免费电子书

学习

scikit-learn

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#scikit-learn

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1: scikit-learn

`scikit-learn`python。 pythonNumPySciPymatplotlib

`scikit-learn`。

Examples

scikit-learn

scikit-learn

- Python> = 2.6> = 3.3
- NumPy> = 1.6.1
- SciPy> = 0.9。

`pip` pythonpython

```
pip install scikit-learn
```

Linux`conda`

```
conda install scikit-learn
```

`scikit-learn` shell

```
python -c 'import sklearn; print(sklearn.__version__)'
```

WindowsMac OSX

WindowspythonMac OSXLinux CanopyAnaconda*scikit-learn* 。

iris

```
import sklearn.datasets
iris_dataset = sklearn.datasets.load_iris()
X, y = iris_dataset['data'], iris_dataset['target']
```

。 `train_test_split`Xy `train_size=0.75` 75。

k- 。 `fit`。

```
from sklearn.cross_validation import train_test_split
X_train, X_test, y_train, y_test = train_test_split(X, y, train_size=0.75)
from sklearn.neighbors import KNeighborsClassifier
```

```
clf = KNeighborsClassifier(n_neighbors=3)
clf.fit(X_train, y_train)
```

```
clf.score(X_test, y_test) # Output: 0.94736842105263153
```

◦ /◦ cross_val_scorecross_val_score◦ 5◦

```
from sklearn.cross_validation import cross_val_score
scores = cross_val_score(clf, X, y, cv=5)
print(scores)
# Output: array([ 0.96666667,  0.96666667,  0.93333333,  0.96666667,  1.        ])
print "Accuracy: %0.2f (+/- %0.2f)" % (scores.mean(), scores.std() / 2)
# Output: Accuracy: 0.97 (+/- 0.03)
```

◦ sklearn ◦

◦

```
from sklearn.pipeline import make_pipeline
from sklearn.preprocessing import StandardScaler
from sklearn.neighbors import KNeighborsClassifier

pipeline = make_pipeline(StandardScaler(), KNeighborsClassifier(n_neighbors=4))
```

◦ ◦

```
# fitting a classifier
pipeline.fit(X_train, y_train)
# getting predictions for the new data sample
pipeline.predict_proba(X_test)
```

◦

- sklearn.base.ClassifierMixin
- sklearn.base.RegressorMixin
- sklearn.base.TransformerMixin

numpy.arraypandas.DataFrameSnumpy.array S

idid◦

```
import numpy
data = numpy.arange(10).reshape(5, 2)
print(data)

Output:
[[0 1]
 [2 3]
 [4 5]
 [6 7]
 [8 9]]
```

sklearn52。

sklearnsklearn.datasets。 Fisher

```
import sklearn.datasets
iris_dataset = sklearn.datasets.load_iris()
iris_dataset.keys()
['target_names', 'data', 'target', 'DESCR', 'feature_names']
```

target_names 。 。

datatarget。 Xy

```
X, y = iris_dataset['data'], iris_dataset['target']
X.shape, y.shape
((150, 4), (150,))
```

```
numpy.unique(y)
array([0, 1, 2])
```

Xy1504。 0,12。

fit()Xy。

---

sklearn.datasets

load_boston()		506	
load_breast_cancer()		569	
load_diabetes()		442	
load_digits(n_class)		1797	
load_iris()		150	
load_linnerud()	Linnerud	20	

http //scikit-learn.org/stable/datasets/

scikit。 。

sklearn.datasets

- load_mlcompmlcomp.org。 。
- fetch_lfw_pairsfetch_lfw_peoplehttp://vis-www.cs.umass.edu/lfw/Labeled FacesLFW。 200 MB。 。

scikit-learn https://riptutorial.com/zh-CN/scikit-learn/topic/1035/scikit-learn

2:

Examples

◦ SVM`sklearn.svm.SVC``sklearn.svm.SVR` ◦

2D◦

```
import numpy as np
```

xy

```
x0, x1 = np.random.randn(10, 2), np.random.randn(10, 2) + (1, 1)
x = np.vstack((x0, x1))

y = [0] * 10 + [1] * 10
```

x0,01,1◦

```
from sklearn import svm

svm.SVC(kernel='linear').fit(x, y)
```

0,0

```
>>> svm.SVC(kernel='linear').fit(x, y).predict([[0, 0]])
array([0])
```

0◦

```
svm.SVR(kernel='linear').fit(x, y)
```

RandomForestClassifier

◦

```
from sklearn.ensemble import RandomForestClassifier
```

```
train = [[1,2,3],[2,5,1],[2,1,7]]
target = [0,1,0]
```

`target`◦

RandomForestlearnfit

```
rf = RandomForestClassifier(n_estimators=100)
```

```
rf.fit(train, target)
```

```
test = [2,2,3]
predicted = rf.predict(test)
```

f1- 。

sklearn docs

```
from sklearn.metrics import classification_report
y_true = [0, 1, 2, 2, 2]
y_pred = [0, 0, 2, 2, 1]
target_names = ['class 0', 'class 1', 'class 2']
print(classification_report(y_true, y_pred, target_names=target_names))
```

-

```
             precision    recall  f1-score   support

    class 0       0.50      1.00      0.67         1
    class 1       0.00      0.00      0.00         1
    class 2       1.00      0.67      0.80         3

avg / total       0.70      0.60      0.61         5
```

GradientBoostingClassifier

Gradient Boosting。 。

```
from sklearn.ensemble import GradientBoostingClassifier
```

```
from sklearn.datasets import load_iris

iris_dataset = load_iris()

X, y = iris_dataset.data, iris_dataset.target
```

。

```
from sklearn.model_selection import train_test_split
X_train, X_test, y_train, y_test = train_test_split(
    X, y, test_size=0.2, random_state=0)
```

GradientBoostingClassifier。

```
gbc = GradientBoostingClassifier()
gbc.fit(X_train, y_train)
```

```
# We are using the default classification accuracy score
>>> gbc.score(X_test, y_test)
```

```
1
```

100

```
>>> gbc.n_estimators
100
```

n_estimators。

a> 7。

3。

```
from sklearn.tree import DecisionTreeClassifier

# Define training and target set for the classifier
train = [[1,2,3],[2,5,1],[2,1,7]]
target = [10,20,30]

# Initialize Classifier.
# Random values are initialized with always the same random seed of value 0
# (allows reproducible results)
dectree = DecisionTreeClassifier(random_state=0)
dectree.fit(train, target)

# Test classifier with other, unknown feature vector
test = [2,2,3]
predicted = dectree.predict(test)

print predicted
```

```
import pydot
import StringIO

dotfile = StringIO.StringIO()
tree.export_graphviz(dectree, out_file=dotfile)
(graph,)=pydot.graph_from_dot_data(dotfile.getvalue())
graph.write_png("dtree.png")
graph.write_pdf("dtree.pdf")
```

Logistic

LR。 `linear_model`

```
from sklearn.linear_model import LogisticRegression
```

sklearn LRL2L1。sklearn

```
from sklearn.datasets import make_hastie_10_2

X,y = make_hastie_10_2(n_samples=1000)
```

X`n_samples X 10`y-1+1。

70-30

```
from sklearn.model_selection import train_test_split
#sklearn.cross_validation in older scikit versions

data_train, data_test, labels_train, labels_test = train_test_split(X,y, test_size=0.3)
```

LR

```
# Initialize Classifier.
LRC = LogisticRegression()
LRC.fit(data_train, labels_train)

# Test classifier with the test data
predicted = LRC.predict(data_test)
```

Confusion

```
from sklearn.metrics import confusion_matrix

confusion_matrix(predicted, labels_test)
```

https://riptutorial.com/zh-CN/scikit-learn/topic/2468/

3:

Examples

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0。

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```
X = [[0, 0, 1], [0, 1, 0], [1, 0, 0], [0, 1, 1], [0, 1, 0], [0, 1, 1]]
```

36。80。*0.8 *1 - 0.8*。

```
from sklearn.feature_selection import VarianceThreshold
sel = VarianceThreshold(threshold=(.8 * (1 - .8)))
sel.fit_transform(X)
# Output: array([[0, 1],
                 [1, 0],
                 [0, 0],
                 [1, 1],
                 [1, 0],
                 [1, 1]])
```

。

“”。*3*。

```
from sklearn.feature_selection import VarianceThreshold
import numpy as np

# generate dataset
np.random.seed(0)

feat1 = np.random.normal(loc=0, scale=.1, size=100) # normal dist. with mean=0 and std=.1
feat2 = np.random.normal(loc=0, scale=10, size=100) # normal dist. with mean=0 and std=10
feat3 = np.random.uniform(low=0, high=10, size=100) # uniform dist. in the interval [0,10)
data = np.column_stack((feat1,feat2,feat3))

data[:5]
# Output:
# array([[  0.17640523,  18.83150697,   9.61936379],
#        [  0.04001572, -13.47759061,   2.92147527],
#        [  0.0978738 , -12.70484998,   2.4082878 ],
#        [  0.22408932,   9.69396708,   1.00293942],
#        [  0.1867558 , -11.73123405,   0.1642963 ]])

np.var(data, axis=0)
# Output: array([  1.01582662e-02,   1.07053580e+02,   9.07187722e+00])

sel = VarianceThreshold(threshold=0.1)
sel.fit_transform(data)[:5]
# Output:
```

```
# array([[ 18.83150697,   9.61936379],
#        [-13.47759061,   2.92147527],
#        [-12.70484998,   2.4082878 ],
#        [  9.69396708,   1.00293942],
#        [-11.73123405,   0.1642963 ]])
```

。 。

https://riptutorial.com/zh-CN/scikit-learn/topic/4909/

4:

Examples

。

y X OLS*β*

minβ | *y* ^ - *y* | *2* *2*

y ^ =*Xβ*。

sklearn`sklearn.linear_model.LinearRegression`。

OLS

- Classfication
- upvotes

`LinearRegression`。

`X`

```
import numpy as np

X = np.random.randn(100, 3)
```

`yX`

```
beta = np.array([[1, 1, 0]])
y = (np.dot(x, beta.T) + 0.01 * np.random.randn(100, 1))[:, 0]
```

`y`β。

`Xy`

```
>>> linear_model.LinearRegression().fit(x, y).coef_
array([  9.97768469e-01,   9.98237634e-01,   7.55016533e-04])
```

`beta`。

https://riptutorial.com/zh-CN/scikit-learn/topic/5190/

5:

Examples

- ◦ ◦ X_test, y_test ◦ “”◦

scikit-learn train_test_split◦

```
>>> import numpy as np
>>> from sklearn import cross_validation
>>> from sklearn import datasets
>>> from sklearn import svm

>>> iris = datasets.load_iris()
>>> iris.data.shape, iris.target.shape
((150, 4), (150,))
```

40

```
>>> X_train, X_test, y_train, y_test = cross_validation.train_test_split(
...     iris.data, iris.target, test_size=0.4, random_state=0)

>>> X_train.shape, y_train.shape
((90, 4), (90,))
>>> X_test.shape, y_test.shape
((60, 4), (60,))
```

```
>>> clf = svm.SVC(kernel='linear', C=1).fit(X_train, y_train)
>>> clf.score(X_test, y_test)
```

K-Cross

K//◦ K“”K-1◦

scikit◦ ◦

K-

K“”K-1◦

```
from sklearn.model_selection import KFold
X = np.array([[1, 2], [3, 4], [5, 6], [7, 8]])
y = np.array([1, 2, 1, 2])
cv = KFold(n_splits=3, random_state=0)

for train_index, test_index in cv.split(X):
...    print("TRAIN:", train_index, "TEST:", test_index)

TRAIN: [2 3] TEST: [0 1]
```

```
TRAIN: [0 1 3] TEST: [2]
TRAIN: [0 1 2] TEST: [3]
```

`StratifiedKFold`k-fold

ShuffleSplit

/。 。

```
from sklearn.model_selection import ShuffleSplit
X = np.array([[1, 2], [3, 4], [5, 6], [7, 8]])
y = np.array([1, 2, 1, 2])
cv = ShuffleSplit(n_splits=3, test_size=.25, random_state=0)

for train_index, test_index in cv.split(X):
...     print("TRAIN:", train_index, "TEST:", test_index)

TRAIN: [3 1 0] TEST: [2]
TRAIN: [2 1 3] TEST: [0]
TRAIN: [0 2 1] TEST: [3]
```

`StratifiedShuffleSplit`ShuffleSplit。

Leave One / p OutTimeSeriesSplitK-foldscikit model_selection。

https://riptutorial.com/zh-CN/scikit-learn/topic/4901/

6: ROC

Examples

ROCAUC

ROC。

ROCYX。“” - 1。AUC。

ROC“”。

```
import numpy as np
from sklearn import metrics
import matplotlib.pyplot as plt
```

```
y - model.predict(x_test)
```

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

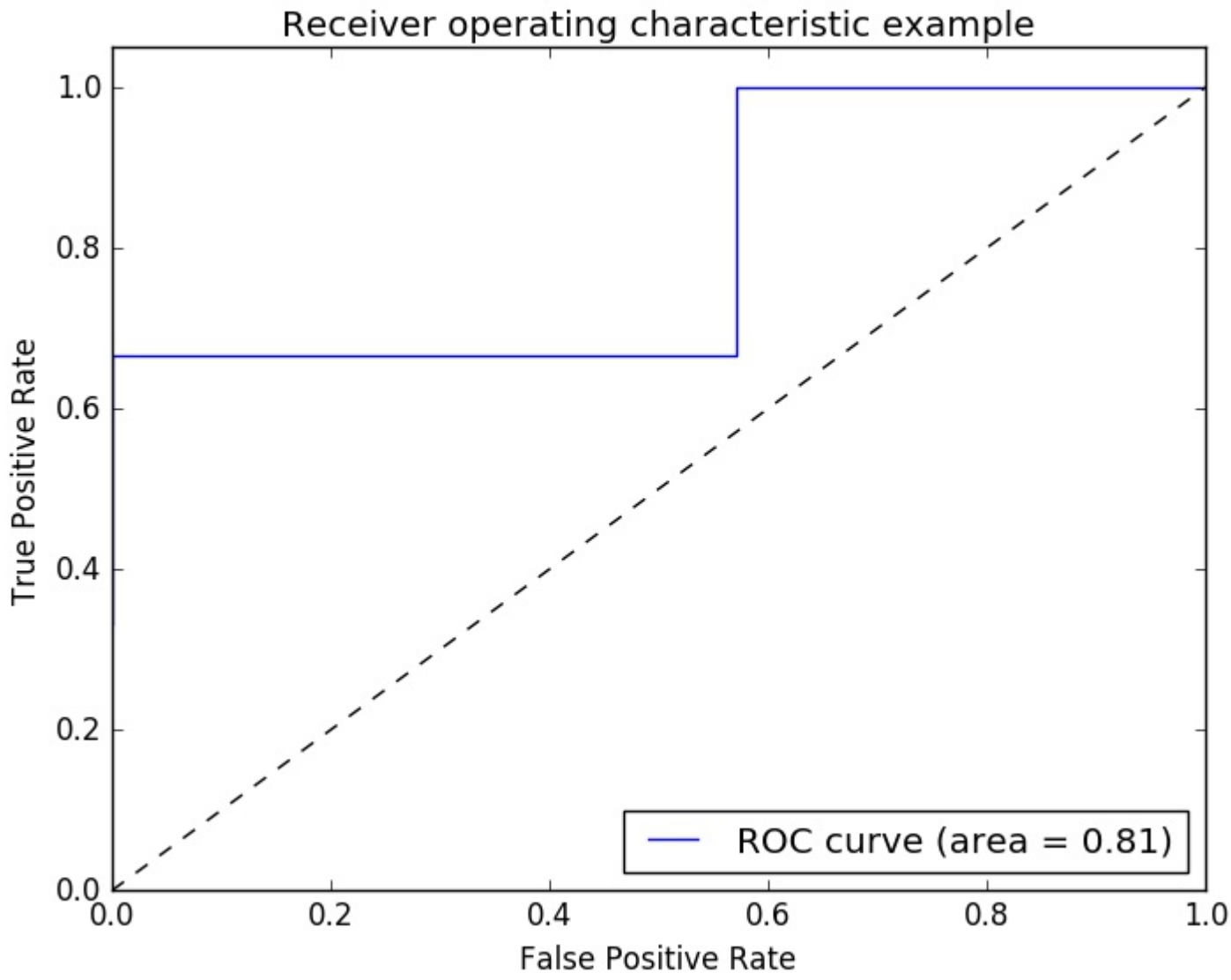
```
model.score(X,Y)
```

```
scores = np.array([0.3, 0.4, 0.95,0.78,0.8,0.64,0.86,0.81,0.9, 0.8])
```

ROCAUC

```
fpr, tpr, thresholds = metrics.roc_curve(y, scores, pos_label=2)
roc_auc = metrics.auc(fpr, tpr)
```

```
plt.figure()
plt.plot(fpr, tpr, label='ROC curve (area = %0.2f)' % roc_auc)
plt.plot([0, 1], [0, 1], 'k--')
plt.xlim([0.0, 1.0])
plt.ylim([0.0, 1.05])
plt.xlabel('False Positive Rate')
plt.ylabel('True Positive Rate')
plt.title('Receiver operating characteristic example')
plt.legend(loc="lower right")
plt.show()
```



link1link2

ROC-AUC

ROC-AUC。 `cross_val_predictpredict`。 ROC-AUC`predictpredict_probapredict_proba`。

```
from sklearn.datasets import make_classification
from sklearn.linear_model import LogisticRegression
from sklearn.cross_validation import cross_val_predict
from sklearn.metrics import roc_auc_score

class LogisticRegressionWrapper(LogisticRegression):
    def predict(self, X):
        return super(LogisticRegressionWrapper, self).predict_proba(X)

X, y = make_classification(n_samples = 1000, n_features=10, n_classes = 2, flip_y = 0.5)

log_reg_clf = LogisticRegressionWrapper(C=0.1, class_weight=None, dual=False,
             fit_intercept=True)

y_hat = cross_val_predict(log_reg_clf, X, y)[:,1]
```

```
print("ROC-AUC score: {}".format(roc_auc_score(y, y_hat)))
```

```
ROC-AUC score: 0.724972396025
```

ROC https://riptutorial.com/zh-CN/scikit-learn/topic/5945/-roc-

7:

Examples

。 。 。

k。 *nmX.kmk*$_{\beta k}$。 *Xβnk*。 *βkmkX*。

scikit-learn sklearn.decomposition.PCAPCA。 100 X 75

```
import numpy as np
np.random.seed(123) # we'll set a random seed so that our results are reproducible
X = np.hstack((np.random.randn(100, 2) + (10, 10), 0.001 * np.random.randn(100, 5)))
```

2

```
from sklearn.decomposition import PCA
pca = PCA(n_components=2)
pca.fit(X)
```

。

```
pca.components_
# array([[ -2.84271217e-01,  -9.58743893e-01,  -8.25412629e-05,
#           1.96237855e-05,  -1.25862328e-05,   8.27127496e-05,
#          -9.46906600e-05],
#        [ -9.58743890e-01,   2.84271223e-01,  -7.33055823e-05,
#          -1.23188872e-04,  -1.82458739e-05,   5.50383246e-05,
#           1.96503690e-05]])
```

PCA。

PCApca.explained_variance_ratio_

```
pca.explained_variance_ratio_
# array([ 0.57039059,  0.42960728])
```

https://riptutorial.com/zh-CN/scikit-learn/topic/4829/--

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