RandomForestQualityScore10FoldTrTest

November 19, 2018

```
In [8]: import numpy as np
        import matplotlib.pyplot as plt
        from sklearn.model_selection import train_test_split
        from sklearn import metrics
        from sklearn.metrics import classification_report
        from sklearn.ensemble import RandomForestClassifier
        from sklearn.metrics import precision_score, f1_score, confusion_matrix
        import pandas as pd
        from sklearn.model_selection import StratifiedKFold
        from sklearn.metrics import roc_curve, auc
        import matplotlib.patches as patches
        from sklearn.model_selection import cross_val_score

        from scipy import interp


        import warnings
        warnings.filterwarnings('ignore')
        # Set random seed
        np.random.seed(0)
```

```
In [2]: # Random Forest ML model for predicting Service Time (350-476 OR 476-600)
        # 80-20% train test split
        data = pd.read_csv("ServiceTimeBinaryBothFinal.csv")
        data.head()

        X = data.ix[:,(0,1,2,3,4,5)].values
        y = data.ix[:,6].values

        X_train, X_test, y_train, y_test = train_test_split(X, y, test_size = .2, random_state=0
        clf = RandomForestClassifier(n_estimators=10, max_depth=4, random_state=0)
        clf.fit(X_train, y_train)
```

```
Out[2]: RandomForestClassifier(bootstrap=True, class_weight=None, criterion='gini',
                    max_depth=4, max_features='auto', max_leaf_nodes=None,
                    min_impurity_decrease=0.0, min_impurity_split=None,
                    min_samples_leaf=1, min_samples_split=2,
                    min_weight_fraction_leaf=0.0, n_estimators=10, n_jobs=None,
                    oob_score=False, random_state=0, verbose=0, warm_start=False)
```

```
In [3]: # Collecting F-1 score, precision, recall
        y_pred = clf.predict(X_test)
        print(classification_report(y_test, y_pred))
```

```
              precision    recall  f1-score   support

           1       0.82      0.79      0.81        29
           2       0.70      0.74      0.72        19

   micro avg       0.77      0.77      0.77        48
   macro avg       0.76      0.76      0.76        48
weighted avg       0.77      0.77      0.77        48
```

```
In [4]: # Collecting Precision score (Accuracy)
        print('Random Forest Model accuracy for train-test split: ', round(precision_score(y_tes
```

```
Random Forest Model accuracy for train-test split:  77.336 %
```

```
In [5]: print('Random Forest Model F-1 score for train-test split: ', round(f1_score(y_test,y_pr
```

```
Random Forest Model F-1 score for train-test split:  0.772
```

```
In [6]: print('Random Forest Model Confusion Matrix for train-test split: \n ', confusion_matrix
```

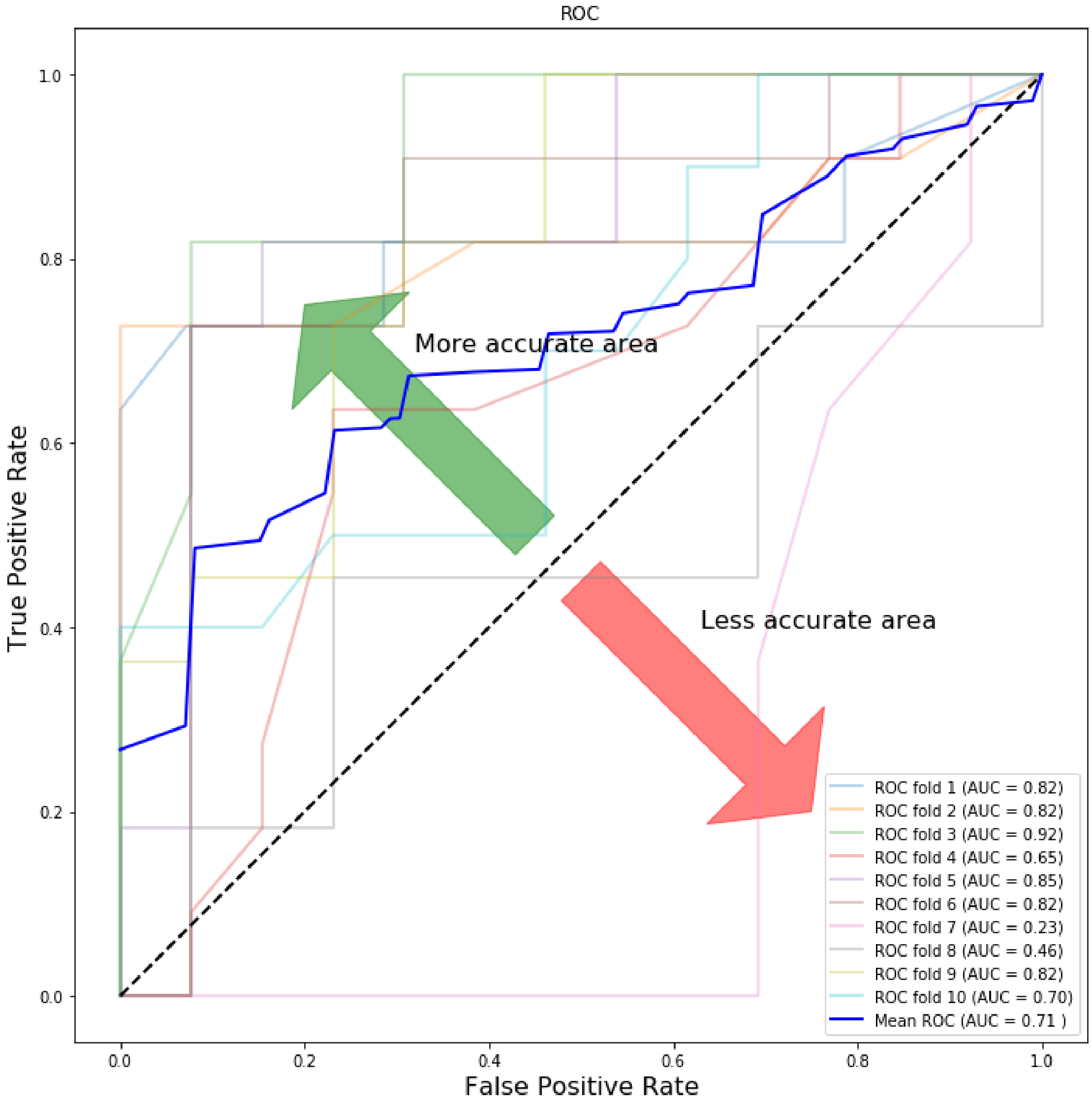
```
Random Forest Model Confusion Matrix for train-test split:
  [[23  6]
 [ 5 14]]
```

```
In [9]: # Random Forest ML model for predicting Service Time (350-476 OR 476-600)
        # 10-fold cross validation
        clf = RandomForestClassifier(n_estimators=100, max_depth=4, random_state=0)
        cv = StratifiedKFold(n_splits=10,shuffle=False)
        print ('Random Forest Accuracy:', round(np.mean(cross_val_score(clf, X, y, cv=10)),4) *
```

```
Random Forest Accuracy: 62.470000000000006  %
```

```
In [10]: # ROC curve
         data = pd.read_csv("ServiceTimeBinaryBothFinal.csv")
         dict = {2:1,1:0}       # label = column name
         data['Quality Score'] = data['Quality Score'].map(dict)
```

```
random_state = np.random.RandomState(0)
clf = RandomForestClassifier(n_estimators=100, max_depth=4, random_state=0)
cv = StratifiedKFold(n_splits=10,shuffle=False)

x = data.loc[:, data.columns != 'Quality Score']
y = data.loc[:,'Quality Score']
fig1 = plt.figure(figsize=[12,12])
ax1 = fig1.add_subplot(111,aspect = 'equal')
ax1.add_patch(
    patches.Arrow(0.45,0.5,-0.25,0.25,width=0.3,color='green',alpha = 0.5)
    )
ax1.add_patch(
    patches.Arrow(0.5,0.45,0.25,-0.25,width=0.3,color='red',alpha = 0.5)
    )

tprs = []
aucs = []
mean_fpr = np.linspace(0,1,100)

i = 1
for train,test in cv.split(x,y):
    prediction = clf.fit(x.iloc[train],y.iloc[train]).predict_proba(x.iloc[test])[:, 1]
    fpr, tpr, t = roc_curve(y[test], prediction)
    tprs.append(interp(mean_fpr, fpr, tpr))
    roc_auc = auc(fpr, tpr)
    aucs.append(roc_auc)
    plt.plot(fpr, tpr, lw=2, alpha=0.3, label='ROC fold %d (AUC = %0.2f)' % (i, roc_auc
    i= i+1

plt.plot([0,1],[0,1],linestyle = '--',lw = 2,color = 'black')
mean_tpr = np.mean(tprs, axis=0)
mean_auc = auc(mean_fpr, mean_tpr)
plt.plot(mean_fpr, mean_tpr, color='blue',
         label=r'Mean ROC (AUC = %0.2f )' % (mean_auc),lw=2, alpha=1)

plt.xlabel('False Positive Rate',fontsize = 16)
plt.ylabel('True Positive Rate',fontsize = 16)
plt.title('ROC')
plt.legend(loc="lower right")
plt.text(0.32,0.7,'More accurate area',fontsize = 16)
plt.text(0.63,0.4,'Less accurate area',fontsize = 16)
plt.show()
```


ROC
True Positive Rate
False Positive Rate
0.0
0.2
0.4
0.6
0.8
1.0
0.0
0.2
0.4
0.6
0.8
1.0
More accurate area
Less accurate area
ROC fold 1 (AUC = 0.82)
ROC fold 2 (AUC = 0.82)
ROC fold 3 (AUC = 0.92)
ROC fold 4 (AUC = 0.65)
ROC fold 5 (AUC = 0.85)
ROC fold 6 (AUC = 0.82)
ROC fold 7 (AUC = 0.23)
ROC fold 8 (AUC = 0.46)
ROC fold 9 (AUC = 0.82)
ROC fold 10 (AUC = 0.70)
Mean ROC (AUC = 0.71)