Vector Support Machines

IRIS dataset (http://en.wikipedia.org/wiki/Iris_flower_data_set (http://en.wikipedia.org/wiki/Iris_flower_data_set)).

In [2]:
```
# The Iris Setosa
from IPython.display import Image
url = 'http://upload.wikimedia.org/wikipedia/commons/5/56/Kosaciec_szczecinkowaty
_Iris_setosa.jpg'
Image(url,width=300, height=300)
```

Out[2]:

In [3]:
```
# The Iris Versicolor
from IPython.display import Image
url = 'http://upload.wikimedia.org/wikipedia/commons/4/41/Iris_versicolor_3.jpg'
Image(url,width=300, height=300)
```

Out[3]:

In [4]:
```
# The Iris Virginica
from IPython.display import Image
url = 'http://upload.wikimedia.org/wikipedia/commons/9/9f/Iris_virginica.jpg'
Image(url,width=300, height=300)
```

Out[4]:

Upload the Data

In [5]:
```
import seaborn as sns
iris = sns.load_dataset('iris')
```

Check the data

In [6]:
```
iris.head()
```

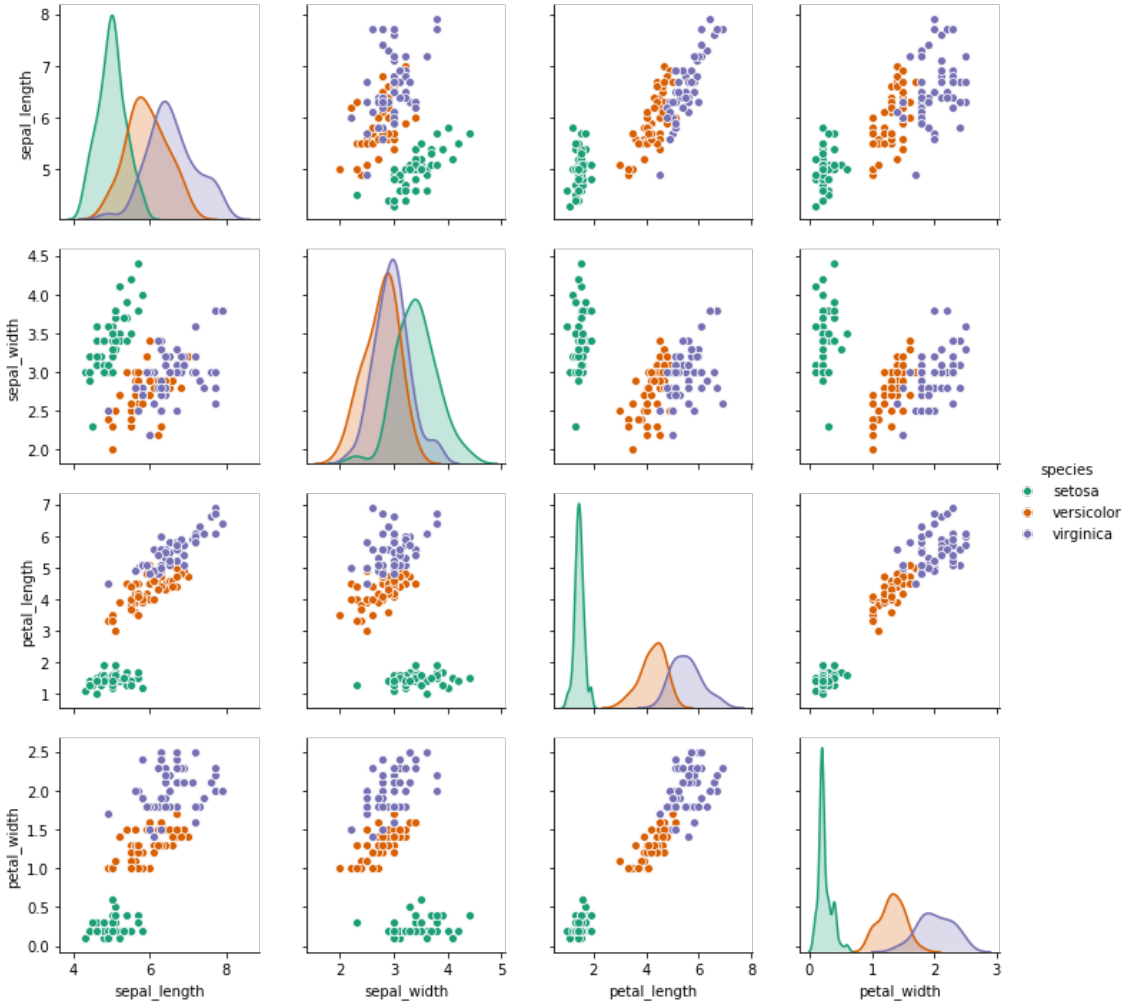
Out[6]:

	sepal_length	sepal_width	petal_length	petal_width	species
0	5.1	3.5	1.4	0.2	setosa
1	4.9	3.0	1.4	0.2	setosa
2	4.7	3.2	1.3	0.2	setosa
3	4.6	3.1	1.5	0.2	setosa
4	5.0	3.6	1.4	0.2	setosa

In [7]:
```
import pandas as pd
import numpy as np
%matplotlib inline
```

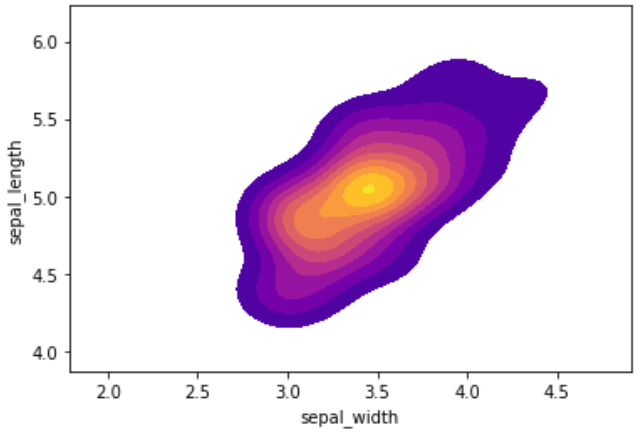
In [8]:
```
# Create a pair plot from the data
sns.pairplot(iris,hue='species',palette='Dark2')
```

Out[8]: <seaborn.axisgrid.PairGrid at 0x1a1f18d6a0>



In [9]:
```
#KDE Plot
setosa = iris[iris['species']=='setosa']
sns.kdeplot(setosa['sepal_width'],setosa['sepal_length'],cmap='plasma',shade=True,
            shade_lowest=False)
```

Out[9]:
```
<matplotlib.axes._subplots.AxesSubplot at 0x1a1fb20470>
```



Train Test Split

In [10]:
```
from sklearn.model_selection import train_test_split
```

In [11]:
```
X = iris.drop('species', axis=1)
y = iris['species']
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.3)
```

In [12]:
```
#Train the model
from sklearn.svm import SVC
```

In [13]:
```
svc_model = SVC()
```

In [14]:
```
svc_model.fit(X_train,y_train)
```

```
/anaconda3/lib/python3.7/site-packages/sklearn/svm/base.py:193: FutureWarning: T
he default value of gamma will change from 'auto' to 'scale' in version 0.22 to
account better for unscaled features. Set gamma explicitly to 'auto' or 'scale'
to avoid this warning.
  "avoid this warning.", FutureWarning)
```

Out[14]:
```
SVC(C=1.0, cache_size=200, class_weight=None, coef0=0.0,
    decision_function_shape='ovr', degree=3, gamma='auto_deprecated',
    kernel='rbf', max_iter=-1, probability=False, random_state=None,
    shrinking=True, tol=0.001, verbose=False)
```

In [15]:
```
#Evaluate the Model
pred = svc_model.predict(X_test)
```

In [16]:
```
from sklearn.metrics import classification_report,confusion_matrix
```

In [17]:
```
print(confusion_matrix(y_test,pred))
```

```
[[13  0  0]
 [ 0 20  0]
 [ 0  0 12]]
```

In [18]:
```
print(classification_report(y_test,pred))
```

```
              precision    recall  f1-score   support

      setosa       1.00      1.00      1.00        13
  versicolor       1.00      1.00      1.00        20
   virginica       1.00      1.00      1.00        12

    accuracy                           1.00        45
   macro avg       1.00      1.00      1.00        45
weighted avg       1.00      1.00      1.00        45
```

The model should show minor improvement

Grid Search

Shouldn't see any improvement on the outcome due to the small data size.

In [19]:
```
from sklearn.model_selection import GridSearchCV
```

In [20]:
```
param_grid = {'C':[0.1,1,10,100],'gamma':[1,0.1,0.01,0.001]}
```

In [21]:
```
#use verbose 2 due to the small data size
grid = GridSearchCV(SVC(),param_grid,verbose=2)
grid.fit(X_train,y_train)
```

```
/anaconda3/lib/python3.7/site-packages/sklearn/model_selection/_split.py:1978: F
utureWarning: The default value of cv will change from 3 to 5 in version 0.22. S
pecify it explicitly to silence this warning.
  warnings.warn(CV_WARNING, FutureWarning)
[Parallel(n_jobs=1)]: Using backend SequentialBackend with 1 concurrent workers.
[Parallel(n_jobs=1)]: Done   1 out of   1 | elapsed:    0.0s remaining:    0.0s
```

```
Fitting 3 folds for each of 16 candidates, totalling 48 fits
[CV] C=0.1, gamma=1 ..................................................
[CV] ..................................... C=0.1, gamma=1, total=   0.0s
[CV] C=0.1, gamma=1 ..................................................
[CV] ..................................... C=0.1, gamma=1, total=   0.0s
[CV] C=0.1, gamma=1 ..................................................
[CV] ..................................... C=0.1, gamma=1, total=   0.0s
[CV] C=0.1, gamma=0.1 ................................................
[CV] ................................... C=0.1, gamma=0.1, total=   0.0s
[CV] C=0.1, gamma=0.1 ................................................
[CV] ................................... C=0.1, gamma=0.1, total=   0.0s
[CV] C=0.1, gamma=0.1 ................................................
[CV] ................................... C=0.1, gamma=0.1, total=   0.0s
[CV] C=0.1, gamma=0.01 ...............................................
[CV] .................................. C=0.1, gamma=0.01, total=   0.0s
[CV] C=0.1, gamma=0.01 ...............................................
[CV] .................................. C=0.1, gamma=0.01, total=   0.0s
[CV] C=0.1, gamma=0.01 ...............................................
[CV] .................................. C=0.1, gamma=0.01, total=   0.0s
[CV] C=0.1, gamma=0.001 ..............................................
[CV] ................................. C=0.1, gamma=0.001, total=   0.0s
[CV] C=0.1, gamma=0.001 ..............................................
[CV] ................................. C=0.1, gamma=0.001, total=   0.0s
[CV] C=0.1, gamma=0.001 ..............................................
[CV] ................................. C=0.1, gamma=0.001, total=   0.0s
[CV] C=1, gamma=1 ....................................................
[CV] ....................................... C=1, gamma=1, total=   0.0s
[CV] C=1, gamma=1 ....................................................
[CV] ....................................... C=1, gamma=1, total=   0.0s
[CV] C=1, gamma=1 ....................................................
[CV] ....................................... C=1, gamma=1, total=   0.0s
[CV] C=1, gamma=0.1 ..................................................
[CV] ..................................... C=1, gamma=0.1, total=   0.0s
[CV] C=1, gamma=0.1 ..................................................
[CV] ..................................... C=1, gamma=0.1, total=   0.0s
[CV] C=1, gamma=0.1 ..................................................
[CV] ..................................... C=1, gamma=0.1, total=   0.0s
[CV] C=1, gamma=0.01 .................................................
[CV] .................................... C=1, gamma=0.01, total=   0.0s
[CV] C=1, gamma=0.01 .................................................
[CV] .................................... C=1, gamma=0.01, total=   0.0s
[CV] C=1, gamma=0.01 .................................................
[CV] .................................... C=1, gamma=0.01, total=   0.0s
[CV] C=1, gamma=0.001 ................................................
[CV] ................................... C=1, gamma=0.001, total=   0.0s
[CV] C=1, gamma=0.001 ................................................
[CV] ................................... C=1, gamma=0.001, total=   0.0s
[CV] C=1, gamma=0.001 ................................................
[CV] ................................... C=1, gamma=0.001, total=   0.0s
[CV] C=10, gamma=1 ...................................................
[CV] ..................................... C=10, gamma=1, total=   0.0s
[CV] C=10, gamma=1 ...................................................
[CV] ..................................... C=10, gamma=1, total=   0.0s
[CV] C=10, gamma=1 ...................................................
[CV] ..................................... C=10, gamma=1, total=   0.0s
[CV] C=10, gamma=0.1 .................................................
[CV] .................................... C=10, gamma=0.1, total=   0.0s
[CV] C=10, gamma=0.1 .................................................
[CV] .................................... C=10, gamma=0.1, total=   0.0s
[CV] C=10, gamma=0.1 .................................................
[CV] .................................... C=10, gamma=0.1, total=   0.0s
[CV] C=10, gamma=0.01 ................................................
[CV] ................................... C=10, gamma=0.01, total=   0.0s
[CV] C=10, gamma=0.01 ................................................
[CV] ................................... C=10, gamma=0.01, total=   0.0s
```

```
[Parallel(n_jobs=1)]: Done  48 out of  48 | elapsed:    0.3s finished
/anaconda3/lib/python3.7/site-packages/sklearn/model_selection/_search.py:813: D
eprecationWarning: The default of the `iid` parameter will change from True to F
alse in version 0.22 and will be removed in 0.24. This will change numeric resul
ts when test-set sizes are unequal.
  DeprecationWarning)
```

Out[21]:
```
GridSearchCV(cv='warn', error_score='raise-deprecating',
             estimator=SVC(C=1.0, cache_size=200, class_weight=None, coef0=0.0,
                           decision_function_shape='ovr', degree=3,
                           gamma='auto_deprecated', kernel='rbf', max_iter=-1,
                           probability=False, random_state=None, shrinking=True,
                           tol=0.001, verbose=False),
             iid='warn', n_jobs=None,
             param_grid={'C': [0.1, 1, 10, 100],
                         'gamma': [1, 0.1, 0.01, 0.001]},
             pre_dispatch='2*n_jobs', refit=True, return_train_score=False,
             scoring=None, verbose=2)
```

In [22]:
```
grid_pred = grid.predict(X_test)
```

In [23]:
```
print(confusion_matrix(y_test,grid_pred))
```

```
[[13  0  0]
 [ 0 20  0]
 [ 0  0 12]]
```

In [24]:
```
print(classification_report(y_test,pred))
```

```
              precision    recall  f1-score   support

      setosa       1.00      1.00      1.00        13
  versicolor       1.00      1.00      1.00        20
   virginica       1.00      1.00      1.00        12

    accuracy                           1.00        45
   macro avg       1.00      1.00      1.00        45
weighted avg       1.00      1.00      1.00        45
```

The outcome is the same as the table in evaluate the model.