3train3testLR

December 13, 2017

```
In [17]: import pandas as pd
         import pandas as pd
         from sklearn.linear_model import LogisticRegression
         from sklearn.metrics import confusion_matrix
         from sklearn.model_selection import train_test_split
         from sklearn.metrics import roc_auc_score
         import numpy as np
         from pandas import DataFrame,Series
         from matplotlib.colors import ListedColormap
         from random import sample
         import matplotlib.pyplot as plt
         from sklearn.model_selection import StratifiedKFold
         from sklearn.model_selection import cross_val_score
```

```
In [ ]: #Description of features
        #Average[3]: Average acceleration (for each axis)
        #Standard Deviation[3]: Standard deviation (for each axis)
        #Average Absolute Difference[3]: Average absolute
        #difference between the value of each of the 200 readings
        #within the ED and the mean value over those 200 values
        #(for each axis)
        #Average Resultant Acceleration[1]: Average of the square
        #roots of the sum of the values of each axis squared
        #over the ED
        #Time Between Peaks[3]: Time in milliseconds between
        #peaks in the sinusoidal waves associated with most
        #activities (for each axis)
        #Binned Distribution[30]: We determine the range of values
        #for each axis (maximum  minimum), divide this range into
        #10 equal sized bins, and then record what fraction of the
        #200 values fell within each of the bins.
```

```
In [20]: #Importing the dataset
         df_features = pd.read_csv("H:/mastersProject/activity_analyzer/LogisticRegression/Data
         X_data = df_features.values[:, 2:45]
         y_data = df_features.values[:, 45]
         print(len(df_features))
```

```
417
```

```
In [25]: # Data 3 people for training the model
         lr = LogisticRegression(C=100.0, random_state=1)
         X_train, X_test, y_train, y_test = train_test_split(X_data, y_data, test_size = 0.30,
         probas = lr.fit(X_train, y_train)
         predict = lr.predict(X_test)
         logisticRegScore = lr.score(X_test, y_test)
         print(lr.coef_)
         print("Score of Logistic regression=", logisticRegScore)
```

```
[[ -4.26355078e-02  -1.08800655e-01  -1.18109762e-01  -6.98166698e-02
   -1.26457660e-01  -4.19031457e-02   1.56527014e-01   6.83777586e-02
   -1.59095593e-01  -7.86240681e-02  -5.60574777e-02  -3.31296621e-01
   -4.65490429e-01  -4.03954530e-01  -1.10690882e-01  -1.79563681e-01
    2.70517854e-01   3.51522240e-01   2.14428600e-01   7.35074257e-02
   -3.70309035e-02   1.59810737e-02   3.08821037e-01   5.74312214e-02
   -1.60570347e-03  -2.36263254e-01  -3.11438642e-01  -6.36148683e-02
   -6.77054416e-02  -1.33159005e-01   6.39061136e-03   4.96286921e-01
    3.70190201e-01  -3.91525716e+00  -3.18801967e+00  -1.33183169e+00
    1.00325076e+00   1.57433713e+00  -3.93544302e+00  -4.33108295e+00
   -3.60672448e+00  -1.10803655e+00   2.73663678e-01]]
Score of Logistic regression= 1.0
```

```
In [26]: from sklearn.metrics import confusion_matrix

         cm = confusion_matrix(y_test, predict, labels=["walking", "running"])
         print(cm)
```

```
[[77  0]
 [ 0 49]]
```

```
In [14]: # Cross validation using KFold
         lr_data = pd.read_csv('H:/mastersProject/activity_analyzer/LogisticRegression/Data/fe
         X = lr_data.values[:, 2:45]
         y = lr_data.values[:, 45]
         X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.3)
         lr = LogisticRegression(C=100.0, random_state=1)
         lr.fit(X_train, y_train)
         kfold = StratifiedKFold(n_splits=32, random_state=1).split(X_train, y_train)
         scores = cross_val_score(estimator=lr, X=X_train, y=y_train, cv=10)
         print(scores)
```

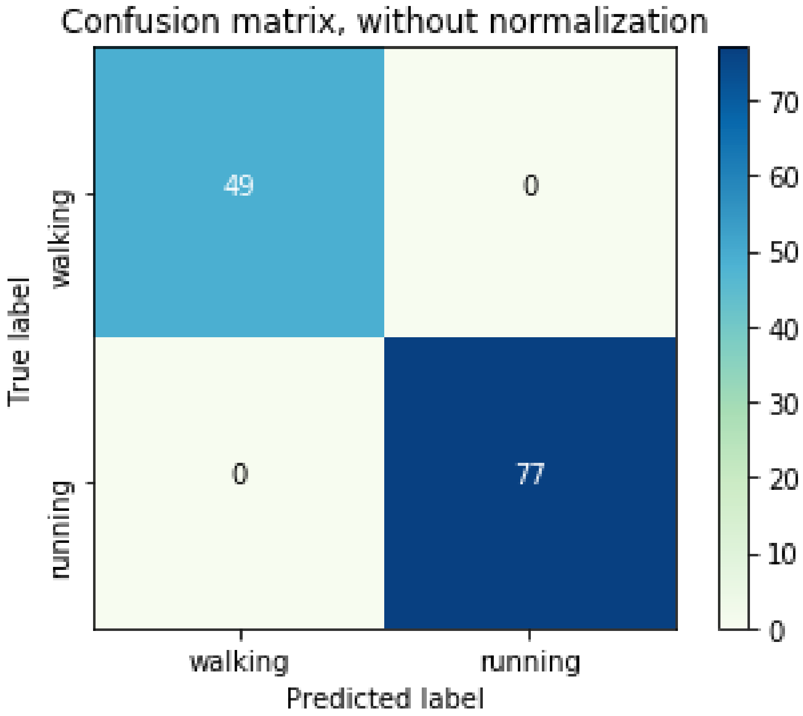
```
[ 1.          1.          1.          1.          1.          1.          1.
  1.          1.          0.96551724]
```

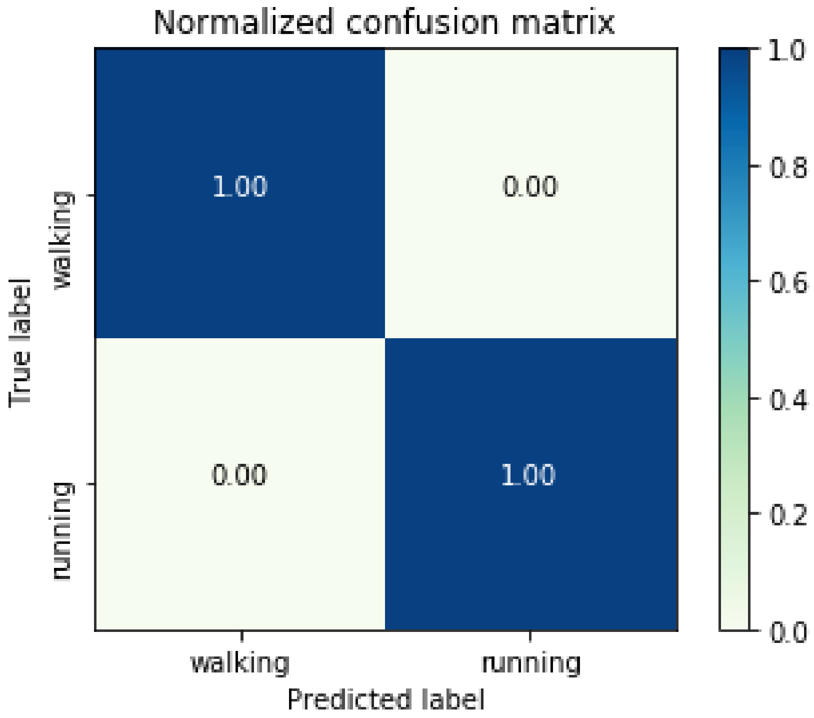
```
In [ ]: #This model is overfitting as it has just 3 people data.
```

```
In [34]: #Confusion matrix plot
         import itertools
         import numpy as np
         import matplotlib.pyplot as plt

         def plot_confusion_matrix(cm, classes,
                                   normalize=False,
                                   title='Confusion matrix',
                                   cmap=plt.cm.GnBu):
             """
             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')

             print(cm)

             plt.imshow(cm, interpolation='nearest', cmap=cmap)
             plt.title(title)
             plt.colorbar()
             tick_marks = np.arange(len(classes))
             plt.xticks(tick_marks, classes)
             plt.yticks(tick_marks, classes, rotation=90)

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

         # Compute confusion matrix
         cnf_matrix = confusion_matrix(y_test, predict)
         np.set_printoptions(precision=2)

         # Plot non-normalized confusion matrix
         plt.figure()
         class_names = ["walking", "running"]
```

```
    plot_confusion_matrix(cnf_matrix, classes=["walking", "running"],
                          title='Confusion matrix, without normalization')
    # plt.savefig('H:/mastersProject/activity_analyzer/LogisticRegression/cm_lr', dpi=100

    # Plot normalized confusion matrix
    plt.figure()
    plot_confusion_matrix(cnf_matrix, classes=class_names, normalize=True,
                          title='Normalized confusion matrix')

    # plt.savefig('H:/mastersProject/activity_analyzer/LogisticRegression/cm_lr_normalize
    plt.show()
```

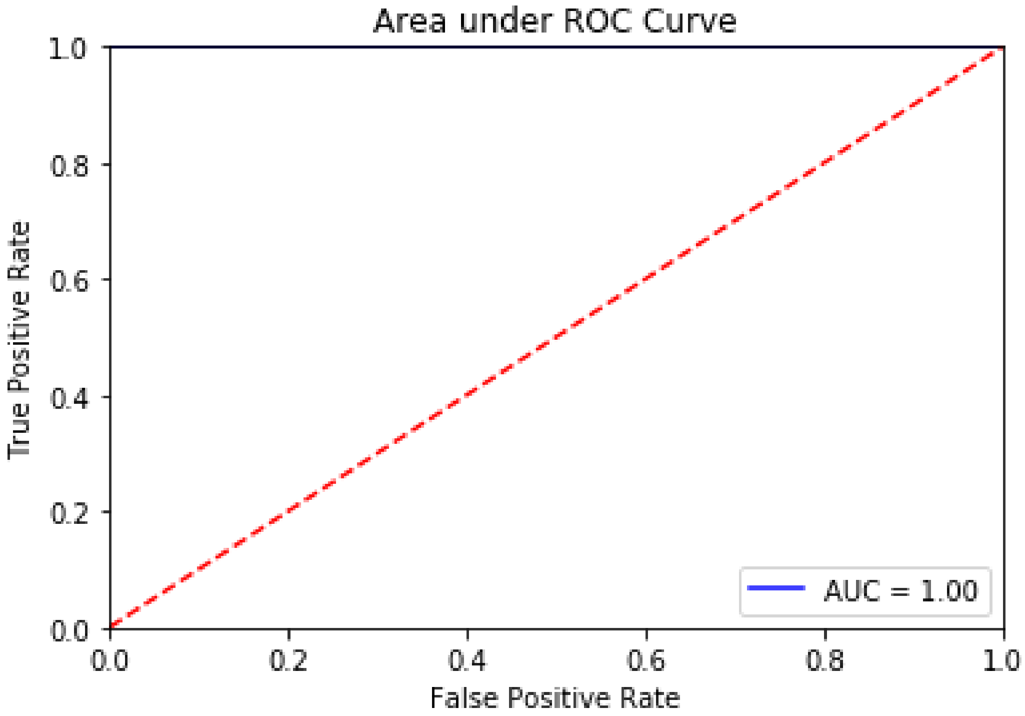
```
Confusion matrix, without normalization
[[49  0]
 [ 0 77]]
Normalized confusion matrix
[[ 1.  0.]
 [ 0.  1.]]
```





```
In [32]: from sklearn.metrics import roc_curve
         from sklearn.metrics import auc
         from sklearn.preprocessing import LabelEncoder
         import matplotlib.pyplot as plt
         #Area under ROC
         num_predns = []

         for i in range(0,len(predict)):
             if predict[i] == "walking":
                 num_predns.append(0)
             else:
                 num_predns.append(1)

         num_labels = []

         for i in range(0,len(y_test)):
             if y_test[i] == "walking":
                 num_labels.append(0)
             else:
                 num_labels.append(1)

         predns = np.array(num_predns)
         labels = np.array(num_labels)
```

```
fpr, tpr, thresholds = roc_curve(labels, predns)
roc_auc = auc(fpr, tpr)
import matplotlib.pyplot as plt
plt.title('Area under ROC Curve')
plt.plot(fpr, tpr, 'b', label = 'AUC = %0.2f' % roc_auc)
plt.legend(loc = 'lower right')
plt.plot([0, 1], [0, 1],'r--')
plt.xlim([0, 1])
plt.ylim([0, 1])
plt.ylabel('True Positive Rate')
plt.xlabel('False Positive Rate')
plt.show()
```


Area under ROC Curve
True Positive Rate
AUC = 1.00
False Positive Rate