Day6

January 8, 2019

** Implement logistic regression on a social network dataset**

0.1 Data preprocessing

0.1.1 Import modules

```
In [19]: import numpy as np
         import matplotlib.pyplot as plt
         import pandas as pd
         %matplotlib inline
```

0.1.2 Import dataset

- four features: ID, Gender, Age, Salary
- output: whether or not buy SUV
- our task: predict a user will or will not buy SUV based on feature age and salary

```
In [20]: dataset = pd.read_csv('../datasets/Social_Network_Ads.csv')
         print(dataset.head())
         X = dataset.iloc[:, [2,3]].values
         Y = dataset.iloc[:, 4].values
         print("Original data shape X:{}, Y:{}".format(X.shape, Y.shape))
```

```
    User ID  Gender  Age  EstimatedSalary  Purchased
0  15624510    Male   19            19000          0
1  15810944    Male   35            20000          0
2  15668575  Female   26            43000          0
3  15603246  Female   27            57000          0
4  15804002    Male   19            76000          0
Original data shape X:(400, 2), Y:(400,)
```

0.1.3 Splitting dataset

```
In [21]: from sklearn.cross_validation import train_test_split
         X_train, X_test, Y_train, Y_test = train_test_split(X, Y, test_size = 0.25, random_stat
```

0.2 Feature scaling

```
In [22]: from sklearn.preprocessing import StandardScaler
         sc = StandardScaler()
         X_train = sc.fit_transform(X_train)
         X_test = sc.fit_transform(X_test)
```

```
/home/huiwen/anaconda3/lib/python3.6/site-packages/sklearn/utils/validation.py:475: DataConversi
  warnings.warn(msg, DataConversionWarning)
```

0.3 Step 2: Train a logistic model

- train logistic model with sklearn

```
In [23]: from sklearn.linear_model import LogisticRegression
         model = LogisticRegression()
         model.fit(X_train, Y_train)
```

```
Out[23]: LogisticRegression(C=1.0, class_weight=None, dual=False, fit_intercept=True,
                   intercept_scaling=1, max_iter=100, multi_class='ovr', n_jobs=1,
                   penalty='l2', random_state=None, solver='liblinear', tol=0.0001,
                   verbose=0, warm_start=False)
```

0.4 Step 3: Prediction

```
In [24]: y_pred = model.predict(X_test)
         print(y_pred)
```

```
[0 0 0 0 0 0 0 1 0 1 0 0 0 0 0 0 0 0 1 0 0 1 0 1 0 1 0 0 0 0 0 0 1 0 0 0 0
 0 0 1 0 0 0 0 1 0 0 1 0 1 1 0 0 1 1 0 0 0 0 0 0 1 0 1 0 1 0 0 0 1 1 0 0 0
 0 0 1 0 1 1 1 1 0 0 1 1 0 1 0 0 0 1 0 0 0 0 0 0 0 1 1]
```

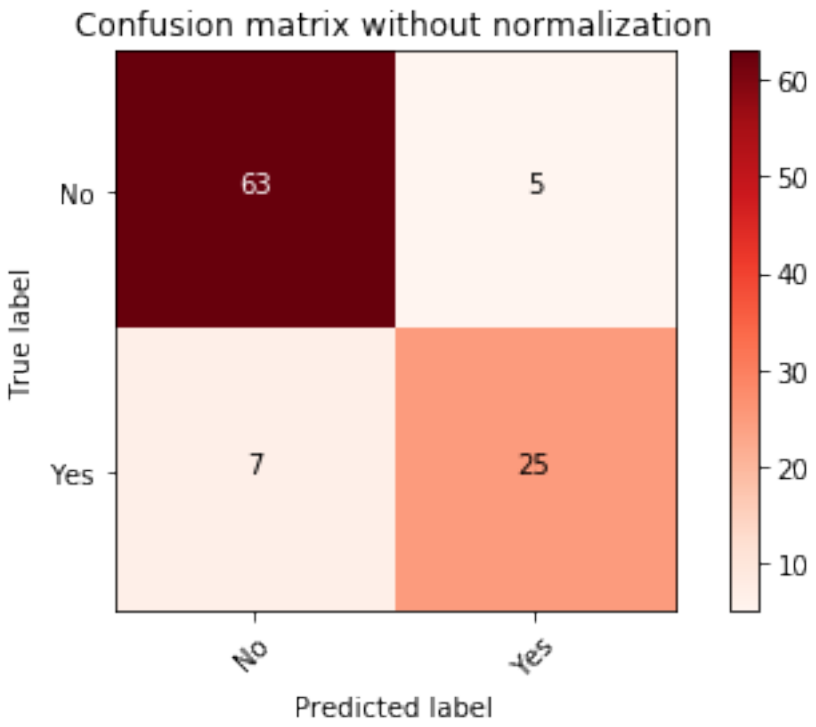
0.5 Step 4: Evaluation

- draw confusion matrix to see whether our model works correctly

```
In [25]: from sklearn.metrics import  confusion_matrix
         import itertools

         # utlis function used to draw confusion matrix
         def plot_confusion_matrix(cm, classes,
                                   normalize=False,
                                   title='Confusion matrix',
                                   cmap=plt.cm.Reds):
             """
             This function prints and plots the confusion matrix.
             Normalization can be applied by setting `normalize=True`.
```

```
        """
        if normalize:
            cm = cm.astype('float') / cm.sum(axis=1)[:, np.newaxis]
            print("Normalized confusion matrix")
        else:
            print('Confusion matrix, without normalization')

        plt.imshow(cm, interpolation='nearest', cmap=cmap)
        plt.title(title)
        plt.colorbar()
        tick_marks = np.arange(len(classes))
        plt.xticks(tick_marks, classes, rotation=45)
        plt.yticks(tick_marks, classes)

        fmt = '.2f' if normalize else 'd'
        thresh = cm.max() / 2.
        for i, j in itertools.product(range(cm.shape[0]), range(cm.shape[1])):
            plt.text(j, i, format(cm[i, j], fmt),
                     horizontalalignment="center",
                     color="white" if cm[i, j] > thresh else "black")

        plt.ylabel('True label')
        plt.xlabel('Predicted label')
        plt.tight_layout()


    cm = confusion_matrix(Y_test, y_pred)
    plt.figure()
    plot_confusion_matrix(cm, classes=['No', 'Yes'], title="Confusion matrix without normal
```

```
Confusion matrix, without normalization
```


Confusion matrix without normalization
63
5
7
25
No
Yes
True label
No
Yes
Predicted label
60
50
40
30
20
10