

### Definition

**Scikit-learn** is an open source Python library that implements a range of machine learning, preprocessing, cross-validation and visualization algorithms using a unified interface

### Splitting Data

```
from sklearn.model_selection import train_test_split
```

```
X_train, X_test, y_train, y_test = train_test_split(X, y, random_state=7)
```

### Handling Missing Data

```
from sklearn.impute import SimpleImputer
```

```
missingvalues = SimpleImputer(missing_values = np.nan, strategy = 'mean')
```

```
missingvalues = missingvalues.fit(X[:, 1:3])
```

```
X[:, 1:3]=missingvalues.transform(X[:, 1:3])
```

### Linear Regression

```
from sklearn.linear_model import LinearRegression
```

```
linear_reg = LinearRegression()
```

```
linear_reg.fit(X, y)
```

### Decision Tree and Random forest

```
from sklearn.tree import DecisionTreeRegressor
```

```
from sklearn.ensemble import RandomForestRegressor
```

```
regressor = DecisionTreeRegressor(random_state = 0)
```

```
regressor.fit(X,y)
```

```
regressor2 = RandomForestRegressor(n_estimators =
```

```
100,random_state=0)
```

```
regressor2.fit(X,y)
```

### Cross-Validation

```
from sklearn.datasets import make_regression
```

```
from sklearn.linear_model import LinearRegression
```

```
from sklearn.model_selection import cross_validate
```

```
X, y = make_regression(n_samples = 1000, random_state = 0)
```

```
lr = LinearRegression()
```

```
result = cross_validate(lr,X,y)
```

```
result['test_score']
```

It is used to know the effectiveness of our Models by re-sampling and applying to models in different iterations.

### Pandas functions for importing Data

```
pd.read_csv(filename) From a CSV file
```

```
pd.read_excel(filename) From an Excel file
```

```
pd.read_sql(query, connection_object) Read from a SQL table/database
```

```
pd.read_clipboard() Takes the contents of your clipboard and passes it to read_table()
```

### Visualization using Scikit-learn

```
from sklearn.metrics import plot_roc_curve Importing "plot_roc_curve" to plot
```

```
svc_disp = plot_roc_curve(svc, X_test, y_test) Plotting Receiver operating characteristic Curve
```

```
metrics.plot_confusion_matrix Plotting Confusion Matrix.
```

### Clustering metrics

Adjusted Rand Index

```
>>> from sklearn.metrics import adjusted_rand_score
```

```
>>> adjusted_rand_score(y_true, y_pred)
```

Homogeneity

```
>>> from sklearn.metrics import homogeneity_score >>> homogeneity_score(y_true, y_pred)
```

V-measure

```
>>> from sklearn.metrics import v_measure_score
```

```
>>> metrics.v_measure_score(y_true, y_pred)
```

### Pandas Data Cleaning functions

```
pd.isnull() Checks for null Values, Returns Boolean Array
```

```
pd.notnull() Opposite of pd.isnull()
```

```
df.dropna() Drop all rows that contain null values
```

```
df.dropna(axis=1) Drop all columns that contain null values
```

```
df.fillna(x) Replace all null values with x
```

### Numpy Basic Functions

```
import numpy as np importing numpy
```

```
example = [0,1,2] array([0, 1, 2])
```

```
example = np.array(example)
```

```
np.arange(1,4) array([1,2,3])
```

```
np.zeros(2,2) array([[0,0],[0,0]])
```



### Numpy Basic Functions (cont)

```
np.linspace(0,10,2)    array([0,5]), gives two evenly spaced values
np.eye(2)             array([[1,0],[0,1)], 2*2 Identity Matrix
example.reshape(3,1)  array([[0],[1],[2]])
```

### Loading Dataset from local Machine

```
import pandas as pd
data = pd.read_csv(pathname)
```

If the file is in the local directory then we can directly use File name

### Loading Data from Standard datasets

```
from sklearn import datasets
iris = datasets.load_iris()
digits = datasets.load_digits()
```

### Encoding Categorical Variables

```
from sklearn.preprocessing import LabelEncoder
labelencoder_X = LabelEncoder()
X[:, 0] = labelencoder_X.fit_transform(X[:, 0])
onehotencoder = OneHotEncoder(categorical_features = [0])
X = onehotencoder.fit_transform(X).toarray()
```

### Polynomial Regression

```
from sklearn.preprocessing import PolynomialFeatures
poly_reg = PolynomialFeatures(degree =2)
X_poly = poly_reg.fit_transform(X)
```

It not only checks the relation between X(independent) and y(dependent). But also checks with  $X^2 \dots X^n$ . (n is degree specified by us).

### Evaluation of Regression Model Performance

$$R^2 = 1 - \frac{SS(\text{residuals})}{SS(\text{total})}$$

$$SS(\text{res}) = \sum (Y_i - \hat{y}_j)^2$$

$$SS(\text{Total}) = \sum (y_i - \text{avg})^2$$

```
from sklearn.metrics import r2_score
r2_score(y_true,y_pred)
```

The Greater the  $R^2$  value the better the model is..

### Converting Dataframe to Matrix

```
data = pd.read_csv("data.csv")
X = data.iloc[:, :-1].values
y = data.iloc[:, 3].values
y is Dependent parameter
```

### Feature Scaling

```
from sklearn.preprocessing import StandardScaler
sc_X = StandardScaler()
X_train = sc_X.fit_transform(X_train)
X_test = sc_X.transform(X_test)
```

Euclidean distance is dominated by the larger numbers and to make all the values on the same scale. hence Scaling should be done. Most of the models do feature scaling by themselves.

### SVR(Non-linear Regression model)

```
from sklearn.svm import SVR
regressor = SVR(kernel = 'rbf')
regressor.fit(X,y)
y_prediction = regressor.predict(values)
```

Basically, the kernel is selected based on the given problem. If the problem is Linear then **kernel='linear'**. And if problem is non-linear we can choose either 'poly' or **'rbf'(gussian)**

### Some Classification Models

- Logistic Regression
- K-NN(K- nearest neighbours)
- Support Vector Machine(SVM)
- Naive Bayes
- Decision Tree Classification
- Random Forest Classification

### Some Clustering Models

- K-Means Clustering
- Hierarchical Clustering
- DB-SCAN

### Knowing about Data information with Pandas

df.head(n)	First n rows of the DataFrame
df.tail(n)	Last n rows of the DataFrame
df.shape	Number of rows and columns
df.info()	Index, Datatype and Memory information
df.describe()	Summary statistics for numerical columns

