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Class / DATA602 SVM.ipynb

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6aeea6f on Sep 2, 2019

1 contributor

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420 lines (420 sloc) 149 KB

In [6]:
```
# Support Vecto Machine

# Kernel Trick Visualization
from IPython.display import YouTubeVideo
YouTubeVideo('3liCbRZPrZA')
```

Out[6]:

In [7]:
```
#Imports
import numpy as np
import matplotlib.pyplot as plt
%matplotlib inline
```

In [10]:
```
from sklearn import datasets

# load the iris datasets
iris = datasets.load_iris()

# Grab features (X) and the Target (Y)
X = iris.data

Y = iris.target

# Show the Built-in Data Description
print (iris.DESCR)
```

```
.. _iris_dataset:

Iris plants dataset
--------------------

**Data Set Characteristics:**

    :Number of Instances: 150 (50 in each of three classes)
    :Number of Attributes: 4 numeric, predictive attributes and the class
    :Attribute Information:
        - sepal length in cm
        - sepal width in cm
        - petal length in cm
        - petal width in cm
        - class:
                - Iris-Setosa
                - Iris-Versicolour
                - Iris-Virginica

    :Summary Statistics:

    ============== ==== ==== ======= ===== ====================
                    Min  Max   Mean    SD   Class Correlation
    ============== ==== ==== ======= ===== ====================
    sepal length:   4.3  7.9   5.84   0.83    0.7826
    sepal width:    2.0  4.4   3.05   0.43   -0.4194
    petal length:   1.0  6.9   3.76   1.76    0.9490  (high!)
    petal width:    0.1  2.5   1.20   0.76    0.9565  (high!)
    ============== ==== ==== ======= ===== ====================

    :Missing Attribute Values: None
    :Class Distribution: 33.3% for each of 3 classes.
    :Creator: R.A. Fisher
    :Donor: Michael Marshall (MARSHALL%PLU@io.arc.nasa.gov)
    :Date: July, 1988

The famous Iris database, first used by Sir R.A. Fisher. The dataset is taken
from Fisher's paper. Note that it's the same as in R, but not as in the UCI
Machine Learning Repository, which has two wrong data points.

This is perhaps the best known database to be found in the
pattern recognition literature.  Fisher's paper is a classic in the field and
is referenced frequently to this day.  (See Duda & Hart, for example.)  The
data set contains 3 classes of 50 instances each, where each class refers to a
type of iris plant.  One class is linearly separable from the other 2; the
latter are NOT linearly separable from each other.

.. topic:: References

   - Fisher, R.A. "The use of multiple measurements in taxonomic problems"
     Annual Eugenics, 7, Part II, 179-188 (1936); also in "Contributions to
     Mathematical Statistics" (John Wiley, NY, 1950).
   - Duda, R.O., & Hart, P.E. (1973) Pattern Classification and Scene Analysis.
     (Q327.D83) John Wiley & Sons.  ISBN 0-471-22361-1.  See page 218.
   - Dasarathy, B.V. (1980) "Nosing Around the Neighborhood: A New System
     Structure and Classification Rule for Recognition in Partially Exposed
     Environments".  IEEE Transactions on Pattern Analysis and Machine
     Intelligence, Vol. PAMI-2, No. 1, 67-71.
   - Gates, G.W. (1972) "The Reduced Nearest Neighbor Rule".  IEEE Transactions
     on Information Theory, May 1972, 431-433.
   - See also: 1988 MLC Proceedings, 54-64.  Cheeseman et al"s AUTOCLASS II
     conceptual clustering system finds 3 classes in the data.
   - Many, many more ...
```

In [13]:
```python
# Support Vector Machine Imports
from sklearn.svm import SVC
```

In [19]:
```python
# Fit a SVM model to the data
model = SVC(gamma='auto')
```

In [20]:
```python
from sklearn.model_selection import train_test_split
# Split the data into Trainging and Testing sets
X_train, X_test, Y_train, Y_test = train_test_split(X, Y)
```

In [21]:
```python
# Fit the model
model.fit(X_train,Y_train)
```

Out[21]:
```
SVC(C=1.0, cache_size=200, class_weight=None, coef0=0.0,
  decision_function_shape='ovr', degree=3, gamma='auto', kernel='rbf',
  max_iter=-1, probability=False, random_state=None, shrinking=True,
  tol=0.001, verbose=False)
```

In [23]:
```python
from sklearn import metrics

# Get predictions
predicted = model.predict(X_test)
expected = Y_test

# Compare results
print (metrics.accuracy_score(expected,predicted))
```

```
0.9736842105263158
```

In [33]:
```python
# Import all SVM
from sklearn import svm

# We'll use all the data and not bother with a split between training and testing. We'll
 also only use two features.
X = iris.data[:,:2]
Y = iris.target

# SVM regularization parameter
C = 1.0

# SVC with a Linear Kernel  (our original example)
svc = svm.SVC(kernel='linear', gamma='auto', max_iter=-1, C=C).fit(X, Y)

# Gaussian Radial Bassis Function
rbf_svc = svm.SVC(kernel='rbf', gamma=0.7, C=C).fit(X, Y)

# SVC with 3rd degree poynomial
poly_svc = svm.SVC(kernel='poly', degree=3,gamma='auto', C=C).fit(X, Y)

# SVC Linear
lin_svc = svm.LinearSVC(C=C).fit(X,Y)
```

```
C:\Users\tonyd\AppData\Local\Continuum\anaconda3\lib\site-packages\sklearn\svm\base.py:93
1: ConvergenceWarning: Liblinear failed to converge, increase the number of iterations.
  "the number of iterations.", ConvergenceWarning)
```

In [34]:
```python
# Set the step size
h = 0.02

# X axis min and max
x_min=X[:, 0].min() - 1
x_max =X[:, 0].max() + 1

# Y axis min and max
y_min = X[:, 1].min() - 1
y_max = X[:, 1].max() + 1

# Finally, numpy can create a meshgrid
xx, yy = np.meshgrid(np.arange(x_min, x_max, h),np.arange(y_min, y_max, h))
```

In [35]:
```python
# title for the plots
titles = ['SVC with linear kernel',
          'LinearSVC (linear kernel)',
          'SVC with RBF kernel',
          'SVC with polynomial (degree 3) kernel']
```

In [36]:
```python
# Use enumerate for a count
for i, clf in enumerate((svc, lin_svc, rbf_svc, poly_svc)):

    # Plot the decision boundary. For that, we will assign a color to each
    # point in the mesh [x_min, m_max]x[y_min, y_max].
    plt.figure(figsize=(15,15))
    # Set the subplot position (Size = 2 by 2, position deifined by i count
    plt.subplot(2, 2, i + 1)

    # SUbplot spacing
    plt.subplots_adjust(wspace=0.4, hspace=0.4)

    # Define Z as the prediction, not the use of ravel to format the arrays
```

```
    Z = clf.predict(np.c_[xx.ravel(), yy.ravel()])

    # Put the result into a color plot
    Z = Z.reshape(xx.shape)

    # Contour plot (filled with contourf)
    plt.contourf(xx, yy, Z, cmap=plt.cm.terrain, alpha=0.5,linewidths=0)

    # Plot also the training points
    plt.scatter(X[:, 0], X[:, 1], c=Y, cmap=plt.cm.Dark2)

    # Labels and Titles
    plt.xlabel('Sepal length')
    plt.ylabel('Sepal width')
    plt.xlim(xx.min(), xx.max())
    plt.ylim(yy.min(), yy.max())
    plt.xticks(())
    plt.yticks(())
    plt.title(titles[i])



plt.show()
```

```
C:\Users\tonyd\AppData\Local\Continuum\anaconda3\lib\site-packages\matplotlib\contour.py:
942: UserWarning: linewidths is ignored by contourf
  warnings.warn('linewidths is ignored by contourf')
C:\Users\tonyd\AppData\Local\Continuum\anaconda3\lib\site-packages\matplotlib\contour.py:
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942: UserWarning: linewidths is ignored by contourf
  warnings.warn('linewidths is ignored by contourf')
```

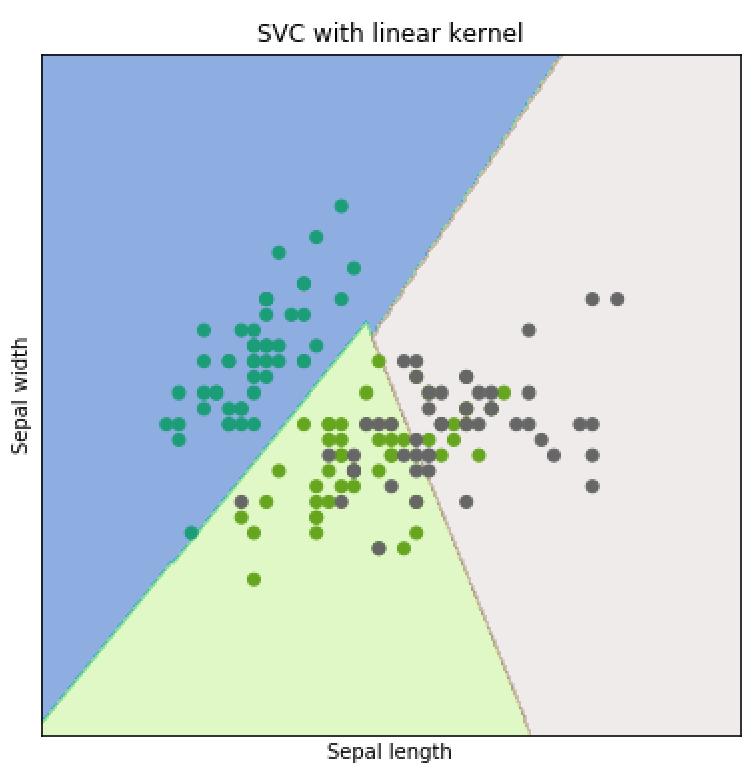

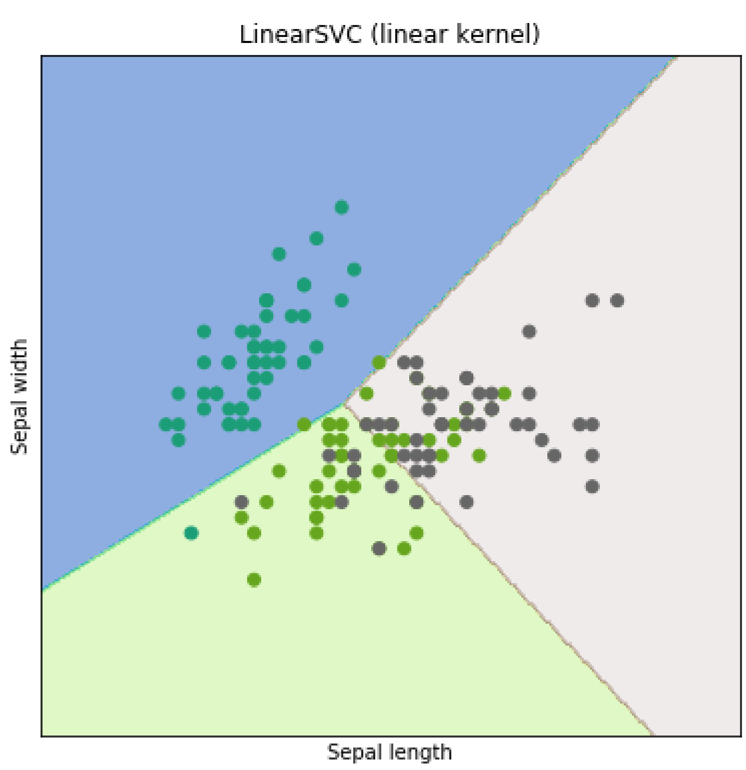

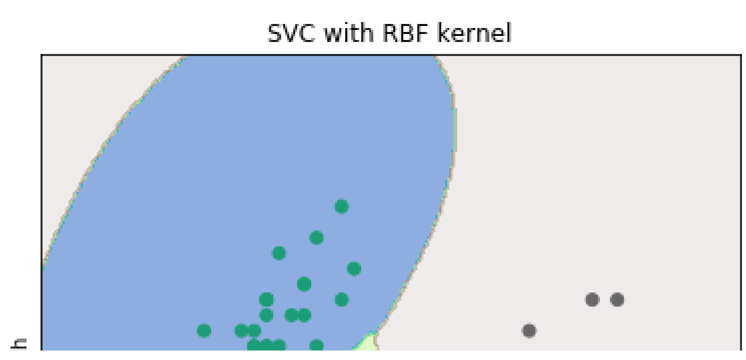

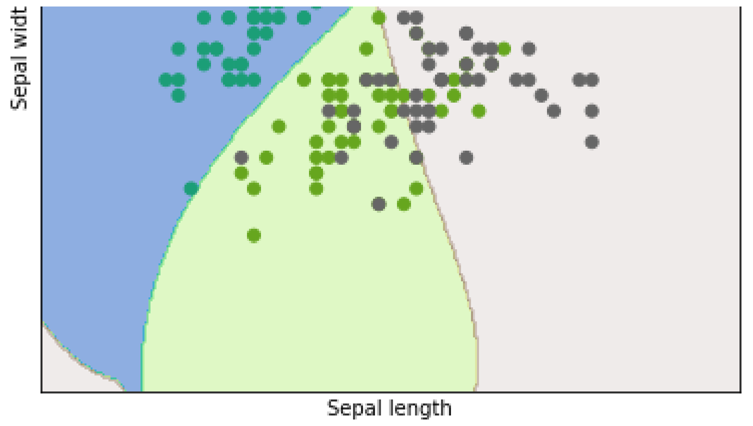

SVC with polynomial (degree 3) kernel


```
In [ ]:
```