Dogs vs Cats

December 16, 2015

1 Dogs vs Cats - features

Kaggle

1 = dog

0 = cat

Notes for report: analyse how the variability of nr_features affects try different detectors

```
In [84]: import cv2
         from matplotlib import pyplot as plt
         import sklearn
         import numpy as np
         import pickle as pk
         from os import listdir

         plt.style.use('ggplot')
         %matplotlib inline
```

```
In [85]: NR_SAMPLES = 100
         NR_WORDS = 100
```

1.0.1 Load training dataset

```
In [8]: train_folder = 'data/train/'
```

```
In [9]: imgs_paths = [train_folder + filepath for filepath in listdir(train_folder)]
```

```
In [52]: # select a subset
         imgs_paths = imgs_paths[:NR_SAMPLES]
```

```
In [11]: from os import listdir

         def load_images(imgs_paths, gray=False):
             for path in imgs_paths:
                 img = cv2.imread(path)

                 if gray:
                     yield cv2.imread(path, cv2.IMREAD_GRAYSCALE)
                 else:
                     yield cv2.imread(path)
```

```
In [12]: labels = [1 if "dog" in path else 0 for path in imgs_paths]
```

```
In [13]: print('Nr dogs:', labels.count(1))
```

```
Nr dogs: 52
```

```
In [14]: print('Nr cats:', labels.count(0))
```

```
Nr cats: 48
```

1.1 Features Extraction

Features detectors, descriptors and matcher

```
In [15]: # SIFT features detector and extractor
         sift = cv2.xfeatures2d.SIFT_create()
```

```
In [16]: # SURF features detector and extractor
         surf = cv2.xfeatures2d.SURF_create()
```

```
In [17]: # FAST features detector
         fast = cv2.FastFeatureDetector_create()
```

```
In [18]: # BRISK descriptors extractor
         br = cv2.BRISK_create()
```

```
In [19]: # FLANN matcher
         FLANN_INDEX_KDTREE = 0
         index_params = dict(algorithm = FLANN_INDEX_KDTREE, trees = 5)
         search_params = dict(checks=50)   # or pass empty dictionary

         flann = cv2.FlannBasedMatcher(index_params,search_params)
```

Bag of Words

```
In [37]: def train_bow(imgs, detector, matcher, extractor=None):
             if extractor == None:
                 extractor = detector

             bow_trainer = cv2.BOWKMeansTrainer(NR_WORDS,
                                                attempts=1,
                                                flags=cv2.KMEANS_PP_CENTERS)

             bow_extractor = cv2.BOWImgDescriptorExtractor(extractor, matcher)

             for img in load_images(imgs, gray=True):

                 kp = detector.detect(img)
                 kp, des = extractor.compute(img, kp)

                 bow_trainer.add(des)

             vocabulary = bow_trainer.cluster()

             bow_extractor.setVocabulary(vocabulary)

             return bow_extractor
```

```
In [38]: detector = sift
         extractor = sift
```

```
In [39]: sift_bow_extractor = train_bow(imgs_paths, detector, flann, extractor=extractor)
```

```
In [40]: features = np.empty((0, NR_WORDS))
         imgs = load_images(imgs_paths, gray=True)

         for img in imgs:
             kp = detector.detect(img)

             img_features = sift_bow_extractor.compute(img, kp)

             features = np.concatenate((features, img_features), axis=0)
```

```
In [41]: features.shape

Out[41]: (100, 100)

In [42]: labels = np.asarray(labels)

         labels.shape

Out[42]: (100,)

In [43]: target_names = ['dog', 'cat']
```

1.2 Prediction

```
In [44]: from sklearn.cross_validation import train_test_split
         from sklearn.cross_validation import StratifiedKFold
         from sklearn.base import clone as skl_clone
         from sklearn.metrics import accuracy_score, confusion_matrix
         from sklearn.metrics import classification_report
         from sklearn.metrics import roc_curve, auc
         from sklearn.preprocessing import label_binarize

         def k_fold_model_select(features, labels, raw_classifiers, n_folds=10, weigh_samples_fn=None):
             # weigh_samples_fn is explained below
             # assumes that the raw_classifier output is in probability

             # split into training and test data
             X_train, X_test, y_train, y_test = train_test_split(features,
                                                                 labels,
                                                                 test_size=0.3,
                                                                 stratify=labels,
                                                                 random_state=0)


             # use stratified k-fold cross validation to select the model
             skf = StratifiedKFold(y_train, n_folds=n_folds)

             best_classifier = None
             best_score = float('-inf')

             for train_index, validation_index in skf:
                 for raw_classifier in raw_classifiers:
                     classifier = skl_clone(raw_classifier)
                     classifier = classifier.fit(X_train[train_index], y_train[train_index])

                     if weigh_samples_fn != None:
                         y_pred = classifier.predict(X_train[validation_index])
                         sample_weight = weigh_samples_fn(y_train[validation_index], y_pred)
                     else:
```

```
                sample_weight = None

            score = accuracy_score(classifier.predict(X_train[validation_index]), y_train[vali
                                     sample_weight=sample_weight)

            if score > best_score:
                best_classifier = classifier
                best_score = score

    # compute the confusion matrix
    y_pred = best_classifier.predict(X_test)
    conf_mat = confusion_matrix(y_test, y_pred)

    # now compute the score for the test data of the best found classifier
    if weigh_samples_fn != None:
        sample_weight = weigh_samples_fn(y_test, y_pred)
    else:
        sample_weight = None
    test_score = accuracy_score(best_classifier.predict(X_test), y_test, sample_weight=sample_

    # obtain the classification report
    report = classification_report(y_test, y_pred, target_names=[’cat’, ’dog’], sample_weight=s

    # obtain ROC curve
    y_test_bin = label_binarize(y_test, classes=[0, 1])
    y_prob = best_classifier.predict_proba(X_test)

    #fpr, tpr, _ = roc_curve(y_test_bin[:, 1], y_prob[:, 1])
    fpr, tpr, _ = roc_curve(y_test_bin, y_prob[:, 1])
    roc_info = (best_classifier.__class__.__name__, (fpr, tpr))

    return (test_score, report, conf_mat, roc_info, best_classifier)
```

Nearest Neighbors

```
In [45]: from sklearn.neighbors import KNeighborsClassifier

         knn = KNeighborsClassifier(weights=’distance’, algorithm=’auto’)
         knn_score, knn_rep, knn_cm, knn_roc, knn_clf = k_fold_model_select(features, labels, [knn])

         print("Nearest Neighbors")
         print("Score:", knn_score)
         print("Confusion matrix:", knn_cm, sep=’\n’)
         print("Classification report:", knn_rep, sep=’\n’)
```

```
Score: 0.533333333333
Confusion matrix:
[[ 0 14]
 [ 0 16]]
Classification report:
             precision    recall  f1-score   support

        cat       0.00      0.00      0.00        14
        dog       0.53      1.00      0.70        16
```

```
avg / total       0.28      0.53      0.37        30

/home/diogo/bin/anaconda3/lib/python3.4/site-packages/sklearn/metrics/classification.py:1074: Undefined
  ’precision’, ’predicted’, average, warn_for)
```

Gaussian Naive Bayes

```
In [46]: from sklearn.naive_bayes import GaussianNB

         nb = GaussianNB()
         nb_score, nb_rep, nb_cm, nb_roc, nb_clf = k_fold_model_select(features, labels, [nb])

         print("Gaussian Naive Bayes")
         print("Score:", nb_score)
         print("Confusion matrix:", nb_cm, sep=’\n’)
         print("Classification report:", nb_rep, sep=’\n’)
```

```
Score: 0.533333333333
Confusion matrix:
[[13  1]
 [13  3]]
Classification report:
             precision    recall  f1-score   support

        cat       0.50      0.93      0.65        14
        dog       0.75      0.19      0.30        16

avg / total       0.63      0.53      0.46        30
```

SVM

```
In [47]: from sklearn.svm import SVC
         from sklearn.pipeline import Pipeline
         from sklearn.preprocessing import MinMaxScaler

         svc = SVC(kernel=’rbf’, random_state=0, class_weight=’balanced’, probability=True)

         pipeline = Pipeline([
                 (’min/max scaler’, MinMaxScaler(feature_range=(0.0, 1.0))),
                 (’svc linear’, svc)])

         svc_score, svc_rep, svc_cm, svc_roc, svc_clf = \
             k_fold_model_select(features, labels, [pipeline])

         print("SVM")
         print("Score:", svc_score)
         print("Confusion matrix:", svc_cm, sep=’\n’)
         print("Classification report:", svc_rep, sep=’\n’)
```

```
Score: 0.533333333333
Confusion matrix:
[[ 0 14]
 [ 0 16]]
Classification report:
```

```
             precision    recall  f1-score   support

        cat       0.00      0.00      0.00        14
        dog       0.53      1.00      0.70        16

avg / total       0.28      0.53      0.37        30
```

```
/home/diogo/bin/anaconda3/lib/python3.4/site-packages/sklearn/metrics/classification.py:1074: Undefined
  'precision', 'predicted', average, warn_for)
```

AdaBoost

```
In [48]: from sklearn.ensemble import AdaBoostClassifier
         from sklearn.tree import DecisionTreeClassifier

         dt = DecisionTreeClassifier(min_samples_split=15, random_state=0, min_samples_leaf=5, class_we

         ab = AdaBoostClassifier(base_estimator=dt, random_state=0)
         ab_score, ab_rep, ab_cm, ab_roc, ab_clf = k_fold_model_select( features, labels, [ab])

         print("AdaBoos")
         print("Score:", ab_score)
         print("Confusion matrix:", ab_cm, sep='\n')
         print("Classification report:", ab_rep, sep='\n')
```

```
Score: 0.533333333333
Confusion matrix:
[[ 0 14]
 [ 0 16]]
Classification report:
             precision    recall  f1-score   support

        cat       0.00      0.00      0.00        14
        dog       0.53      1.00      0.70        16

avg / total       0.28      0.53      0.37        30
```

```
/home/diogo/bin/anaconda3/lib/python3.4/site-packages/sklearn/metrics/classification.py:1074: Undefined
  'precision', 'predicted', average, warn_for)
```

1.2.1 Random Forest

```
In [49]: from sklearn.ensemble import RandomForestClassifier

         rf = RandomForestClassifier(n_estimators=100, random_state=0)

         rf_score, rf_rep, rf_cm, rf_roc, rf_clf = k_fold_model_select(features, labels, [rf])

         print("Random Forest")
         print("Score:", rf_score)
         print("Confusion matrix:", rf_cm, sep='\n')
         print("Classification report:", rf_rep, sep='\n')
```

```
Score: 0.533333333333
Confusion matrix:
[[ 0 14]
```

```
 [ 0 16]]
Classification report:
             precision    recall  f1-score   support

        cat       0.00      0.00      0.00        14
        dog       0.53      1.00      0.70        16

avg / total       0.28      0.53      0.37        30

/home/diogo/bin/anaconda3/lib/python3.4/site-packages/sklearn/metrics/classification.py:1074: Undefined
  'precision', 'predicted', average, warn_for)
```

1.2.2 Selecting the Best

```
In [86]: classifiers = [knn_clf, nb_clf, svc_clf, ab_clf, rf_clf]
```

```
In [88]: best_score, best_rep, best_cm, best_roc, best_clf = k_fold_model_select(features, labels, clas

         print("Classifier:", best_clf.__class__.__name__)
         print("Score:", best_score)
         print("Confusion matrix:", best_cm, sep='\n')
         print("Classification report:", best_rep, sep='\n')
```

```
Classifier: KNeighborsClassifier
Score: 0.533333333333
Confusion matrix:
[[ 0 14]
 [ 0 16]]
Classification report:
             precision    recall  f1-score   support

        cat       0.00      0.00      0.00        14
        dog       0.53      1.00      0.70        16

avg / total       0.28      0.53      0.37        30

/home/diogo/bin/anaconda3/lib/python3.4/site-packages/sklearn/metrics/classification.py:1074: Undefined
  'precision', 'predicted', average, warn_for)
```

```
In [92]: import pickle as pk

         pk.dump(best_clf, open('best_clf.p', 'wb'))
```

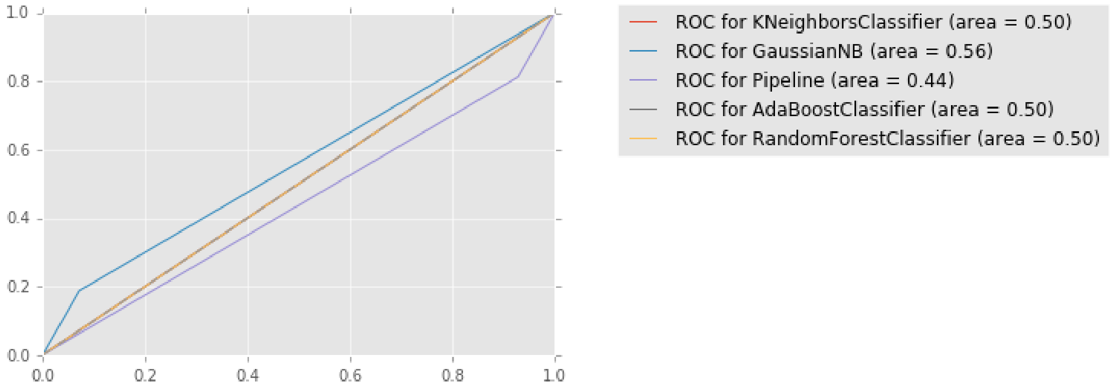
1.3 ROC Curves

```
In [50]: def plot_roc_curves(roc_curves):
             for name, (fpr, tpr) in roc_curves:
                 roc_auc = auc(fpr, tpr)
                 plt.plot(fpr, tpr, lw=1, label='ROC for {} (area = {:0.2f})'.format(name, roc_auc))

             plt.legend(bbox_to_anchor=(2.1, 1.05))
             plt.plot([0, 1], [0, 1], '--', color=(0.6, 0.6, 0.6), label='Luck')
```

```
In [51]: roc_curves = [knn_roc, nb_roc, svc_roc, ab_roc, rf_roc]

         plot_roc_curves(roc_curves)
```



1.4 Testing

```
In [125]: def save_labels_csv(labels):
              indexed_labels = np.concatenate((np.asmatrix(range(1, len(labels) + 1)).transpose(), np.as

              print(indexed_labels)

              np.savetxt('result.csv',
                         indexed_labels,
                         fmt='%d',
                         delimiter=',',
                         header='id,label',
                         comments='')
```

```
In [111]: test_folder = 'data/test1/'
```

```
In [130]: test_imgs_paths = [test_folder + filepath for filepath in listdir(test_folder)]
```

```
In [131]: test_imgs_paths = test_imgs_paths[:10]
```

```
In [132]: pred = []

          test_imgs = load_images(test_imgs_paths, gray=True)

          for img in test_imgs:

              kp = detector.detect(img)
              img_features = sift_bow_extractor.compute(img, kp)

              p = best_clf.predict(img_features)

              pred.append(p)
```

```
In [133]: save_labels_csv(pred)
```

```
[[ 1  1]
 [ 2  1]
 [ 3  1]
 [ 4  1]
 [ 5  1]
 [ 6  1]
 [ 7  1]
 [ 8  1]
 [ 9  1]
 [10  1]]
```

```
In [ ]:
```