4주차 실습과제

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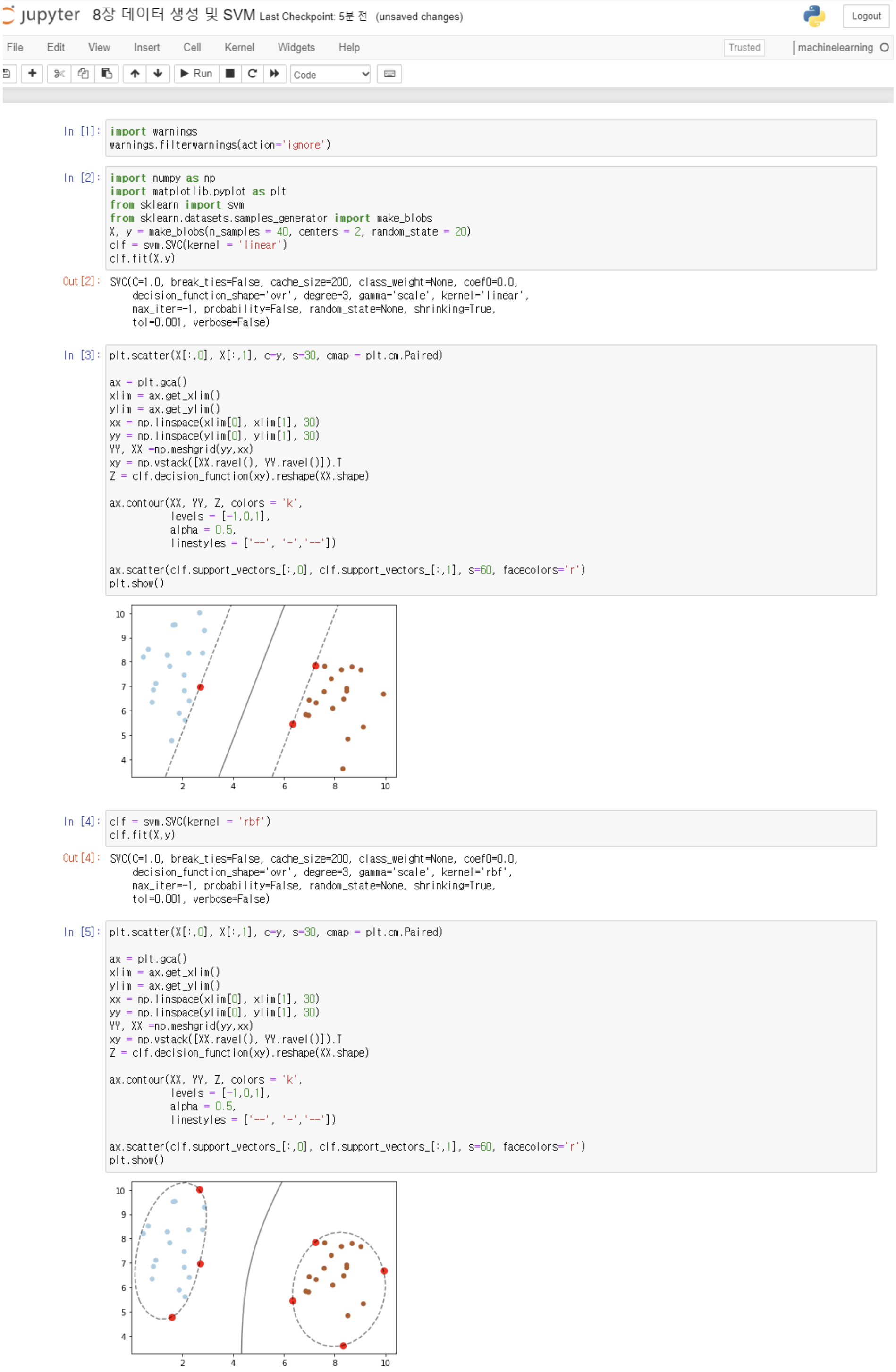
[8장 실습 – 데이터 생성 및 SVM]

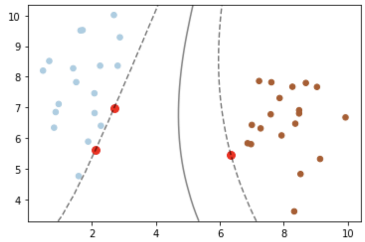


```
In [1]: import warnings
        warnings.filterwarnings(action='ignore')

In [2]: import numpy as np
        import matplotlib.pyplot as plt
        from sklearn import svm
        from sklearn.datasets.samples_generator import make_blobs
        X, y = make_blobs(n_samples = 40, centers = 2, random_state = 20)
        clf = svm.SVC(kernel = 'linear')
        clf.fit(X,y)

Out[2]: SVC(C=1.0, break_ties=False, cache_size=200, class_weight=None, coef0=0.0,
            decision_function_shape='ovr', degree=3, gamma='scale', kernel='linear',
            max_iter=-1, probability=False, random_state=None, shrinking=True,
            tol=0.001, verbose=False)

In [3]: plt.scatter(X[:,0], X[:,1], c=y, s=30, cmap = plt.cm.Paired)

        ax = plt.gca()
        xlim = ax.get_xlim()
        ylim = ax.get_ylim()
        xx = np.linspace(xlim[0], xlim[1], 30)
        yy = np.linspace(ylim[0], ylim[1], 30)
        YY, XX =np.meshgrid(yy,xx)
        xy = np.vstack([XX.ravel(), YY.ravel()]).T
        Z = clf.decision_function(xy).reshape(XX.shape)

        ax.contour(XX, YY, Z, colors = 'k',
                   levels = [-1,0,1],
                   alpha = 0.5,
                   linestyles = ['--', '-','--'])

        ax.scatter(clf.support_vectors_[:,0], clf.support_vectors_[:,1], s=60, facecolors='r')
        plt.show()

In [4]: clf = svm.SVC(kernel = 'rbf')
        clf.fit(X,y)

Out[4]: SVC(C=1.0, break_ties=False, cache_size=200, class_weight=None, coef0=0.0,
            decision_function_shape='ovr', degree=3, gamma='scale', kernel='rbf',
            max_iter=-1, probability=False, random_state=None, shrinking=True,
            tol=0.001, verbose=False)

In [5]: plt.scatter(X[:,0], X[:,1], c=y, s=30, cmap = plt.cm.Paired)

        ax = plt.gca()
        xlim = ax.get_xlim()
        ylim = ax.get_ylim()
        xx = np.linspace(xlim[0], xlim[1], 30)
        yy = np.linspace(ylim[0], ylim[1], 30)
        YY, XX =np.meshgrid(yy,xx)
        xy = np.vstack([XX.ravel(), YY.ravel()]).T
        Z = clf.decision_function(xy).reshape(XX.shape)

        ax.contour(XX, YY, Z, colors = 'k',
                   levels = [-1,0,1],
                   alpha = 0.5,
                   linestyles = ['--', '-','--'])

        ax.scatter(clf.support_vectors_[:,0], clf.support_vectors_[:,1], s=60, facecolors='r')
        plt.show()
```

In [6]:
```
clf = svm.SVC(kernel = 'poly')
clf.fit(X,y)
```

Out[6]:
```
SVC(C=1.0, break_ties=False, cache_size=200, class_weight=None, coef0=0.0,
    decision_function_shape='ovr', degree=3, gamma='scale', kernel='poly',
    max_iter=-1, probability=False, random_state=None, shrinking=True,
    tol=0.001, verbose=False)
```

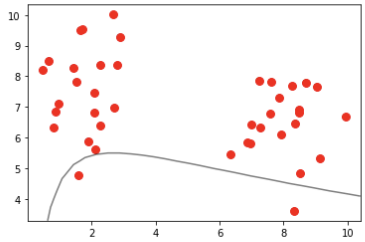
In [7]:
```
plt.scatter(X[:,0], X[:,1], c=y, s=30, cmap = plt.cm.Paired)

ax = plt.gca()
xlim = ax.get_xlim()
ylim = ax.get_ylim()
xx = np.linspace(xlim[0], xlim[1], 30)
yy = np.linspace(ylim[0], ylim[1], 30)
YY, XX =np.meshgrid(yy,xx)
xy = np.vstack([XX.ravel(), YY.ravel()]).T
Z = clf.decision_function(xy).reshape(XX.shape)

ax.contour(XX, YY, Z, colors = 'k',
           levels = [-1,0,1],
           alpha = 0.5,
           linestyles = ['--', '-','--'])

ax.scatter(clf.support_vectors_[:,0], clf.support_vectors_[:,1], s=60, facecolors='r')
plt.show()
```



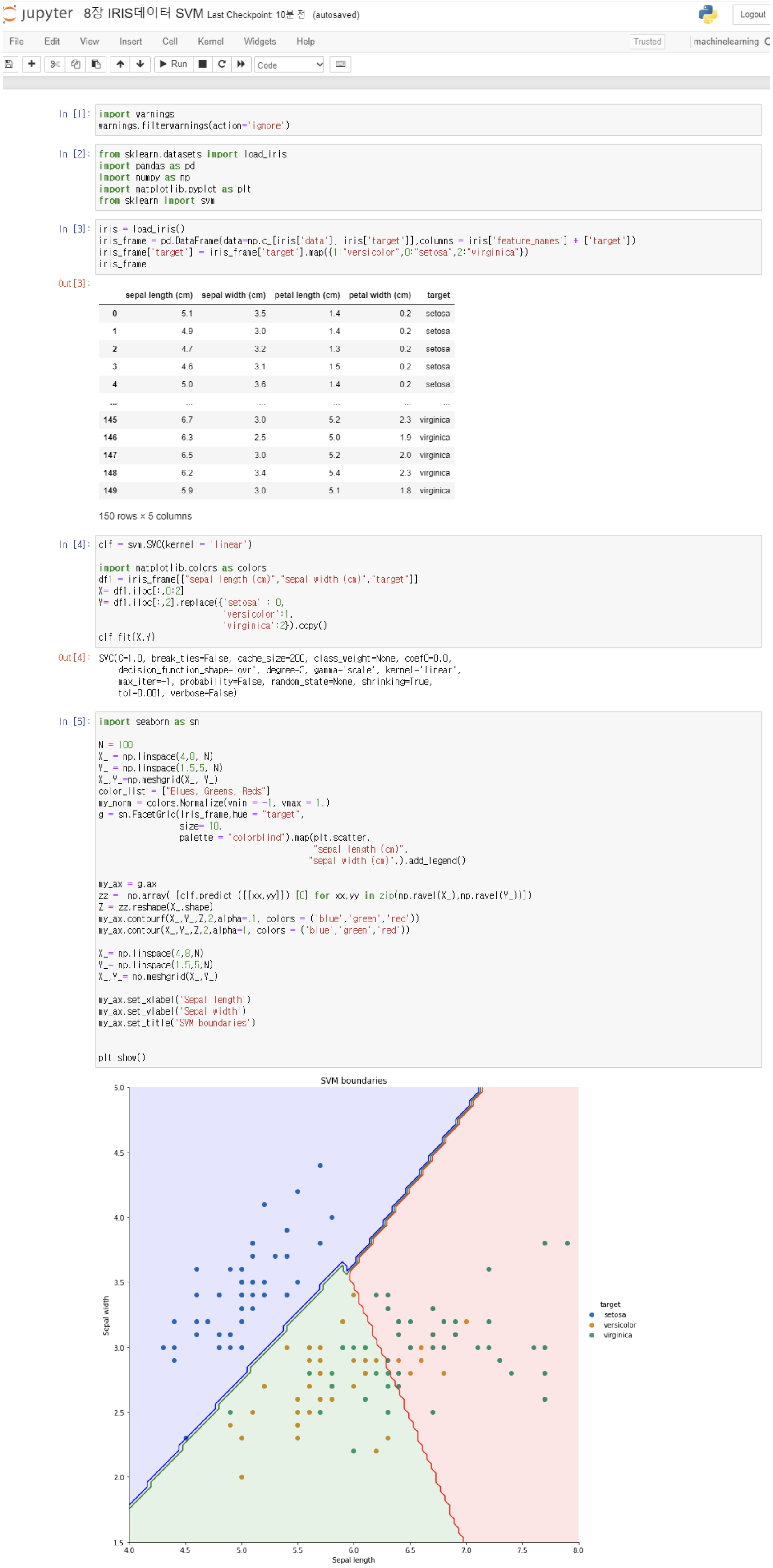
In [8]:
```
clf = svm.SVC(kernel = 'sigmoid')
clf.fit(X,y)
```

Out[8]:
```
SVC(C=1.0, break_ties=False, cache_size=200, class_weight=None, coef0=0.0,
    decision_function_shape='ovr', degree=3, gamma='scale', kernel='sigmoid',
    max_iter=-1, probability=False, random_state=None, shrinking=True,
    tol=0.001, verbose=False)
```

In [9]:
```
plt.scatter(X[:,0], X[:,1], c=y, s=30, cmap = plt.cm.Paired)

ax = plt.gca()
xlim = ax.get_xlim()
ylim = ax.get_ylim()
xx = np.linspace(xlim[0], xlim[1], 30)
yy = np.linspace(ylim[0], ylim[1], 30)
YY, XX =np.meshgrid(yy,xx)
xy = np.vstack([XX.ravel(), YY.ravel()]).T
Z = clf.decision_function(xy).reshape(XX.shape)

ax.contour(XX, YY, Z, colors = 'k',
           levels = [-1,0,1],
           alpha = 0.5,
           linestyles = ['--', '-','--'])

ax.scatter(clf.support_vectors_[:,0], clf.support_vectors_[:,1], s=60, facecolors='r')
plt.show()
```



[8장 실습 – IRIS 데이터 SVM]



In [1]:
```
import warnings
warnings.filterwarnings(action='ignore')
```

In [2]:
```
from sklearn.datasets import load_iris
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
from sklearn import svm
```

In [3]:
```
iris = load_iris()
iris_frame = pd.DataFrame(data=np.c_[iris['data'], iris['target']],columns = iris['feature_names'] + ['target'])
iris_frame['target'] = iris_frame['target'].map({1:"versicolor",0:"setosa",2:"virginica"})
iris_frame
```

Out[3]:

	sepal length (cm)	sepal width (cm)	petal length (cm)	petal width (cm)	target
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
...	...	...	...	...	...
145	6.7	3.0	5.2	2.3	virginica
146	6.3	2.5	5.0	1.9	virginica
147	6.5	3.0	5.2	2.0	virginica
148	6.2	3.4	5.4	2.3	virginica
149	5.9	3.0	5.1	1.8	virginica

150 rows × 5 columns

In [4]:
```
clf = svm.SVC(kernel = 'linear')

import matplotlib.colors as colors
df1 = iris_frame[["sepal length (cm)","sepal width (cm)","target"]]
X= df1.iloc[:,0:2]
Y= df1.iloc[:,2].replace({'setosa' : 0,
                          'versicolor':1,
                          'virginica':2}).copy()
clf.fit(X,Y)
```

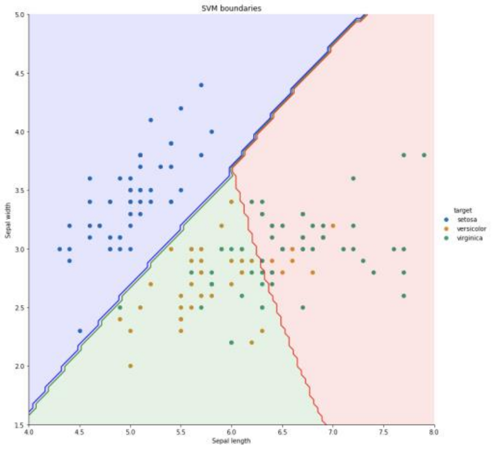
Out[4]:
```
SVC(C=1.0, break_ties=False, cache_size=200, class_weight=None, coef0=0.0,
    decision_function_shape='ovr', degree=3, gamma='scale', kernel='linear',
    max_iter=-1, probability=False, random_state=None, shrinking=True,
    tol=0.001, verbose=False)
```

In [5]:
```
import seaborn as sn

N = 100
X_ = np.linspace(4,8, N)
Y_ = np.linspace(1.5,5, N)
X_,Y_=np.meshgrid(X_, Y_)
color_list = ["Blues, Greens, Reds"]
my_norm = colors.Normalize(vmin = -1, vmax = 1.)
g = sn.FacetGrid(iris_frame,hue = "target",
                 size= 10,
                 palette = "colorblind").map(plt.scatter,
                                             "sepal length (cm)",
                                            "sepal width (cm)",).add_legend()

my_ax = g.ax
zz =  np.array( [clf.predict ([[xx,yy]]) [0] for xx,yy in zip(np.ravel(X_),np.ravel(Y_))])
Z = zz.reshape(X_.shape)
my_ax.contourf(X_,Y_,Z,2,alpha=.1, colors = ('blue','green','red'))
my_ax.contour(X_,Y_,Z,2,alpha=1, colors = ('blue','green','red'))

X_= np.linspace(4,8,N)
Y_= np.linspace(1.5,5,N)
X_,Y_= np.meshgrid(X_,Y_)

my_ax.set_xlabel('Sepal length')
my_ax.set_ylabel('Sepal width')
my_ax.set_title('SVM boundaries')


plt.show()
```

In [6]:
```
clf = svm.SVC(kernel = 'rbf')

import matplotlib.colors as colors
df1 = iris_frame[["sepal length (cm)","sepal width (cm)","target"]]
X= df1.iloc[:,0:2]
Y= df1.iloc[:,2].replace({'setosa' : 0,
                          'versicolor':1,
                          'virginica':2}).copy()
clf.fit(X,Y)
```

Out[6]:
```
SVC(C=1.0, break_ties=False, cache_size=200, class_weight=None, coef0=0.0,
    decision_function_shape='ovr', degree=3, gamma='scale', kernel='rbf',
    max_iter=-1, probability=False, random_state=None, shrinking=True,
    tol=0.001, verbose=False)
```

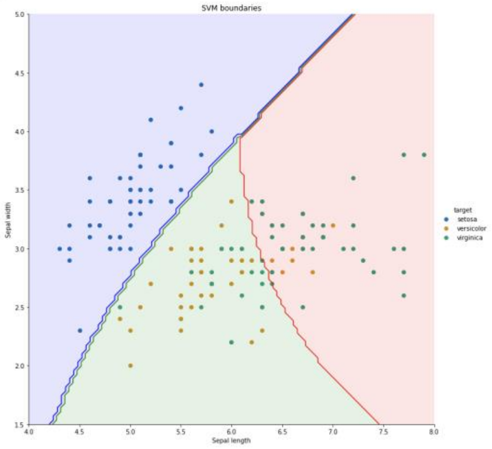
In [7]:
```
import seaborn as sn

N = 100
X_ = np.linspace(4,8, N)
Y_ = np.linspace(1.5,5, N)
X_,Y_=np.meshgrid(X_, Y_)
color_list = ["Blues, Greens, Reds"]
my_norm = colors.Normalize(vmin = -1, vmax = 1.)
g = sn.FacetGrid(iris_frame,hue = "target",
                 size= 10,
                 palette = "colorblind").map(plt.scatter,
                                             "sepal length (cm)",
                                            "sepal width (cm)",).add_legend()

my_ax = g.ax
zz =  np.array( [clf.predict ([[xx,yy]]) [0] for xx,yy in zip(np.ravel(X_),np.ravel(Y_))])
Z = zz.reshape(X_.shape)
my_ax.contourf(X_,Y_,Z,2,alpha=.1, colors = ('blue','green','red'))
my_ax.contour(X_,Y_,Z,2,alpha=1, colors = ('blue','green','red'))

X_= np.linspace(4,8,N)
Y_= np.linspace(1.5,5,N)
X_,Y_= np.meshgrid(X_,Y_)

my_ax.set_xlabel('Sepal length')
my_ax.set_ylabel('Sepal width')
my_ax.set_title('SVM boundaries')


plt.show()
```



In [8]:
```
clf = svm.SVC(kernel = 'poly')

import matplotlib.colors as colors
df1 = iris_frame[["sepal length (cm)","sepal width (cm)","target"]]
X= df1.iloc[:,0:2]
Y= df1.iloc[:,2].replace({'setosa' : 0,
                          'versicolor':1,
                          'virginica':2}).copy()
clf.fit(X,Y)
```

Out[8]:
```
SVC(C=1.0, break_ties=False, cache_size=200, class_weight=None, coef0=0.0,
    decision_function_shape='ovr', degree=3, gamma='scale', kernel='poly',
    max_iter=-1, probability=False, random_state=None, shrinking=True,
    tol=0.001, verbose=False)
```

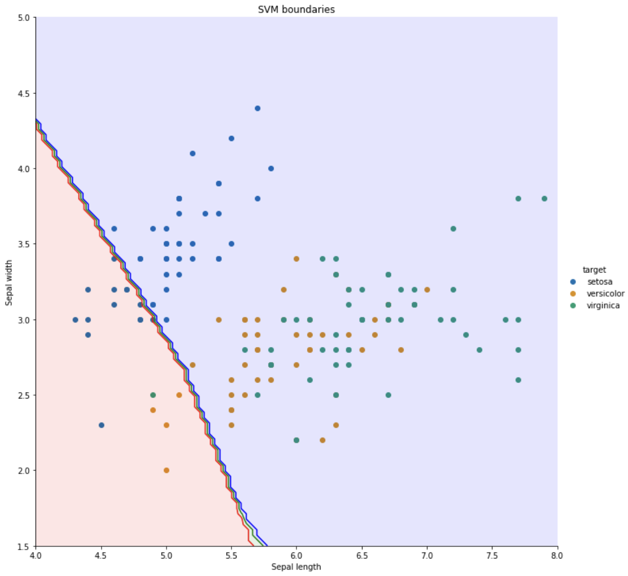
In [9]:
```
import seaborn as sn

N = 100
X_ = np.linspace(4,8, N)
Y_ = np.linspace(1.5,5, N)
X_,Y_=np.meshgrid(X_, Y_)
color_list = ["Blues, Greens, Reds"]
my_norm = colors.Normalize(vmin = -1, vmax = 1.)
g = sn.FacetGrid(iris_frame,hue = "target",
                 size= 10,
                 palette = "colorblind").map(plt.scatter,
                                             "sepal length (cm)",
                                            "sepal width (cm)",).add_legend()

my_ax = g.ax
zz =  np.array( [clf.predict ([[xx,yy]]) [0] for xx,yy in zip(np.ravel(X_),np.ravel(Y_))])
Z = zz.reshape(X_.shape)
my_ax.contourf(X_,Y_,Z,2,alpha=.1, colors = ('blue','green','red'))
my_ax.contour(X_,Y_,Z,2,alpha=1, colors = ('blue','green','red'))

X_= np.linspace(4,8,N)
Y_= np.linspace(1.5,5,N)
X_,Y_= np.meshgrid(X_,Y_)

my_ax.set_xlabel('Sepal length')
my_ax.set_ylabel('Sepal width')
my_ax.set_title('SVM boundaries')


plt.show()
```



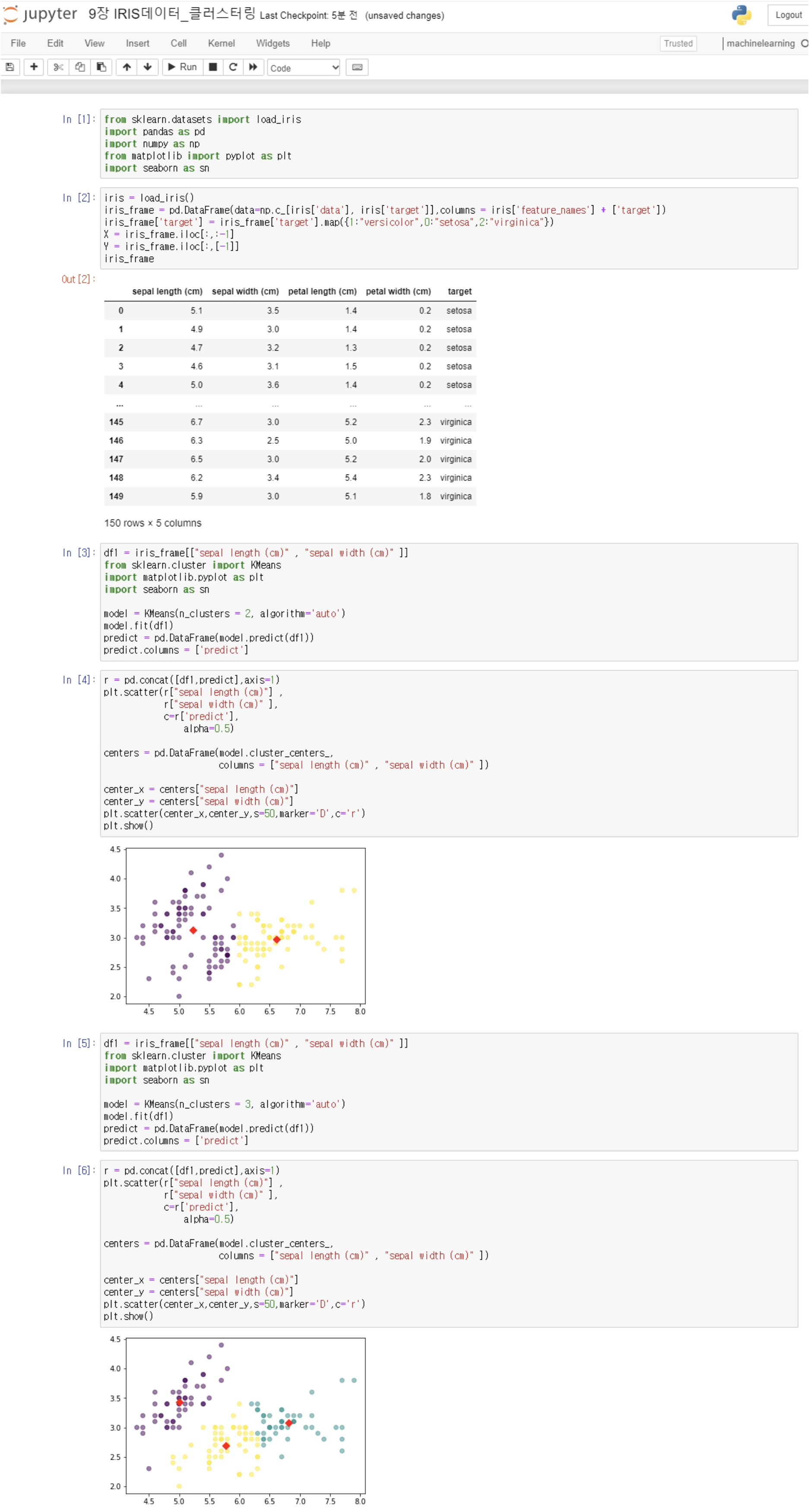
```
In [10]: clf = svm.SVC(kernel = 'sigmoid')

         import matplotlib.colors as colors
         df1 = iris_frame[["sepal length (cm)","sepal width (cm)","target"]]
         X= df1.iloc[:,0:2]
         Y= df1.iloc[:,2].replace({'setosa' : 0,
                                   'versicolor':1,
                                   'virginica':2}).copy()
         clf.fit(X,Y)
```

```
Out[10]: SVC(C=1.0, break_ties=False, cache_size=200, class_weight=None, coef0=0.0,
             decision_function_shape='ovr', degree=3, gamma='scale', kernel='sigmoid',
             max_iter=-1, probability=False, random_state=None, shrinking=True,
             tol=0.001, verbose=False)
```

```
In [11]: import seaborn as sn

         N = 100
         X_ = np.linspace(4,8, N)
         Y_ = np.linspace(1.5,5, N)
         X_,Y_=np.meshgrid(X_, Y_)
         color_list = ["Blues, Greens, Reds"]
         my_norm = colors.Normalize(vmin = -1, vmax = 1.)
         g = sn.FacetGrid(iris_frame,hue = "target",
                          size= 10,
                          palette = "colorblind").map(plt.scatter,
                                                       "sepal length (cm)",
                                                      "sepal width (cm)",).add_legend()

         my_ax = g.ax
         zz =  np.array( [clf.predict ([[xx,yy]]) [0] for xx,yy in zip(np.ravel(X_),np.ravel(Y_))])
         Z = zz.reshape(X_.shape)
         my_ax.contourf(X_,Y_,Z,2,alpha=.1, colors = ('blue','green','red'))
         my_ax.contour(X_,Y_,Z,2,alpha=1, colors = ('blue','green','red'))

         X_= np.linspace(4,8,N)
         Y_= np.linspace(1.5,5,N)
         X_,Y_= np.meshgrid(X_,Y_)

         my_ax.set_xlabel('Sepal length')
         my_ax.set_ylabel('Sepal width')
         my_ax.set_title('SVM boundaries')


         plt.show()
```



[9장 실습 – IRIS데이터 클러스터링]



In [1]:
```
from sklearn.datasets import load_iris
import pandas as pd
import numpy as np
from matplotlib import pyplot as plt
import seaborn as sn
```

In [2]:
```
iris = load_iris()
iris_frame = pd.DataFrame(data=np.c_[iris['data'], iris['target']],columns = iris['feature_names'] + ['target'])
iris_frame['target'] = iris_frame['target'].map({1:"versicolor",0:"setosa",2:"virginica"})
X = iris_frame.iloc[:,:-1]
Y = iris_frame.iloc[:,[-1]]
iris_frame
```

Out[2]:

	sepal length (cm)	sepal width (cm)	petal length (cm)	petal width (cm)	target
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
...	...	...	...	...	...
145	6.7	3.0	5.2	2.3	virginica
146	6.3	2.5	5.0	1.9	virginica
147	6.5	3.0	5.2	2.0	virginica
148	6.2	3.4	5.4	2.3	virginica
149	5.9	3.0	5.1	1.8	virginica

150 rows × 5 columns

In [3]:
```
df1 = iris_frame[["sepal length (cm)" , "sepal width (cm)" ]]
from sklearn.cluster import KMeans
import matplotlib.pyplot as plt
import seaborn as sn

model = KMeans(n_clusters = 2, algorithm='auto')
model.fit(df1)
predict = pd.DataFrame(model.predict(df1))
predict.columns = ['predict']
```

In [4]:
```
r = pd.concat([df1,predict],axis=1)
plt.scatter(r["sepal length (cm)"] ,
            r["sepal width (cm)" ],
            c=r['predict'],
               alpha=0.5)

centers = pd.DataFrame(model.cluster_centers_,
                       columns = ["sepal length (cm)" , "sepal width (cm)" ])

center_x = centers["sepal length (cm)"]
center_y = centers["sepal width (cm)"]
plt.scatter(center_x,center_y,s=50,marker='D',c='r')
plt.show()
```

In [5]:
```
df1 = iris_frame[["sepal length (cm)" , "sepal width (cm)" ]]
from sklearn.cluster import KMeans
import matplotlib.pyplot as plt
import seaborn as sn

model = KMeans(n_clusters = 3, algorithm='auto')
model.fit(df1)
predict = pd.DataFrame(model.predict(df1))
predict.columns = ['predict']
```

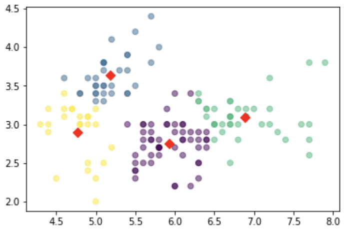
In [6]:
```
r = pd.concat([df1,predict],axis=1)
plt.scatter(r["sepal length (cm)"] ,
            r["sepal width (cm)" ],
            c=r['predict'],
               alpha=0.5)

centers = pd.DataFrame(model.cluster_centers_,
                       columns = ["sepal length (cm)" , "sepal width (cm)" ])

center_x = centers["sepal length (cm)"]
center_y = centers["sepal width (cm)"]
plt.scatter(center_x,center_y,s=50,marker='D',c='r')
plt.show()
```

In [7]:

```python
df1 = iris_frame[["sepal length (cm)" , "sepal width (cm)" ]]
from sklearn.cluster import KMeans
import matplotlib.pyplot as plt
import seaborn as sn

model = KMeans(n_clusters = 4, algorithm='auto')
model.fit(df1)
predict = pd.DataFrame(model.predict(df1))
predict.columns = ['predict']
```

In [8]:

```python
r = pd.concat([df1,predict],axis=1)
plt.scatter(r["sepal length (cm)"] ,
            r["sepal width (cm)" ],
            c=r['predict'],
                alpha=0.5)

centers = pd.DataFrame(model.cluster_centers_,
                       columns = ["sepal length (cm)" , "sepal width (cm)" ])

center_x = centers["sepal length (cm)"]
center_y = centers["sepal width (cm)"]
plt.scatter(center_x,center_y,s=50,marker='D',c='r')
plt.show()
```

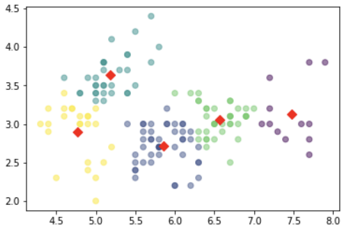


In [9]:

```python
df1 = iris_frame[["sepal length (cm)" , "sepal width (cm)" ]]
from sklearn.cluster import KMeans
import matplotlib.pyplot as plt
import seaborn as sn

model = KMeans(n_clusters = 5, algorithm='auto')
model.fit(df1)
predict = pd.DataFrame(model.predict(df1))
predict.columns = ['predict']
```

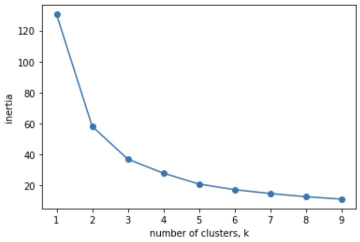
In [10]:

```python
r = pd.concat([df1,predict],axis=1)
plt.scatter(r["sepal length (cm)"] ,
            r["sepal width (cm)" ],
            c=r['predict'],
                alpha=0.5)

centers = pd.DataFrame(model.cluster_centers_,
                       columns = ["sepal length (cm)" , "sepal width (cm)" ])

center_x = centers["sepal length (cm)"]
center_y = centers["sepal width (cm)"]
plt.scatter(center_x,center_y,s=50,marker='D',c='r')
plt.show()
```

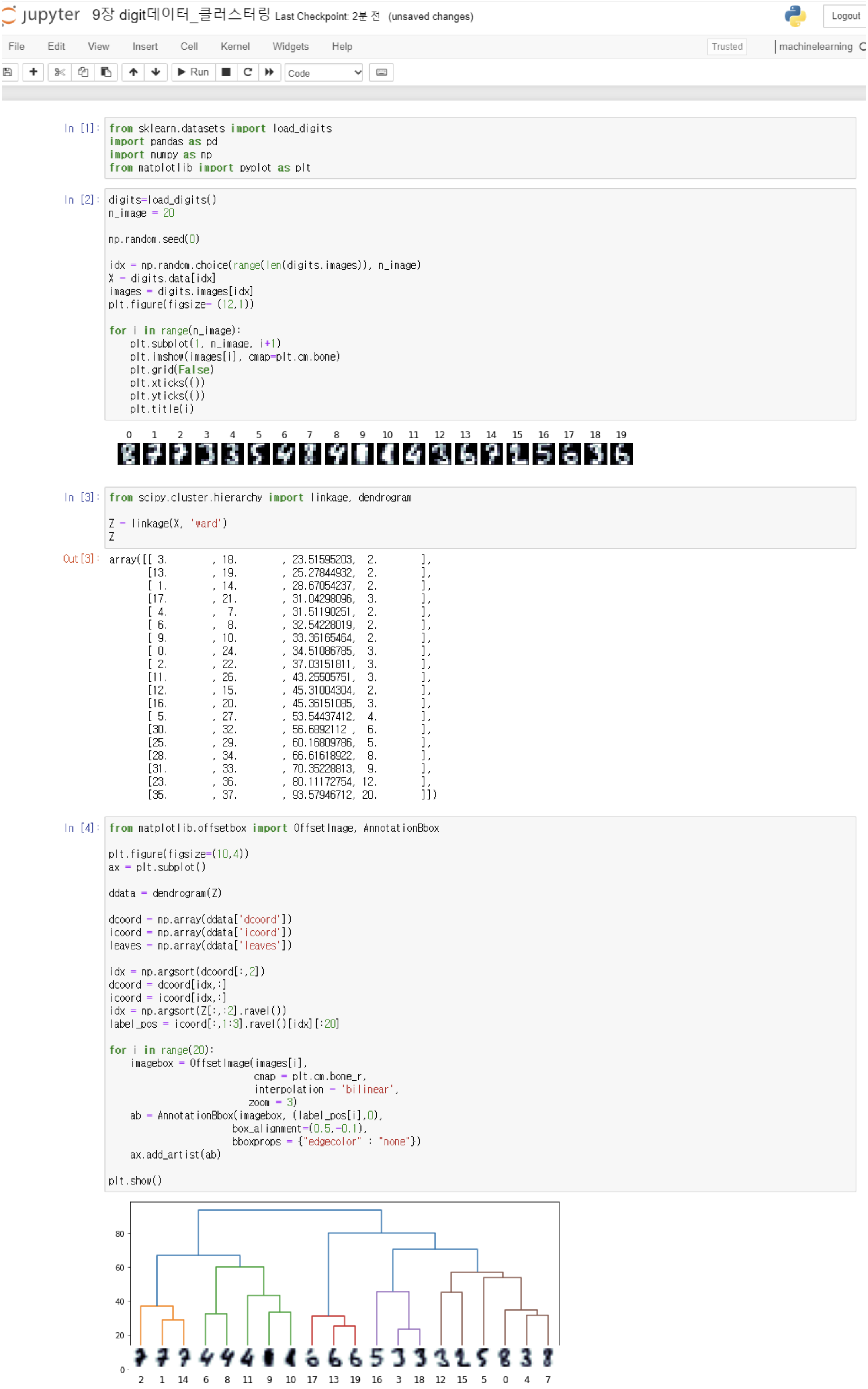


In [11]:

```python
ks = range(1,10)
iner=[]

for k in ks:
    model = KMeans(n_clusters=k)
    model.fit(df1)
    iner.append(model.inertia_)
plt.plot(ks,iner,'-o')
plt.xlabel('number of clusters, k')
plt.ylabel('inertia')
plt.xticks(ks)
plt.show()
```



[9장 실습 - digit데이터 클러스터링]



jupyter 9장 digit데이터_클러스터링 Last Checkpoint: 2분 전 (unsaved changes)
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Code

In [1]:
```
from sklearn.datasets import load_digits
import pandas as pd
import numpy as np
from matplotlib import pyplot as plt
```

In [2]:
```
digits=load_digits()
n_image = 20

np.random.seed(0)

idx = np.random.choice(range(len(digits.images)), n_image)
X = digits.data[idx]
images = digits.images[idx]
plt.figure(figsize= (12,1))

for i in range(n_image):
    plt.subplot(1, n_image, i+1)
    plt.imshow(images[i], cmap=plt.cm.bone)
    plt.grid(False)
    plt.xticks(())
    plt.yticks(())
    plt.title(i)
```

In [3]:
```
from scipy.cluster.hierarchy import linkage, dendrogram

Z = linkage(X, 'ward')
Z
```

Out[3]:
```
array([[ 3.        , 18.        , 23.51595203,  2.        ],
       [13.        , 19.        , 25.27844932,  2.        ],
       [ 1.        , 14.        , 28.67054237,  2.        ],
       [17.        , 21.        , 31.04298096,  3.        ],
       [ 4.        ,  7.        , 31.51190251,  2.        ],
       [ 6.        ,  8.        , 32.54228019,  2.        ],
       [ 9.        , 10.        , 33.36165464,  2.        ],
       [ 0.        , 24.        , 34.51086785,  3.        ],
       [ 2.        , 22.        , 37.03151811,  3.        ],
       [11.        , 26.        , 43.25505751,  3.        ],
       [12.        , 15.        , 45.31004304,  2.        ],
       [16.        , 20.        , 45.36151085,  3.        ],
       [ 5.        , 27.        , 53.54437412,  4.        ],
       [30.        , 32.        , 56.6892112 ,  6.        ],
       [25.        , 29.        , 60.16809786,  5.        ],
       [28.        , 34.        , 66.61618922,  8.        ],
       [31.        , 33.        , 70.35228813,  9.        ],
       [23.        , 36.        , 80.11172754, 12.        ],
       [35.        , 37.        , 93.57946712, 20.        ]])
```

In [4]:
```
from matplotlib.offsetbox import OffsetImage, AnnotationBbox

plt.figure(figsize=(10,4))
ax = plt.subplot()

ddata = dendrogram(Z)

dcoord = np.array(ddata['dcoord'])
icoord = np.array(ddata['icoord'])
leaves = np.array(ddata['leaves'])

idx = np.argsort(dcoord[:,2])
dcoord = dcoord[idx,:]
icoord = icoord[idx,:]
idx = np.argsort(Z[:,:2].ravel())
label_pos = icoord[:,1:3].ravel()[idx][:20]

for i in range(20):
    imagebox = OffsetImage(images[i],
                           cmap = plt.cm.bone_r,
                           interpolation = 'bilinear',
                          zoom = 3)
    ab = AnnotationBbox(imagebox, (label_pos[i],0),
                        box_alignment=(0.5,-0.1),
                        bboxprops = {"edgecolor" : "none"})
    ax.add_artist(ab)

plt.show()
```