Lab9_homework

2018 年 11 月 23 日

1 数据预处理

```
In [1]: # 载入数据
        from sklearn.datasets import load_iris
        # iris.data 表示特征矩阵, iris.target 表示类别向量
        iris=load_iris().data
        iris[:5]
```

```
Out[1]: array([[5.1, 3.5, 1.4, 0.2],
               [4.9, 3. , 1.4, 0.2],
               [4.7, 3.2, 1.3, 0.2],
               [4.6, 3.1, 1.5, 0.2],
               [5. , 3.6, 1.4, 0.2]])
```

```
In [2]: iris_target=load_iris().target
        iris_target[:5]
```

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

```
In [3]: # 数据预处理, sklearn.preprocessing 提供一些预处理工具
        # MinMaxScaler 作用是将属性缩放到一个指定范围, 即 (x-min)/(max-min), 也称归一化
        from sklearn.preprocessing import MinMaxScaler
        MinMaxTransformer=MinMaxScaler()
```

```
In [4]: MinMaxTransformer.fit(iris) # 计算最大, 最小值
        iris_transformed=MinMaxTransformer.transform(iris)
        iris_transformed[:5]
```

```
Out[4]: array([[0.22222222, 0.625     , 0.06779661, 0.04166667],
               [0.16666667, 0.41666667, 0.06779661, 0.04166667],
```

```
        [0.11111111, 0.5       , 0.05084746, 0.04166667],
        [0.08333333, 0.45833333, 0.08474576, 0.04166667],
        [0.19444444, 0.66666667, 0.06779661, 0.04166667]])
```

```
In [5]: # 切分数据集
        from sklearn.model_selection import train_test_split
        X_train, X_test, y_train, y_test=train_test_split(iris_transformed, iris_target, rando
```

2 构造 SVM 分类器

1. 利用默认参数训练，并预测:

```
In [6]: from sklearn.svm import SVC
        import numpy as np
        svm=SVC()
        svm.fit(X_train, y_train)
        predict_labels=svm.predict(X_test)
        accuracy=np.mean(predict_labels==y_test)*100
        print("the accuracy of SVM model is {0}%".format(accuracy))
```

```
the accuracy of SVM model is 97.36842105263158%
```

2. 利用 sklearn 提供的 Grid_searchCV 来寻找最佳参数:

```
In [7]: # 利用 sklearn 提供的 Grid_searchCV 来寻找最佳参数
        from sklearn.grid_search import GridSearchCV
        from sklearn.svm import SVC
        svm=SVC()
        # 候选参数
        tuned_parameters = [{'kernel': ['rbf'], 'gamma': [1e-3, 1e-4],
        'C': [1, 10, 100, 1000]},
        {'kernel': ['linear'], 'C': [1, 10, 100, 1000]}]
        clf=GridSearchCV(svm, tuned_parameters)
        clf.fit(X_train, y_train)
        # 输出最优参数
        print("Best parameters: ")
        print(clf.best_params_)
        for params, mean_score, scores in clf.grid_scores_:
            print("{0} (+/-{1}) for {2}".format(mean_score, scores.std()*2, params))
```

```
Best parameters:
{'C': 1, 'kernel': 'linear'}
0.375 (+/-0.009387856744060414) for {'C': 1, 'gamma': 0.001, 'kernel': 'rbf'}
0.375 (+/-0.009387856744060414) for {'C': 1, 'gamma': 0.0001, 'kernel': 'rbf'}
0.375 (+/-0.009387856744060414) for {'C': 10, 'gamma': 0.001, 'kernel': 'rbf'}
0.375 (+/-0.009387856744060414) for {'C': 10, 'gamma': 0.0001, 'kernel': 'rbf'}
0.875 (+/-0.05235532950912191) for {'C': 100, 'gamma': 0.001, 'kernel': 'rbf'}
0.375 (+/-0.009387856744060414) for {'C': 100, 'gamma': 0.0001, 'kernel': 'rbf'}
0.9285714285714286 (+/-0.04828040611231049) for {'C': 1000, 'gamma': 0.001, 'kernel': 'rbf'}
0.875 (+/-0.05235532950912191) for {'C': 1000, 'gamma': 0.0001, 'kernel': 'rbf'}
0.9553571428571429 (+/-0.048950967308314886) for {'C': 1, 'kernel': 'linear'}
0.9285714285714286 (+/-0.06541323607768817) for {'C': 10, 'kernel': 'linear'}
0.9285714285714286 (+/-0.06541323607768817) for {'C': 100, 'kernel': 'linear'}
0.9285714285714286 (+/-0.06541323607768817) for {'C': 1000, 'kernel': 'linear'}


C:\Users\HASEE\Anaconda3\lib\site-packages\sklearn\cross_validation.py:41: DeprecationWarning:
  "This module will be removed in 0.20.", DeprecationWarning)
C:\Users\HASEE\Anaconda3\lib\site-packages\sklearn\grid_search.py:42: DeprecationWarning: This
  DeprecationWarning)
```

3. **利用获得的参数预测:**

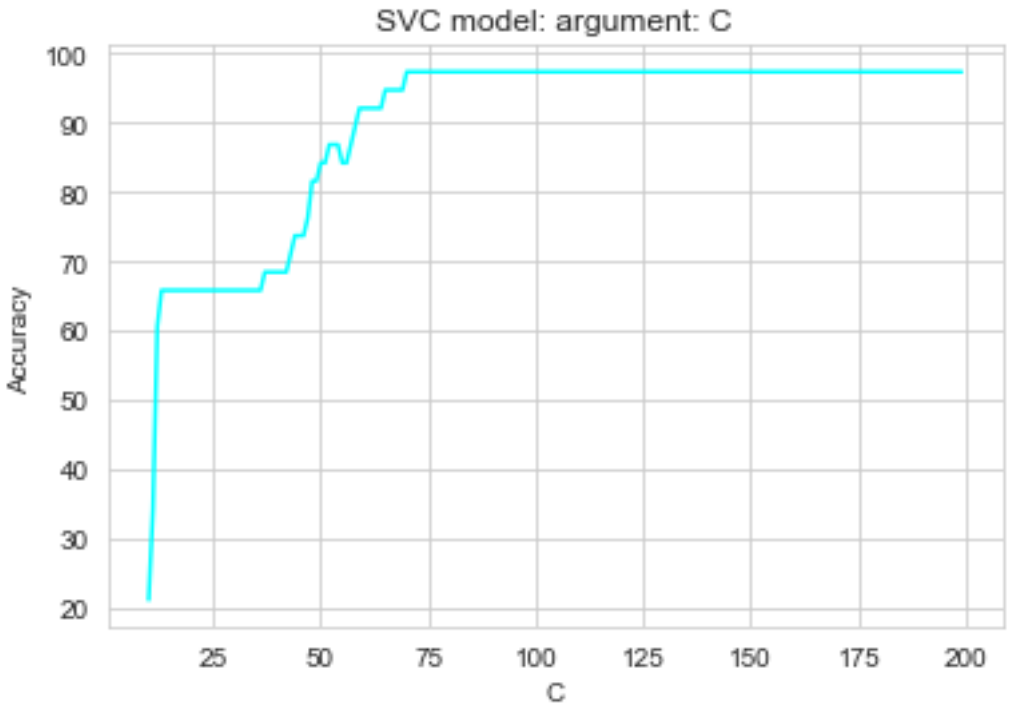
```
In [8]: # 使用获得的参数进行预测
        from sklearn.svm import SVC
        svm=SVC(C=1000, gamma=0.001, kernel='rbf')
        svm.fit(X_train, y_train)
        predict_labels=svm.predict(X_test)
        accuracy=np.mean(predict_labels==y_test)*100
        print("the accuracy of SVM model is {0}%".format(accuracy))

the accuracy of SVM model is 97.36842105263158%
```

4. **使用 matplotlib 描述不同参数设置下模型准确率的变化:**

```
In [10]: # 使用 matplotlib 描述不同参数设置下模型准确率的变化
         Cs=[]
```

```
accuracies=[]
for c in range(10, 200, 1):
    svm=SVC(C=c, gamma=0.001, kernel= 'rbf')
    svm.fit(X_train, y_train)
    predict_labels= svm.predict(X_test)
    accuracy = np.mean(predict_labels==y_test)*100
    # print("the accuracy of SVM model with C = {0} is {1}".format(c, accuracy))
    Cs.append(c)
    accuracies.append(accuracy)
import matplotlib.pyplot as plt
import seaborn as sns
sns.set_style('whitegrid')
plt.title("SVC model: argument: C")
plt.xlabel("C")
plt.ylabel("Accuracy")
plt.plot(Cs, accuracies, 'cyan')
plt.show()
```



3 完成习题

iris 数据集有哪几个属性和类别?

使用 load_iris() 中的 feature_names 方法可以获得数据集的属性名称如下:

```
In [10]: data = load_iris()
         data.feature_names

Out[10]: ['sepal length (cm)',
          'sepal width (cm)',
          'petal length (cm)',
          'petal width (cm)']
```

使用 load_iris() 中的 target_name 方法可以获得数据集的类别名称如下:

```
In [11]: data.target_names

Out[11]: array(['setosa', 'versicolor', 'virginica'], dtype='<U10')
```

利用 sklearn.preprocessing 的标准化（Z-Score）、归一化（Normalization）分别对 iris 数据集进行预处理，并查看处理后的数据。

对数据进行 Z-score 标准化处理:

```
In [12]: iris = load_iris().data
         from sklearn import preprocessing
         scaled_iris = preprocessing.scale(iris) # z-score
         scaled_iris.mean(axis=0) # 均值为 0

Out[12]: array([-1.69031455e-15, -1.63702385e-15, -1.48251781e-15, -1.62314606e-15])

In [13]: scaled_iris.std(axis=0) # 方差为 1

Out[13]: array([1., 1., 1., 1.])
```

对数据进行 Normalization 处理:

```
In [14]: normalized_iris = preprocessing.normalize(iris)
         normalized_iris[:5]
```

```
Out[14]: array([[0.80377277, 0.55160877, 0.22064351, 0.0315205 ],
                [0.82813287, 0.50702013, 0.23660939, 0.03380134],
                [0.80533308, 0.54831188, 0.2227517 , 0.03426949],
                [0.80003025, 0.53915082, 0.26087943, 0.03478392],
                [0.790965  , 0.5694948 , 0.2214702 , 0.0316386 ]])
```

如何查看 sklearn.svm.SVC 训练结果?

当使用线性核时可以使用 coef_ 方法和 intercept_ 方法查看权重和偏移值:

```
In [15]: from sklearn.svm import SVC
         import numpy as np
         svm=SVC(kernel='linear')
         svm.fit(X_train, y_train)

Out[15]: SVC(C=1.0, cache_size=200, class_weight=None, coef0=0.0,
           decision_function_shape='ovr', degree=3, gamma='auto', kernel='linear',
           max_iter=-1, probability=False, random_state=None, shrinking=True,
           tol=0.001, verbose=False)

In [16]: svm.coef_

Out[16]: array([[-0.81501272,  1.41120738, -2.17341427, -1.8491395 ],
                [-0.76230215,  0.5291881 , -1.56010901, -1.38218232],
                [-0.72336481,  0.49372049, -2.65985692, -3.47089235]])

In [17]: svm.intercept_

Out[17]: array([0.77263683, 1.1708772 , 4.29529373])
```

当不是使用共线性核时可以使用 support_vectors_ 方法查看支持向量的坐标:

```
In [24]: from sklearn.svm import SVC
         import numpy as np
         svm=SVC(kernel='rbf')
         svm.fit(X_train, y_train)
         svm.support_vectors_[:5]

Out[24]: array([[0.38888889, 1.        , 0.08474576, 0.125     ],
                [0.02777778, 0.375     , 0.06779661, 0.04166667],
                [0.19444444, 0.58333333, 0.10169492, 0.125     ],
                [0.08333333, 0.45833333, 0.08474576, 0.04166667],
                [0.22222222, 0.70833333, 0.08474576, 0.125     ]])
```

利用 SVC 对邮件数据集 (训练集 horseColicTrainig.txt，测试集 horseColicTest.txt) 进行分类，并评估预测结果。

利用 GridSearchCV() 方法选择最优参数:

```
In [18]: frTrain = open('horseColicTraining.txt')
         frTest = open('horseColicTest.txt')
         trainingSet = []; trainingLabels = []
         for line in frTrain.readlines():
             currLine = line.strip().split('\t')
             lineArr =[]
             for i in range(21):
                 lineArr.append(float(currLine[i]))
             trainingSet.append(lineArr)
             trainingLabels.append(float(currLine[21]))
         tuned_parameters = [{'kernel': ['rbf'], 'gamma': ['auto', 1e-4, 1e-3],
         'C': [1, 10, 100, 1000], 'probability':[True, False], 'decision_function_shape': ['ov
         svm=SVC()
         clf=GridSearchCV(svm, tuned_parameters)
         clf.fit(trainingSet, trainingLabels)
         # 输出最优参数
         print("Best parameters: ")
         print(clf.best_params_)
```

```
Best parameters:
{'C': 10, 'decision_function_shape': 'ovo', 'gamma': 0.0001, 'kernel': 'rbf', 'probability': T
```

训练并计算准确率:

```
In [19]: svm = SVC(C=10,gamma=0.0001,kernel='rbf', probability=True,decision_function_shape='o
         svm.fit(trainingSet, trainingLabels)
         frTest = open('horseColicTest.txt')
         testSet = []; testLabels = []
         for line in frTest.readlines():
             currLine = line.strip().split('\t')
             lineArr =[]
             for i in range(21):
                 lineArr.append(float(currLine[i]))
```

```
            testSet.append(lineArr)
            testLabels.append(float(currLine[21]))
        predict_labels = svm.predict(testSet)
        testLabels = np.array(testLabels)
        accuracy = np.mean(predict_labels==testLabels)*100
        accuracy
```

```
Out[19]: 77.61194029850746
```

计算 F1-score:

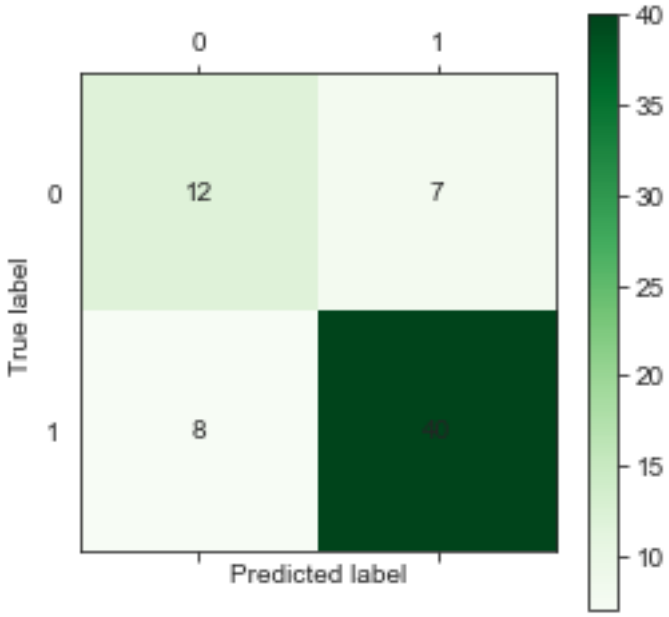
```
In [20]: from sklearn import metrics
         metrics.f1_score(testLabels, predict_labels, average=None)
```

```
Out[20]: array([0.61538462, 0.84210526])
```

绘制混淆矩阵:

```
In [21]: from sklearn.metrics import confusion_matrix
         cm = confusion_matrix(testLabels, predict_labels)
```

```
In [22]: import matplotlib.pyplot as plt
         import seaborn as sns
         sns.set_style('white')
         plt.matshow(cm,cmap=plt.cm.Greens)
         plt.colorbar()
         for x in range(len(cm)):
             for y in range(len(cm)):
                 plt.annotate(cm[x,y],xy=(x,y),horizontalalignment='center',verticalalignment=
         plt.ylabel('True label')
         plt.xlabel('Predicted label')
         plt.show()
```


0
1
0
1
12
7
8
40
True label
Predicted label
40
35
30
25
20
15
10