

# Statistical learning: the setting and the estimator object in scikit-learn

## Datasets

Scikit-learn deals with learning information from one or more datasets that are represented as 2D arrays. They can be understood as a list of multi-dimensional observations. We say that the first axis of these arrays is the **samples** axis, while the second is the **features** axis.

### A simple example shipped with scikit-learn: iris dataset

```
>>> from sklearn import datasets
>>> iris = datasets.load_iris()
>>> data = iris.data
>>> data.shape
(150, 4)
```

It is made of 150 observations of irises, each described by 4 features: their sepal and petal length and width, as detailed in `iris.DESCR`.

When the data is not initially in the `(n_samples, n_features)` shape, it needs to be preprocessed in order to be used by scikit-learn.

### An example of reshaping data would be the digits dataset

The digits dataset is made of 1797 8x8 images of hand-written digits

```
>>> digits = datasets.load_digits()
>>> digits.images.shape
(1797, 8, 8)
>>> import matplotlib.pyplot as plt
>>> plt.imshow(digits.images[-1],
...           cmap=plt.cm.gray_r)
<...>
```



To use this dataset with scikit-learn, we transform each 8x8 image into a feature vector of length 64

```
>>> data = digits.images.reshape(
...     (digits.images.shape[0], -1)
... )
```

## Estimators objects

**Fitting data:** the main API implemented by scikit-learn is that of the *estimator*. An estimator is any object that learns from data; it may be a classification, regression or clustering algorithm or a *transformer* that extracts/filters useful features from raw data.

All estimator objects expose a `fit` method that takes a dataset (usually a 2-d array):

```
>>> estimator.fit(data)
```

**Estimator parameters:** All the parameters of an estimator can be set when it is instantiated or by modifying the corresponding attribute:

```
>>> estimator = Estimator(param1=1, param2=2)
>>> estimator.param1
1
```

**Estimated parameters:** When data is fitted with an estimator, parameters are estimated from the data at hand. All the estimated parameters are attributes of the estimator object ending by an underscore:

```
>>> estimator.estimated_param_ #doctest: +SKIP
```