Support Vector Machine (SVM)

October 30, 2021

1 Support Vector Machine (SVM

1.1 Importing the libraries

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

[2]:
```
from sklearn.model_selection import train_test_split
```

[3]:
```
from sklearn.preprocessing import StandardScaler
```

[4]:
```
from sklearn.svm import SVC
```

[5]:
```
from sklearn.metrics import confusion_matrix,accuracy_score
from sklearn.metrics import classification_report
```

1.2 Importing the dataset

[6]:
```
dataset = pd.read_csv("Social_Network_Ads.csv")
```

[7]:
```
x = dataset.iloc[: , :-1].values
y = dataset.iloc[: , -1].values
```

[8]:
```
dataset.head()
```

[8]:

	Age	EstimatedSalary	Purchased
0	19	19000	0
1	35	20000	0
2	26	43000	0
3	27	57000	0
4	19	76000	0

[9]:
```
print(x)
```

```
[[   19  19000]
 [   35  20000]
 [   26  43000]
```

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[    27  57000]
[    19  76000]
[    27  58000]
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[    28  37000]
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[    39 122000]
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[    50  20000]
[    36  33000]
[    49  36000]]
```

[10]:
```
print(y)
```

```
[0 0 0 0 0 0 0 1 0 0 0 0 0 0 0 0 1 1 1 1 1 1 1 1 1 1 1 0 0 0 1 0 0 0 0 0
 0 0 0 0 0 0 0 0 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 0 0 0 0 0 0 0 0
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 1 1 0 1 0 1 0 0 1 1 0 1 1 1 1 1 1 1 0 1 1 1 1 1 1 0 1 1 1 0 1]
```

1.3 Splitting the dataset into the Training set and Test set

[11]:
```
x_train,x_test,y_train,y_test = train_test_split(x,y,test_size = 0.
↪25,random_state = 0)
```

1.4 Feature Scaling

[12]:
```
sc = StandardScaler()
x_train = sc.fit_transform(x_train)
x_test = sc.transform(x_test)
```

1.5 Training the Support Vector Machine (SVM model on the Training dataset

[13]:
```
classifier = SVC()
classifier.fit(x_train,y_train)
```

[13]:
```
SVC()
```

1.6 Predict New Result

[14]:
```
print(classifier.predict(sc.transform([[30,87000]])))
```

```
[0]
```

1.7 Predict Test Result

[15]:
```
y_predict = classifier.predict(x_test)
df=pd.DataFrame({'Actual':y_test, 'Predicted':y_predict})
pd.set_option('display.max_rows', df.shape[0]+1)
print(df)
```

```
    Actual  Predicted
0        0          0
1        0          0
2        0          0
3        0          0
4        0          0
5        0          0
6        0          0
7        1          1
8        0          0
9        0          1
10       0          0
11       0          0
12       0          0
13       0          0
14       0          0
15       0          1
16       0          0
17       0          0
18       1          1
19       0          0
20       0          0
21       1          1
22       0          0
23       1          1
24       0          0
25       1          1
26       0          0
27       0          0
28       0          0
29       0          0
30       0          0
31       1          0
32       1          1
33       0          0
34       0          0
```

35	0	0
36	0	0
37	0	0
38	0	0
39	1	1
40	0	0
41	0	0
42	0	0
43	0	0
44	1	1
45	0	0
46	0	0
47	1	1
48	0	0
49	1	1
50	1	1
51	0	0
52	0	0
53	0	1
54	1	1
55	1	1
56	0	0
57	0	0
58	1	1
59	0	0
60	0	0
61	1	1
62	0	0
63	1	1
64	0	0
65	1	1
66	0	0
67	0	0
68	0	0
69	0	0
70	1	1
71	0	0
72	0	0
73	1	1
74	0	0
75	0	0
76	0	0
77	0	0
78	1	1
79	1	1
80	1	1
81	0	1
82	0	0

```
83       0          0
84       1          1
85       1          0
86       0          0
87       1          1
88       1          1
89       0          0
90       0          0
91       1          1
92       0          0
93       0          0
94       0          0
95       1          0
96       0          0
97       1          1
98       1          1
99       1          1
```

1.8 Making The confusion Matrix and Evaluting model

[16]:
```
cm = confusion_matrix(y_test, y_predict)
print(cm)
accuracy_score(y_test,y_predict)
```

```
[[64  4]
 [ 3 29]]
```

[16]:
```
0.93
```

[17]:
```
report = classification_report(y_test, y_predict)
print(report)
```

```
              precision    recall  f1-score   support

           0       0.96      0.94      0.95        68
           1       0.88      0.91      0.89        32

    accuracy                           0.93       100
   macro avg       0.92      0.92      0.92       100
weighted avg       0.93      0.93      0.93       100
```

1.9 Visualising the Training set result

[18]:
```
from matplotlib.colors import ListedColormap
X_set, y_set = sc.inverse_transform(x_train), y_train
X1, X2 = np.meshgrid(np.arange(start = X_set[:, 0].min() - 10, stop = X_set[:,␣
 ↪0].max() + 10, step = 0.25),
```

```
                     np.arange(start = X_set[:, 1].min() - 1000, stop = X_set[:
 ↪, 1].max() + 1000, step = 0.25))
plt.contourf(X1, X2, classifier.predict(sc.transform(np.array([X1.ravel(), X2.
 ↪ravel()]).T)).reshape(X1.shape),
             alpha = 0.75, cmap = ListedColormap(('red', 'green')))
plt.xlim(X1.min(), X1.max())
plt.ylim(X2.min(), X2.max())
for i, j in enumerate(np.unique(y_set)):
    plt.scatter(X_set[y_set == j, 0], X_set[y_set == j, 1], c =␣
 ↪ListedColormap(('red', 'green'))(i), label = j)
plt.title(' Support Vector Machine (SVM (Test set)')
plt.xlabel('Age')
plt.ylabel('Estimated Salary')
plt.legend()
plt.show()
```

```
---------------------------------------------------------------------------
MemoryError                               Traceback (most recent call last)
<ipython-input-18-45ae9daf51fc> in <module>
      3 X1, X2 = np.meshgrid(np.arange(start = X_set[:, 0].min() - 10, stop =␣
 ↪X_set[:, 0].max() + 10, step = 0.25),
      4                      np.arange(start = X_set[:, 1].min() - 1000, stop =
 ↪X_set[:, 1].max() + 1000, step = 0.25))
----> 5 plt.contourf(X1, X2, classifier.predict(sc.transform(np.array([X1.
 ↪ravel(), X2.ravel()]).T)).reshape(X1.shape),
      6              alpha = 0.75, cmap = ListedColormap(('red', 'green')))
      7 plt.xlim(X1.min(), X1.max())

~\anaconda3\lib\site-packages\sklearn\svm\_base.py in predict(self, X)
    622             y = np.argmax(self.decision_function(X), axis=1)
    623         else:
--> 624             y = super().predict(X)
    625         return self.classes_.take(np.asarray(y, dtype=np.intp))
    626

~\anaconda3\lib\site-packages\sklearn\svm\_base.py in predict(self, X)
    342         X = self._validate_for_predict(X)
    343         predict = self._sparse_predict if self._sparse else self.
 ↪_dense_predict
--> 344         return predict(X)
    345
    346     def _dense_predict(self, X):

~\anaconda3\lib\site-packages\sklearn\svm\_base.py in _dense_predict(self, X)
    359         svm_type = LIBSVM_IMPL.index(self._impl)
    360
```

```
--> 361         return libsvm.predict(
    362             X, self.support_, self.support_vectors_, self._n_support,
    363             self._dual_coef_, self._intercept_,

sklearn\svm\_libsvm.pyx in sklearn.svm._libsvm.predict()

MemoryError: We've run out of memory
```

1.10 Visualising the Test result

[ ]:
```
from matplotlib.colors import ListedColormap
X_set, y_set = sc.inverse_transform(x_test), y_test
X1, X2 = np.meshgrid(np.arange(start = X_set[:, 0].min() - 10, stop = X_set[:,␣
↪0].max() + 10, step = 0.25),
                     np.arange(start = X_set[:, 1].min() - 1000, stop = X_set[:
↪, 1].max() + 1000, step = 0.25))
plt.contourf(X1, X2, classifier.predict(sc.transform(np.array([X1.ravel(), X2.
↪ravel()]).T)).reshape(X1.shape),
             alpha = 0.75, cmap = ListedColormap(('red', 'green')))
plt.xlim(X1.min(), X1.max())
plt.ylim(X2.min(), X2.max())
for i, j in enumerate(np.unique(y_set)):
    plt.scatter(X_set[y_set == j, 0], X_set[y_set == j, 1], c =␣
↪ListedColormap(('red', 'green'))(i), label = j)
plt.title(' Support Vector Machine (SVM) (Test set)')
plt.xlabel('Age')
plt.ylabel('Estimated Salary')
plt.legend()
plt.show()
```

[ ]:
```

```