Scikit-learn Intro

We want to get a machine to learn how to recognize digits.

Scikit-learn has some builtin datasets

In [1]:
```
from sklearn import datasets
```

The most famous one in ML is the MNIST dataset.

In [2]:
```
digits = datasets.load_digits()
```

Let's take a look at the data briefly.

In [3]:
```
print(digits.data)
```

```
[[ 0.  0.  5. ...  0.  0.  0.]
 [ 0.  0.  0. ... 10.  0.  0.]
 [ 0.  0.  0. ... 16.  9.  0.]
 ...
 [ 0.  0.  1. ...  6.  0.  0.]
 [ 0.  0.  2. ... 12.  0.  0.]
 [ 0.  0. 10. ... 12.  1.  0.]]
```

That was not very helpful. We need to study it in a bit more detail.

In [4]:
```
digits.data.shape
```

Out[4]:
```
(1797, 64)
```

In [5]:
```
digits.data[0]
```

Out[5]:
```
array([ 0.,  0.,  5., 13.,  9.,  1.,  0.,  0.,  0.,  0., 13., 15., 10.,
       15.,  5.,  0.,  0.,  3., 15.,  2.,  0., 11.,  8.,  0.,  0.,  4.,
       12.,  0.,  0.,  8.,  8.,  0.,  0.,  5.,  8.,  0.,  0.,  9.,  8.,
        0.,  0.,  4., 11.,  0.,  1., 12.,  7.,  0.,  0.,  2., 14.,  5.,
       10., 12.,  0.,  0.,  0.,  0.,  6., 13., 10.,  0.,  0.,  0.])
```

And what are we trying to predict?

In [6]:
```
digits.target
```

Out[6]:
```
array([0, 1, 2, ..., 8, 9, 8])
```

In [7]:
```
digits.target[-10:]
```

Out[7]:
```
array([5, 4, 8, 8, 4, 9, 0, 8, 9, 8])
```

In [8]:
```
digits.target.shape
```

Out[8]:
```
(1797,)
```

Learning the digits

Let's load a builtin classifier -- an object that decides what the image corresponds to.

In [9]:
```
from sklearn import svm
```

Don't worry about the exact values we've put in for the parameters. They're not important for us at the moment.

In [10]:
```
clf = svm.SVC(gamma=0.001, C=100.)
```

Let's tell the classifier to learn from the data. We'll show it all the images and tell it which ones they are -- except for the last one. We'll hold that secret.

In [11]:
```
clf.fit(digits.data[:-1], digits.target[:-1])
```

Out[11]:
```
SVC(C=100.0, cache_size=200, class_weight=None, coef0=0.0,
  decision_function_shape='ovr', degree=3, gamma=0.001, kernel='rbf',
  max_iter=-1, probability=False, random_state=None, shrinking=True,
  tol=0.001, verbose=False)
```

The machine has learned the digits -- or so it thinks. Let's test it on the one digits we never showed it. Notice that we're not telling it the `target`.

In [12]:
```
clf.predict(digits.data[-1:])
```

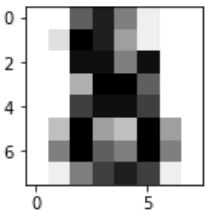
Out[12]:
```
array([8])
```

Let's see what that image looks like and whether the prediction makes sense.

In [13]:
```
%matplotlib inline
import numpy as np
from matplotlib import pyplot as plt

plt.figure(figsize=(2, 2))
plt.imshow(digits.images[-1], interpolation='nearest', cmap=plt.cm.binary)
```

Out[13]:
```
<matplotlib.image.AxesImage at 0x7f85f98219b0>
```



Let's go back and see where all the learning happened.