CSE 523: Machine Learning

Group 17 - Hardly Humans

Weekly Project Report - 10

Quora Insincere Questions Classification

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1) Tasks Performed in the week.

Implemented SVM.

Implemented LDA.

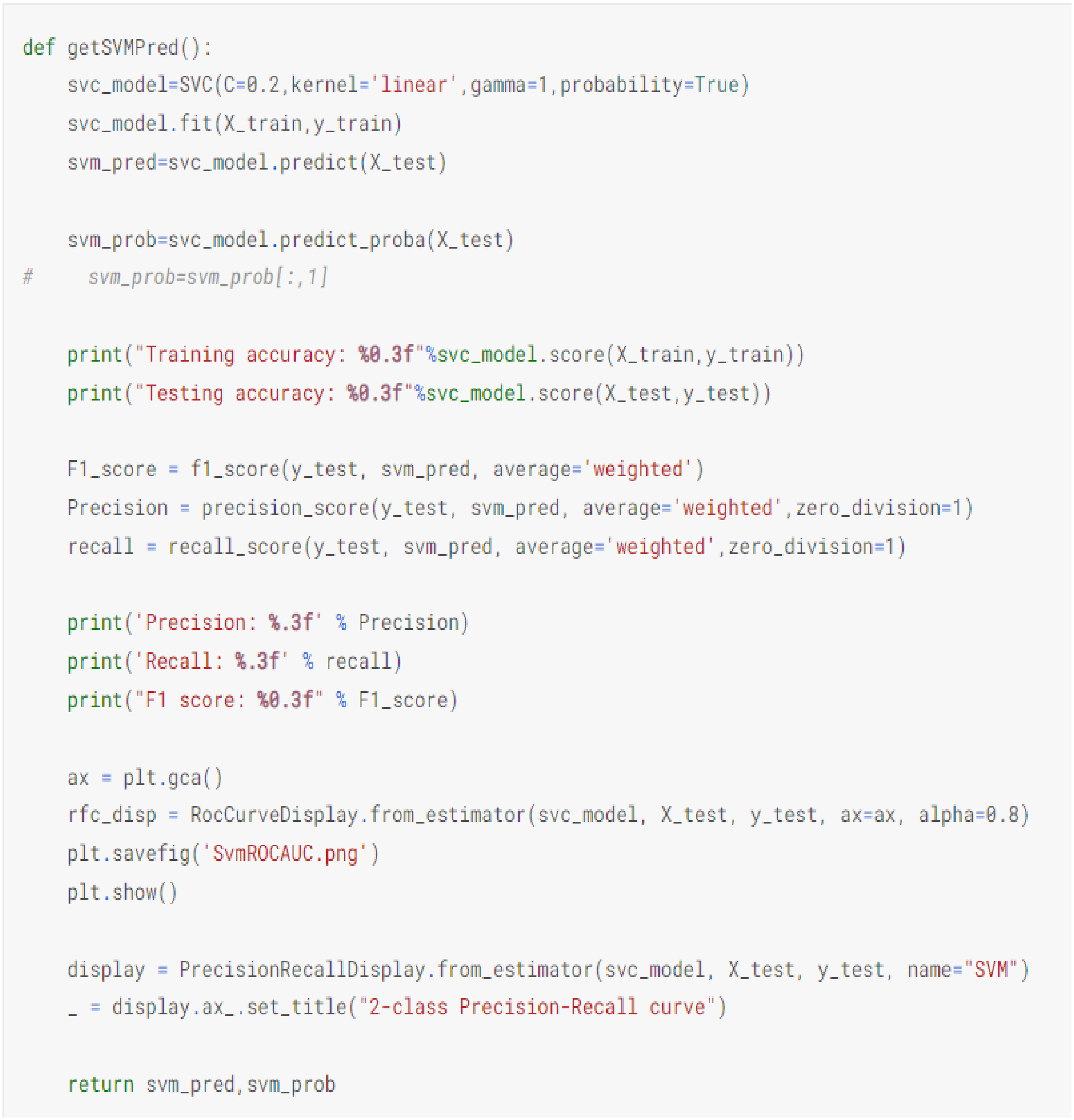
Implemented Random Forest.

2) Outcomes of the tasks performed.

- Models that were fitted to SVM and Random forests respectively.
    1) Model fitting for SVM

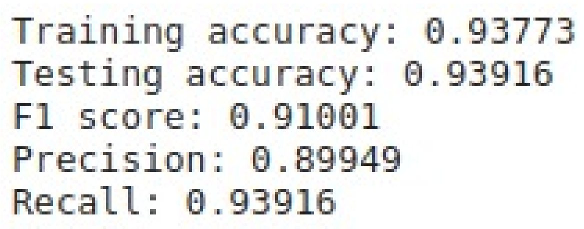
Using SVC from sklearn.svm with parameters - C=0.2,kernel='linear',gamma=1

We train the mode

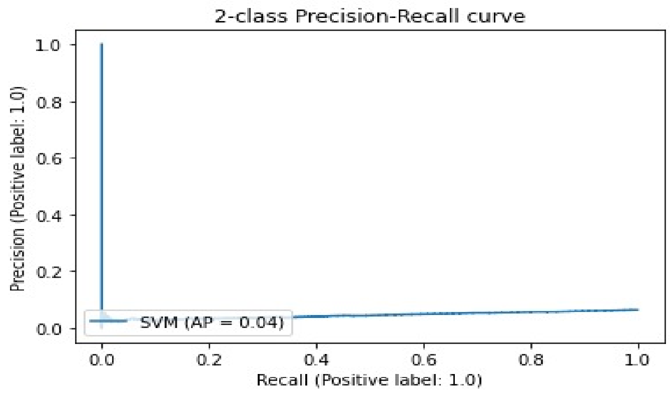


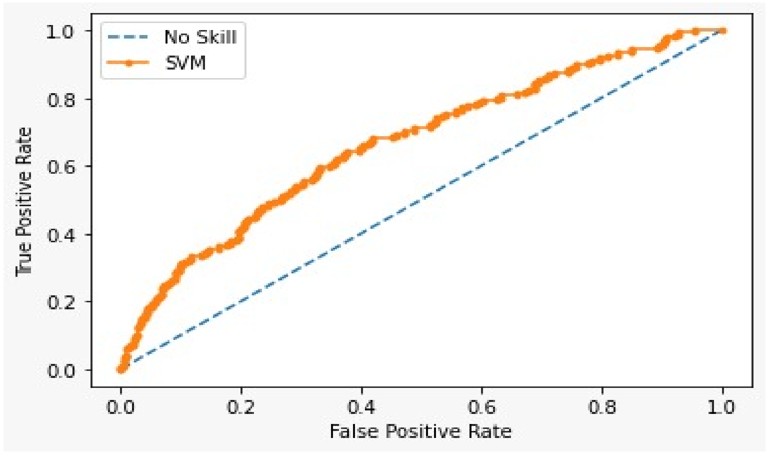
```python
def getSVMPred():
    svc_model=SVC(C=0.2,kernel='linear',gamma=1,probability=True)
    svc_model.fit(X_train,y_train)
    svm_pred=svc_model.predict(X_test)

    svm_prob=svc_model.predict_proba(X_test)
#     svm_prob=svm_prob[:,1]

    print("Training accuracy: %0.3f"%svc_model.score(X_train,y_train))
    print("Testing accuracy: %0.3f"%svc_model.score(X_test,y_test))

    F1_score = f1_score(y_test, svm_pred, average='weighted')
    Precision = precision_score(y_test, svm_pred, average='weighted',zero_division=1)
    recall = recall_score(y_test, svm_pred, average='weighted',zero_division=1)

    print('Precision: %.3f' % Precision)
    print('Recall: %.3f' % recall)
    print("F1 score: %0.3f" % F1_score)

    ax = plt.gca()
    rfc_disp = RocCurveDisplay.from_estimator(svc_model, X_test, y_test, ax=ax, alpha=0.8)
    plt.savefig('SvmROCAUC.png')
    plt.show()

    display = PrecisionRecallDisplay.from_estimator(svc_model, X_test, y_test, name="SVM")
    _ = display.ax_.set_title("2-class Precision-Recall curve")

    return svm_pred,svm_prob
```

Results:



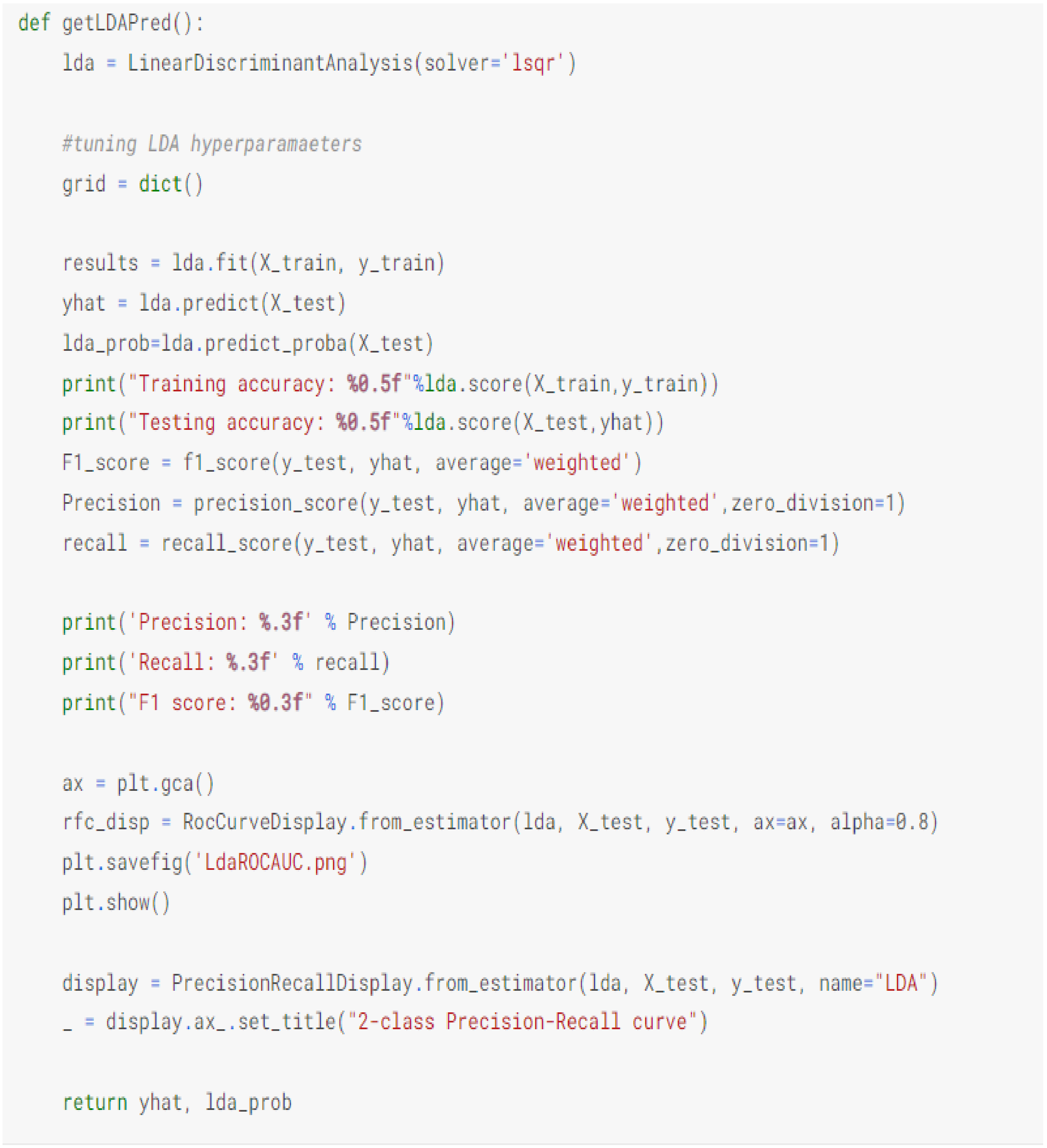
```
Training accuracy: 0.93773
Testing accuracy: 0.93916
F1 score: 0.91001
Precision: 0.89949
Recall: 0.93916
```


2-class Precision-Recall curve
Precision (Positive label: 1.0)
Recall (Positive label: 1.0)
SVM (AP = 0.04)
0.0
0.2
0.4
0.6
0.8
1.0


No Skill
SVM
True Positive Rate
False Positive Rate
0.0
0.2
0.4
0.6
0.8
1.0

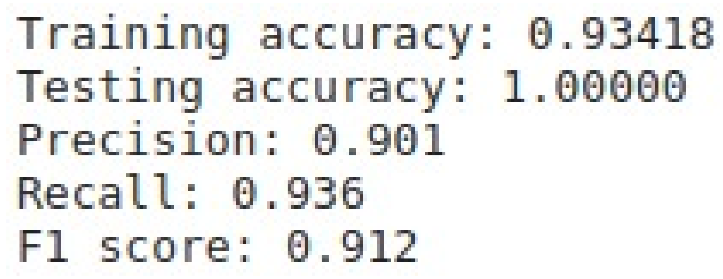
2) Model fitting for LDA

Imported Linear Discriminant Analysis model from sklearn.LinearDiscriminantAnalysis

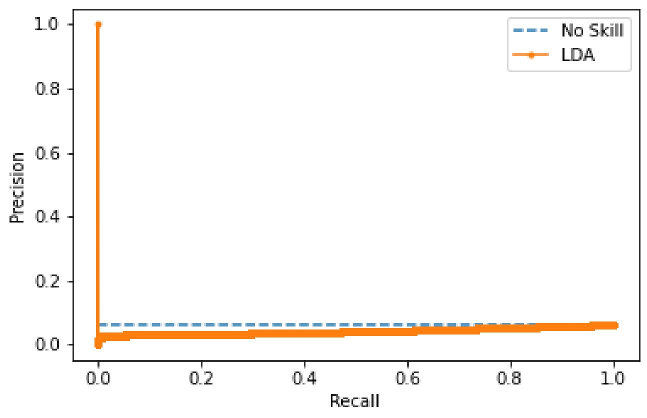


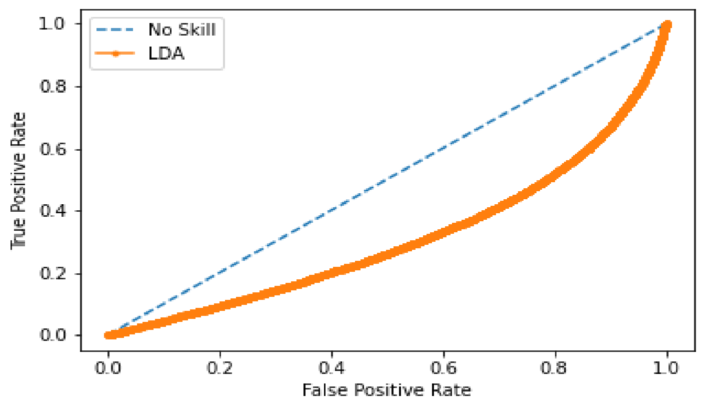
```python
def getLDAPred():
    lda = LinearDiscriminantAnalysis(solver='lsqr')

    #tuning LDA hyperparamaeters
    grid = dict()

    results = lda.fit(X_train, y_train)
    yhat = lda.predict(X_test)
    lda_prob=lda.predict_proba(X_test)
    print("Training accuracy: %0.5f"%lda.score(X_train,y_train))
    print("Testing accuracy: %0.5f"%lda.score(X_test,yhat))
    F1_score = f1_score(y_test, yhat, average='weighted')
    Precision = precision_score(y_test, yhat, average='weighted',zero_division=1)
    recall = recall_score(y_test, yhat, average='weighted',zero_division=1)

    print('Precision: %.3f' % Precision)
    print('Recall: %.3f' % recall)
    print("F1 score: %0.3f" % F1_score)

    ax = plt.gca()
    rfc_disp = RocCurveDisplay.from_estimator(lda, X_test, y_test, ax=ax, alpha=0.8)
    plt.savefig('LdaROCAUC.png')
    plt.show()

    display = PrecisionRecallDisplay.from_estimator(lda, X_test, y_test, name="LDA")
    _ = display.ax_.set_title("2-class Precision-Recall curve")

    return yhat, lda_prob
```

Results:



```
Training accuracy: 0.93418
Testing accuracy: 1.00000
Precision: 0.901
Recall: 0.936
F1 score: 0.912
```





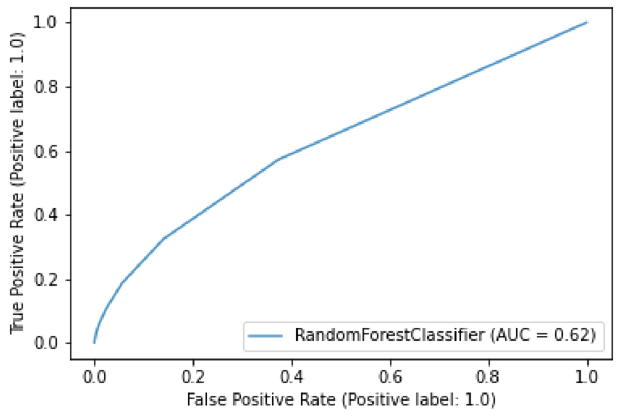
3) Model fitting for Random forest

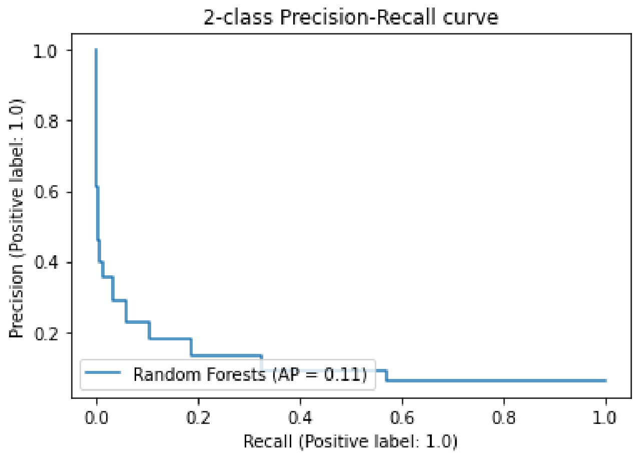
Using RandomForestClassifier from sklearn.ensemble.

```
def getRandomForest():
    RF_model = RandomForestClassifier(n_estimators=10, random_state=42)
    RF_model.fit(X_train,y_train)
    RF_preds = RF_model.predict(X_test)
    RF_prob=RF_model.predict_proba(X_test)
    print("Training accuracy: %0.3f"%RF_model.score(X_train,y_train))
    print("Testing accuracy: %0.3f"%RF_model.score(X_test,y_test))

    F1_score1 = f1_score(y_test, RF_preds, average='weighted')
    Precision1 = precision_score(y_test, RF_preds, average='weighted',zero_division=1)
    recall1 = recall_score(y_test, RF_preds, average='weighted',zero_division=1)

    print('Precision: %.3f' % Precision1)
    print('Recall: %.3f' % recall1)
    print("F1 score: %0.3f" % F1_score1)

    ax = plt.gca()
    rfc_disp = RocCurveDisplay.from_estimator(RF_model, X_test, y_test, ax=ax, alpha=0.8)
    plt.savefig('RandForestROCAUC.png')
    plt.show()

    display = PrecisionRecallDisplay.from_estimator(RF_model, X_test, y_test, name="Random F
orests")
    _ = display.ax_.set_title("2-class Precision-Recall curve")

    return RF_preds,RF_prob
```

Results:

```
Training accuracy: 0.988
Testing accuracy: 0.938
Precision: 0.905
Recall: 0.938
F1 score: 0.912
```


True Positive Rate (Positive label: 1.0)
False Positive Rate (Positive label: 1.0)
RandomForestClassifier (AUC = 0.62)


2-class Precision-Recall curve
Precision (Positive label: 1.0)
Recall (Positive label: 1.0)
Random Forests (AP = 0.11)