Scikit-Learn Cheat Sheet

In [1]:
```
import matplotlib.pyplot as plt
```

In [2]:
```
%precision 3
ipython_plain = get_ipython().display_formatter.formatters['text/plain']
ipython_plain.for_type(np.float64, ipython_plain.lookup_by_type(float));

import warnings
warnings.simplefilter(action='ignore', category=FutureWarning)
```

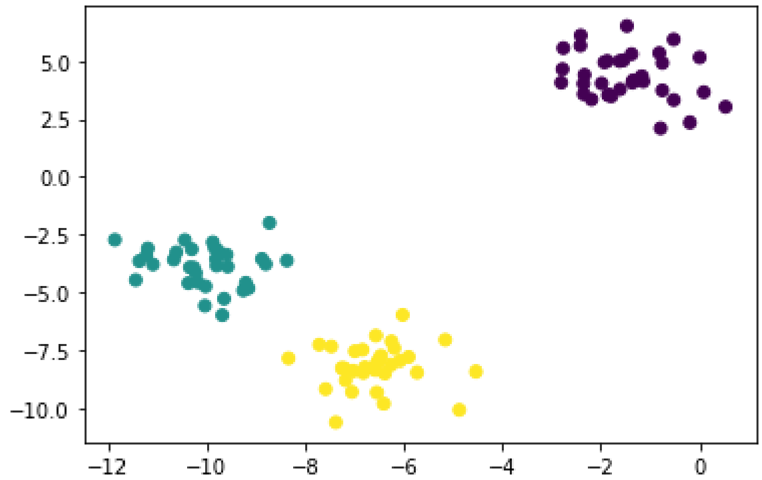
In [3]:
```
m23 = np.array([[1, 2, 3], [4, 5, 6]])
```

Datasets

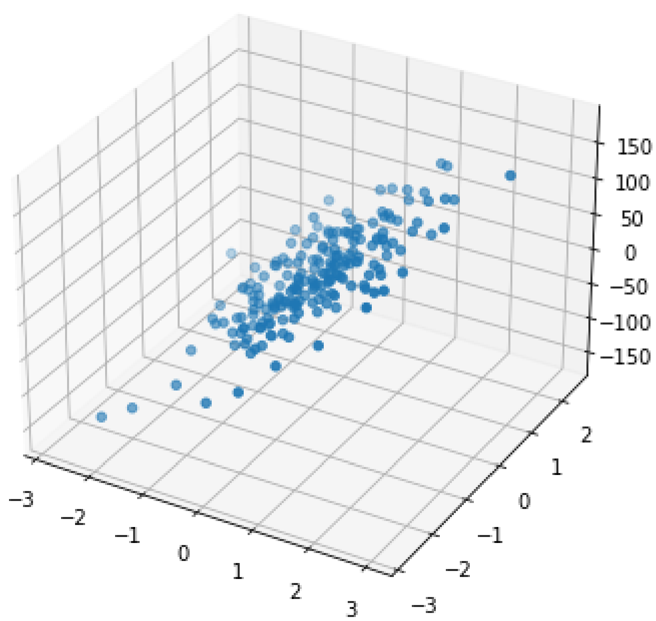
In [4]:
```
from sklearn.datasets import load_boston, load_iris, load_digits

iris, boston, digits = load_iris(), load_boston(), load_digits()
print(boston.keys())
print(iris.keys())
print(digits.keys())
```

```
dict_keys(['data', 'target', 'feature_names', 'DESCR', 'filename', 'data_modul
e'])
dict_keys(['data', 'target', 'frame', 'target_names', 'DESCR', 'feature_name
s', 'filename', 'data_module'])
dict_keys(['data', 'target', 'frame', 'feature_names', 'target_names', 'image
s', 'DESCR'])
```

In [5]:
```
from sklearn.datasets import make_blobs

Xb, yb = make_blobs(n_samples = 100,
                    n_features = 2,
                    centers = 3,
                    cluster_std = 1,
                    random_state = 1)

plt.scatter(Xb[:,0], Xb[:,1], c=yb);
```

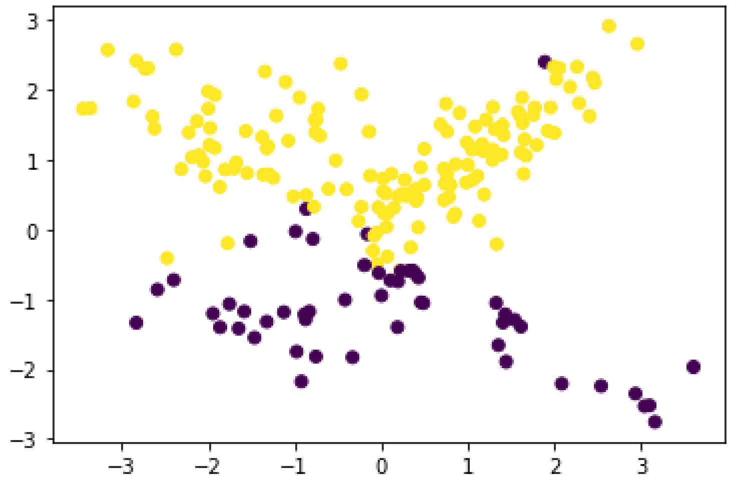


In [6]:
```
from sklearn.datasets import make_regression

Xr, yr = make_regression(n_samples = 200,
                         n_features = 2,
                         n_informative = 2,
                         n_targets = 1,
                         noise = 10,
                         random_state = 1)

plt.figure(figsize=(6, 6))
ax = plt.axes(projection='3d')
ax.scatter3D(Xr[:,0], Xr[:,1], yr);
```



In [7]:
```
from sklearn.datasets import make_classification

Xc, yc = make_classification(n_samples = 200,
                             n_features = 2,
                             n_informative = 2,
                             n_redundant = 0,
                             n_classes = 2,
                             weights = [.25, .75],
```

```
                                  random_state = 3)

plt.scatter(Xc[:,0], Xc[:,1], c=yc);
```



Preprocessing

In [8]:
```
from sklearn.preprocessing import MinMaxScaler

X_new = MinMaxScaler().fit_transform(Xc)
X_new.min(), X_new.max()
```

Out[8]:
```
(0.000, 1.000)
```

In [9]:
```
from sklearn.preprocessing import StandardScaler

X_new = StandardScaler().fit_transform(Xc)
X_new.mean(), X_new.std(), X_new.min(), X_new.max()
```

Out[9]:
```
(0.000, 1.000, -2.625, 2.358)
```

In [10]:
```
from sklearn.preprocessing import RobustScaler

X_outliers = np.random.normal(0, 0.5, (10, 1))
X_outliers[0, 0] = 3
X_new = RobustScaler().fit_transform(X_outliers)
print(X_outliers.flatten())
print(X_new.flatten())
# RobustScaler scales by mean and quartile range
```

```
[ 3.    -0.682 -0.191  0.425  0.178  0.665  1.334  0.059  1.039  0.295]
[ 3.083 -1.217 -0.644  0.075 -0.212  0.356  1.137 -0.351  0.793 -0.075]
```

In [11]:
```
from sklearn.preprocessing import Normalizer

print(m23, end='\n\n')

X_l2norm = Normalizer().fit_transform(m23)
print(X_l2norm, f', L2 = {np.square(X_l2norm[0, :]).sum()}, '
      f'x3/x1 = {X_l2norm[0,2]/X_l2norm[0,0]}')

X_l1norm = Normalizer(norm='l1').fit_transform(m23)
```

```
print(X_l1norm, f', L1 = {X_l1norm[0, :].sum()}, '
      f'x3/x1 = {X_l1norm[0,2]/X_l1norm[0,0]}')

# NOTE: Normalizer defaults to axis=1 (i.e. over samples rather than features).
```

```
[[1 2 3]
 [4 5 6]]

[[0.267 0.535 0.802]
 [0.456 0.57  0.684]] , L2 = 1.0, x3/x1 = 3.0
[[0.167 0.333 0.5  ]
 [0.267 0.333 0.4  ]] , L1 = 1.0, x3/x1 = 3.0
```

Features

In [12]:
```
from sklearn.preprocessing import PolynomialFeatures

feat = np.array([[2, 3]])
PolynomialFeatures(degree=2, include_bias=False).fit_transform(feat)
# x1, x2, x1*x2, x1^2, x2^2
```

Out[12]:
```
array([[2., 3., 4., 6., 9.]])
```

In [13]:
```
from sklearn.preprocessing import FunctionTransformer

FunctionTransformer(lambda x: print(x.shape)).transform(m23)
```

```
(2, 3)
```

In [14]:
```
from sklearn.preprocessing import LabelBinarizer

feat = np.array([['A'], ['B'], ['C'], ['A']])
one_hot = LabelBinarizer()
feat_new = one_hot.fit_transform(feat)
print( feat_new )
print( one_hot.inverse_transform(feat_new), one_hot.classes_ )
```

```
[[1 0 0]
 [0 1 0]
 [0 0 1]
 [1 0 0]]
['A' 'B' 'C' 'A'] ['A' 'B' 'C']
```

In [15]:
```
import pandas as pd

df = pd.DataFrame([['A'], ['B'], ['C'], ['A']])
pd.get_dummies(df.iloc[:, 0])
```

Out[15]:

	A	B	C
0	1	0	0
1	0	1	0
2	0	0	1
3	1	0	0

In [16]:
```
from sklearn.feature_extraction import DictVectorizer
```

```
feat = [{'he': 1, 'she': 2}, {'she': 3}]
vectorizer = DictVectorizer(sparse=False)
feat_new = vectorizer.fit_transform(feat)
print( feat_new )
print( vectorizer.get_feature_names() )
```

```
[[1. 2.]
 [0. 3.]]
['he', 'she']
```

In [17]:
```
from sklearn.impute import SimpleImputer

feat = np.array([[1, 2, 2], [3, 3, 3], [np.nan, 2, 2]])
SimpleImputer(strategy='mean').fit_transform(feat)
# 'strategy': 'mean', 'median', 'most_frequent', 'constant'
```

Out[17]:
```
array([[1., 2., 2.],
       [3., 3., 3.],
       [2., 2., 2.]])
```

In [18]:
```
from sklearn.impute import KNNImputer

feat = np.array([[1, 2, 2], [3, 3, 3], [np.nan, 2, 2]])
KNNImputer(n_neighbors=1).fit_transform(feat)
```

Out[18]:
```
array([[1., 2., 2.],
       [3., 3., 3.],
       [1., 2., 2.]])
```

Clustering

In [19]:
```
X, y = make_blobs(n_samples = 10,
                  n_features = 2,
                  centers = 3,
                  cluster_std = 1,
                  random_state = 1)
y
```

Out[19]:
```
array([2, 2, 2, 1, 0, 0, 0, 1, 0, 1])
```

In [20]:
```
from sklearn.cluster import KMeans

clt = KMeans(3, random_state=0)
clt.fit_predict(X)
```

Out[20]:
```
array([2, 2, 2, 1, 0, 0, 0, 1, 0, 1], dtype=int32)
```

Metrics

In [21]:
```
from sklearn.metrics import r2_score, mean_squared_error


y , y_hat = np.array([1, 2 , 3]) , np.array([1.5, 1.5, 3.5])

print( r2_score(y_hat, y) )
```

```
print( mean_squared_error(y_hat, y) )
print( mean_squared_error(y_hat, y, squared=False) )   # RMSE
```

```
0.71875
0.25
0.5
```

Models

In [22]:
```
from statsmodels.regression.linear_model import OLS
from statsmodels.api import add_constant

X_scaled = StandardScaler().fit_transform(Xr)
X_bias = add_constant(X_scaled)
ols = OLS(yr, X_bias).fit()
ols.summary()
```

Out[22]:

OLS Regression Results

Dep. Variable:	y	**R-squared:**	0.961
Model:	OLS	**Adj. R-squared:**	0.960
Method:	Least Squares	**F-statistic:**	2396.
Date:	Sun, 27 Mar 2022	**Prob (F-statistic):**	5.55e-139
Time:	18:18:36	**Log-Likelihood:**	-751.81
No. Observations:	200	**AIC:**	1510.
Df Residuals:	197	**BIC:**	1520.
Df Model:	2		
Covariance Type:	nonrobust		

	coef	**std err**	**t**	**P>|t|**	**[0.025**	**0.975]**
const	5.3474	0.740	7.229	0.000	3.889	6.806
x1	50.4046	0.745	67.628	0.000	48.935	51.874
x2	17.1283	0.745	22.981	0.000	15.658	18.598

Omnibus:	0.542	**Durbin-Watson:**	2.039
Prob(Omnibus):	0.763	**Jarque-Bera (JB):**	0.264
Skew:	-0.018	**Prob(JB):**	0.876
Kurtosis:	3.174	**Cond. No.**	1.13

Notes:
[1] Standard Errors assume that the covariance matrix of the errors is correctly specified.

In [ ]: