231	2.908000	5.94900
143	13.320000	0.865200	5.224	2.967000	5.469000	5.22100
8	15.460000	0.874700	6.053	3.465000	3.712436	5.87700
83	16.740000	0.877900	6.384	3.772000	1.472000	6.27300
153	13.040000	0.826600	5.220	2.693000	3.332000	5.00100
88	17.210000	0.898900	6.573	4.033000	5.780000	6.23100
41	13.850000	0.885200	5.351	3.158000	2.249000	5.17600
44	14.540000	0.898600	5.579	3.462000	3.128000	5.18000
124	14.890000	0.906400	5.363	3.582000	3.336000	5.14400
128	17.030000	0.873500	6.513	3.773000	1.910000	6.18500

```
y_train

     135    15.380000
     64     12.780000
     98     14.888454
     45     13.800000
     76     17.320000
              ...
     112    19.130000
     105    18.830000
     111    19.380000
     4      14.888454
     89     14.888454
     Name: Area, Length: 168, dtype: float64
```

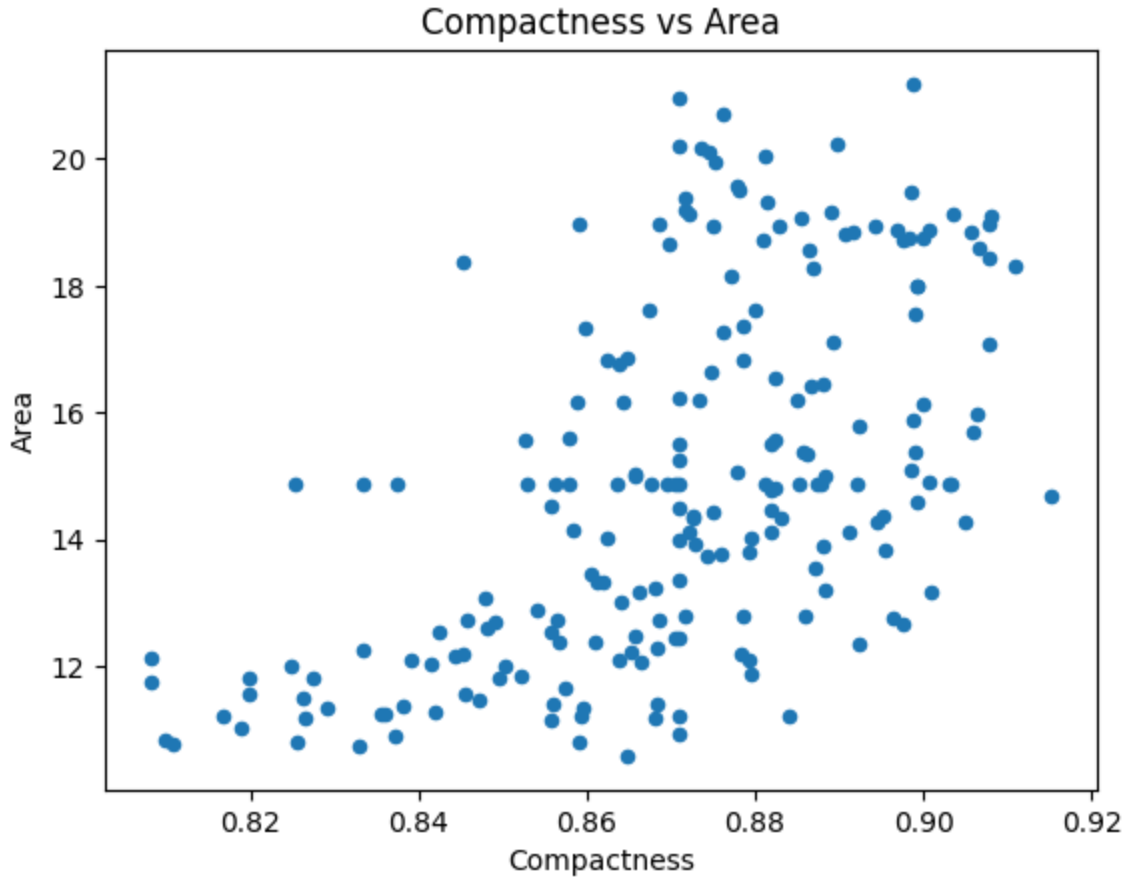
91	16.200000	0.898400	6.172	3.796000	3.120000	6.05300

```
y_test

     70     17.630000
     50     14.430000
     131    18.940000
     143    12.220000
     8      16.630000
     83     19.570000
     153    11.180000
     88     21.180000
     41     14.888454
     44     15.110000
     124    15.990000
     128    20.160000
     164    11.140000
     104    18.950000
     29     13.450000
     200    12.380000
```

```
102    19.460000
113    19.140000
141    13.320000
21     14.110000
91     18.760000
37     17.080000
207    13.200000
51     15.780000
90     20.100000
40     13.540000
19     12.720000
114    20.970000
42     13.160000
38     14.800000
26     13.020000
205    12.190000
180    11.410000
43     15.500000
97     18.980000
121    18.140000
72     17.260000
181    12.460000
77     20.710000
177    10.740000
52     14.490000
160    12.540000
Name: Area, dtype: float64
```

```
file.plot("Compactness","Area",title="Compactness vs Area", xlabel = "Compactness", ylabel=
```



```
#training the model on training data
from sklearn.ensemble import RandomForestRegressor #-->just for creating model not part of
model=RandomForestRegressor()# for model creating


#naive bayes --> classification
from sklearn import naive_baye
model.fit(x_train,y_train)#-->model.fit : training model on training data of x and y
model.score(x_test,y_test)#-->model.score : testing model on training data of x and y
```

```
     0.8033787975692283
```

```
#svm --> classification
from sklearn import svm
model.fit(x_train,y_train)#-->model.fit : training model on training data of x and y
model.score(x_test,y_test)#-->model.score : testing model on training data of x and y
```

```
     0.8793437747215025
```