

```
In [1]: from sklearn.utils import shuffle
        from __future__ import division
        import numpy as np
        import scipy as sp
        import pandas as pd
        import csv
        import random as rn

        import matplotlib.pyplot as plt
```

```
In [2]: from sklearn.ensemble import GradientBoostingClassifier, RandomForestClassifier
        from sklearn.neighbors import KNeighborsClassifier
        from sklearn.decomposition import KernelPCA, PCA
        from sklearn.linear_model import LogisticRegressionCV
        from sklearn import svm, cross_validation, grid_search
        from sklearn.metrics import accuracy_score
        from sklearn.feature_selection import f_classif, RFECV, SelectKBest
        from sklearn.model_selection import KFold
        from sklearn.preprocessing import MinMaxScaler
```

/home/jytay/anaconda3/lib/python3.5/site-packages/sklearn/cross_validation.py:41: DeprecationWarning: This module was deprecated in version 0.18 in favor of the model_selection module into which all the refactored classes and functions are moved. Also note that the interface of the new CV iterators are different from that of this module. This module will be removed in 0.20.

"This module will be removed in 0.20.", DeprecationWarning)

/home/jytay/anaconda3/lib/python3.5/site-packages/sklearn/grid_search.py:42: DeprecationWarning: This module was deprecated in version 0.18 in favor of the model_selection module into which all the refactored classes and functions are moved. This module will be removed in 0.20.

DeprecationWarning)

```
In [3]: dataLoc = r'/home/jytay/Documents/cogs118a/project/skins/Skin_NonSkin.txt'
        skinSet = np.loadtxt(dataLoc) #load into numpy array
        skinDF = pd.read_csv(dataLoc, sep="\t", header=None)
        skinDF.columns = ["b", "g", "r", "y"]
```

```
In [4]: skinDF = shuffle(skinDF)
skinArray = skinDF.as_matrix()
skinDF.head()
```

```
Out[4]:
```

	b	g	r	y
149347	176	176	130	2
156730	7	5	5	2
150994	183	184	142	2
205457	57	59	23	2
116497	50	51	17	2

```
In [5]: skinArray.shape
```

```
Out[5]: (245057, 4)
```

```
In [6]: X = skinArray[:5000,:-1]
Y = skinArray[:5000,-1]

X.shape
Y.shape
```

```
Out[6]: (5000,)
```

```
In [7]: # first proportion : 20 80
X_train, X_test, Y_train, Y_test = cross_validation.train_test_split(
X,Y, train_size=.2)

# 2nd proportion : 40 60
X_train2, X_test2, Y_train2, Y_test2 = cross_validation.train_test_sp
lit(X,Y, train_size = .4)

# 3rd proportion: 50 50
X_train3, X_test3, Y_train3, Y_test3 = cross_validation.train_test_sp
lit(X,Y, train_size = .5)
```

```
In [8]: # Logit L1 for 20 80
logit_clf = LogisticRegressionCV(solver='liblinear', Cs=[.001,.01,.1,
1,10,100], cv=5, penalty='l1')
logit_clf.fit(X_train, Y_train)
logl1_score = logit_clf.score(X_test, Y_test)
print(logl1_score)

0.9215
```

```
In [9]: # Logit L1 for 40 60
logit_clf = LogisticRegressionCV(solver='liblinear', Cs=[.001,.01,.1,
1,10,100], cv=5, penalty='l1')
logit_clf.fit(X_train2, Y_train2)
log12_score = logit_clf.score(X_test2, Y_test2)
print(log12_score)
```

0.924

```
In [10]: # Logit L1 for 50 50
logit_clf = LogisticRegressionCV(solver='liblinear', Cs=[.001,.01,.1,
1,10,100], cv=5, penalty='l1')
logit_clf.fit(X_train3, Y_train3)
log13_score = logit_clf.score(X_test3, Y_test3)
print(log13_score)
```

0.9168

```
In [11]: # Logit l2 for 20 80
logit_clf = LogisticRegressionCV(solver='newton-cg', Cs=[.001,.01,.1,
1,10,100], cv=5,
                                multi_class='multinomial', penalty=
                                'l2')
logit_clf.fit(X_train, Y_train)
log21_score = logit_clf.score(X_test, Y_test)
print(log21_score)
```

0.79175

```
In [12]: # Logit l2 for 40 60
logit_clf = LogisticRegressionCV(solver='newton-cg', Cs=[.001,.01,.1,
1,10,100], cv=5,
                                multi_class='multinomial', penalty=
                                'l2')
logit_clf.fit(X_train2, Y_train2)
log22_score = logit_clf.score(X_test2, Y_test2)
print(log22_score)
```

0.799666666667

```
In [13]: # Logit l2 for 50 50
logit_clf = LogisticRegressionCV(solver='newton-cg', Cs=[.001,.01,.1,
1,10,100], cv=5,
                                multi_class='multinomial', penalty=
                                'l2')
logit_clf.fit(X_train3, Y_train3)
log23_score = logit_clf.score(X_test3, Y_test3)
print(log23_score)
```

0.788

```
In [14]: # average values for L1 and L2 proportions
L1_logit_avg = (log11_score + log12_score + log12_score)/ 3
L2_logit_avg = (log21_score + log22_score + log23_score) / 3

print(L1_logit_avg)
print(L2_logit_avg)
```

```
0.923166666667
```

```
0.793138888889
```

```
In [15]: # code to speed up svm
# proportion 1
scaling = MinMaxScaler(feature_range=(-1,1)).fit(X_train)
X_train = scaling.transform(X_train)
X_test = scaling.transform(X_test)

#proportion 2
scaling = MinMaxScaler(feature_range=(-1,1)).fit(X_train2)
X_train2 = scaling.transform(X_train2)
X_test2 = scaling.transform(X_test2)

#proportion 3
scaling = MinMaxScaler(feature_range=(-1,1)).fit(X_train3)
X_train3 = scaling.transform(X_train3)
X_test3 = scaling.transform(X_test3)
```

```
/home/jytay/anaconda3/lib/python3.5/site-packages/sklearn/utils/validation.py:558: DataConversionWarning: Data with input dtype int64 was converted to float64 by MinMaxScaler.
```

```
warnings.warn(msg, DataConversionWarning)
```

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```
warnings.warn(msg, DataConversionWarning)
```

```
In [18]: # SVM
svm_params = {'C':[0.01,1,10,100,500,700,1200,1500,1800], 'degree':[1,2,3,4]}
clf = svm.SVC(kernel='poly')
svm_clf = grid_search.GridSearchCV(clf, svm_params, cv=5, n_jobs=4)
svm_clf.fit(X_train,Y_train)
print(svm_clf.best_score_)
svm_clf.best_params_
```

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0.956

Out[18]: {'C': 500, 'degree': 3}

```
In [20]: # SVM 2
svm_params = {'C': [.01, 1, 10, 100, 500, 700, 1200, 1500, 1800], 'degree': [1, 2, 3, 4]}
clf = svm.SVC(kernel='poly')
svm_clf = grid_search.GridSearchCV(clf, svm_params, cv=5, n_jobs=4)
svm_clf.fit(X_train2, Y_train2)
print(svm_clf.best_score_)
svm_clf.best_params_
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0.9525

Out[20]: {'C': 1200, 'degree': 3}

```
In [21]: # SVM 3
svm_params = {'C': [.01, 1, 10, 100, 500, 700, 1200, 1500, 1800], 'degree': [1, 2, 3, 4]}
clf = svm.SVC(kernel='poly')
svm_clf = grid_search.GridSearchCV(clf, svm_params, cv=5, n_jobs=4)
svm_clf.fit(X_train3, Y_train3)
print(svm_clf.best_score_)
svm_clf.best_params_
```

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```

0.9648

Out[21]: {'C': 500, 'degree': 3}

```
In [28]: # Random Forests 20 80
rf_params = {"max_features":[1,2,3],
             "n_estimators":[300,400,500,800]}
clf = RandomForestClassifier()
rf_clf = grid_search.GridSearchCV(clf, rf_params, cv=5, n_jobs=4)
rf_clf.fit(X_train,Y_train)
print(rf_clf.best_score_)
print(rf_clf.best_params_)

rf1_score = rf_clf.best_score_
rf1_bestParams = rf_clf.best_params_

0.99
{'max_features': 1, 'n_estimators': 400}
```

```
In [29]: # Random Forests 40 60
rf_params = {"max_features":[1,2,3],
             "n_estimators":[500,800,1024]}
clf = RandomForestClassifier()
rf_clf = grid_search.GridSearchCV(clf, rf_params, cv=5, n_jobs=4)
rf_clf.fit(X_train2,Y_train2)
print(rf_clf.best_score_)
print(rf_clf.best_params_)

rf2_score = rf_clf.best_score_
rf2_bestParams = rf_clf.best_params_

0.994
{'max_features': 1, 'n_estimators': 1024}
```

```
In [31]: # Random Forests 50 50
rf_params = {"max_features":[1,2,3],
             "n_estimators":[600,800,1024,1500]}
clf = RandomForestClassifier()
rf_clf = grid_search.GridSearchCV(clf, rf_params, cv=5, n_jobs=4)
rf_clf.fit(X_train2,Y_train2)
print(rf_clf.best_score_)
print(rf_clf.best_params_)
rf3_score = rf_clf.best_score_
rf3_bestParams = rf_clf.best_params_

0.994
{'max_features': 1, 'n_estimators': 600}
```

```
In [32]: # avg score for each proportion of splitting

RF_avgScore = (rf1_score + rf2_score + rf3_score) / 3
print(RF_avgScore)

0.9926666666666666
```



```
In [21]: # KNN 20 80
knn_params = {"n_neighbors":[5,7,10,15,25,50,100,500]}
clf = KNeighborsClassifier()
knn_clf = grid_search.GridSearchCV(clf, knn_params, cv=5, n_jobs=4)
knn_clf.fit(X_train,Y_train);
print(knn_clf.best_score_)
knn_clf.best_params_

KNN_1score = knn_clf.best_score_

0.992
```

```
In [22]: # KNN 40 60
knn_clf.fit(X_train2,Y_train2);
print(knn_clf.best_score_)
knn_clf.best_params_

KNN_2score = knn_clf.best_score_

0.99675
```

```
In [23]: # KNN 50 50
knn_clf.fit(X_train3,Y_train3);
print(knn_clf.best_score_)
knn_clf.best_params_

KNN_3score = knn_clf.best_score_

0.998
```

```
In [24]: # avg KNN score
KNN_avg = (KNN_1score + KNN_2score + KNN_3score)/3
```

```
In [28]: # Gradient Boosting
gb_params = {"n_estimators":[512,1024],
             "learning_rate":[.01,.1]}
clf = GradientBoostingClassifier()
gb_clf = grid_search.GridSearchCV(clf, gb_params, cv=5, n_jobs=4)
gb_clf.fit(X_train,Y_train);
print(gb_clf.best_score_)
gb_clf.best_params_
GB_1score = gb_clf.best_score_

0.994
```

```
In [31]: gb_clf.fit(X_train2,Y_train2);
print(gb_clf.best_score_)
gb_clf.best_params_
GB_2score = gb_clf.best_score_

0.9945
```

```
In [32]: gb_clf.fit(X_train3,Y_train3);  
         print(gb_clf.best_score_)  
         gb_clf.best_params_  
         GB_3score = gb_clf.best_score_
```

0.9956

```
In [33]: # avg B score  
         GB_avg = (GB_1score + GB_2score + GB_3score) / 3  
         print(GB_avg)
```

0.9947

```
In [ ]: #for classifier in [logit_clf, svm_clf, rf_clf, knn_clf, gb_clf]:  
         #   print classifier.score(X_test, y_test)
```