Olivetti dataset

Labelled Faces in the Wild dataset

The Olivetti dataset will have better accuracy, as there is less variance between samples in a class, and the Olivetti samples are well-lit and nicely cropped.

Olivetti

Left column: model from first project

```
Predicting people's names on the test set
done in 0.008s
              precision    recall  f1-score   support

           0       1.00      1.00      1.00         3
           1       1.00      1.00      1.00         3
           2       0.75      1.00      0.86         3
           3       1.00      1.00      1.00         3
           4       1.00      1.00      1.00         3
           5       1.00      1.00      1.00         3
           6       1.00      1.00      1.00         3
           7       1.00      0.67      0.80         3
           8       1.00      1.00      1.00         3
           9       1.00      0.67      0.80         3
          10       1.00      1.00      1.00         3
          11       1.00      1.00      1.00         3
          12       1.00      1.00      1.00         3
          13       1.00      1.00      1.00         3
          14       1.00      1.00      1.00         3
          15       1.00      0.33      0.50         3
          16       1.00      1.00      1.00         3
          17       1.00      1.00      1.00         3
          18       1.00      1.00      1.00         3
          19       1.00      1.00      1.00         3
          20       0.60      1.00      0.75         3
          21       1.00      1.00      1.00         3
          22       1.00      1.00      1.00         3
          23       1.00      1.00      1.00         3
          24       1.00      1.00      1.00         3
          25       1.00      1.00      1.00         3
          26       1.00      1.00      1.00         3
          27       1.00      1.00      1.00         3
          28       1.00      1.00      1.00         3
          29       1.00      1.00      1.00         3
          30       1.00      1.00      1.00         3
          31       1.00      1.00      1.00         3
          32       1.00      1.00      1.00         3
          33       1.00      1.00      1.00         3
          34       1.00      1.00      1.00         3
          35       1.00      1.00      1.00         3
          36       1.00      1.00      1.00         3
          37       1.00      1.00      1.00         3
          38       1.00      1.00      1.00         3
          39       0.75      1.00      0.86         3

    accuracy                           0.97       120
   macro avg       0.98      0.97      0.96       120
weighted avg       0.98      0.97      0.96       120

[[3 0 0 ... 0 0 0]
 [0 3 0 ... 0 0 0]
 [0 0 3 ... 0 0 0]
 ...
 [0 0 0 ... 3 0 0]
 [0 0 0 ... 0 3 0]
 [0 0 0 ... 0 0 3]]
```

The Olivetti dataset has great accuracy across both models.

Right column: model from second project

```
              precision    recall  f1-score   support

           0       1.00      0.33      0.50         3
           1       1.00      1.00      1.00         3
           2       0.67      0.67      0.67         3
           3       1.00      1.00      1.00         3
           4       1.00      1.00      1.00         3
           5       1.00      1.00      1.00         3
           6       1.00      1.00      1.00         3
           7       0.67      0.67      0.67         3
           8       1.00      1.00      1.00         3
           9       1.00      0.67      0.80         3
          10       1.00      1.00      1.00         3
          11       1.00      1.00      1.00         3
          12       1.00      0.33      0.50         3
          13       1.00      1.00      1.00         3
          14       0.75      1.00      0.86         3
          15       0.60      1.00      0.75         3
          16       1.00      1.00      1.00         3
          17       1.00      1.00      1.00         3
          18       1.00      1.00      1.00         3
          19       1.00      1.00      1.00         3
          20       0.75      1.00      0.86         3
          21       1.00      0.67      0.80         3
          22       1.00      1.00      1.00         3
          23       1.00      1.00      1.00         3
          24       0.75      1.00      0.86         3
          25       1.00      0.67      0.80         3
          26       1.00      1.00      1.00         3
          27       1.00      1.00      1.00         3
          28       1.00      1.00      1.00         3
          29       1.00      1.00      1.00         3
          30       1.00      1.00      1.00         3
          31       1.00      0.67      0.80         3
          32       1.00      1.00      1.00         3
          33       1.00      1.00      1.00         3
          34       1.00      1.00      1.00         3
          35       1.00      1.00      1.00         3
          36       1.00      1.00      1.00         3
          37       1.00      1.00      1.00         3
          38       0.75      1.00      0.86         3
          39       0.60      1.00      0.75         3

    accuracy                           0.92       120
   macro avg       0.94      0.92      0.91       120
weighted avg       0.94      0.92      0.91       120

========== LDA RESULT ==========
Accuracy score:0.94

========== LR RESULT ==========
Accuracy score:0.93

========== NB RESULT ==========
Accuracy score:0.85

========== KNN RESULT ==========
Accuracy score:0.79

========== DT RESULT ==========
Accuracy score:0.60

========== SVM RESULT ==========
Accuracy score:0.92
```

LFW, min samples/person = 100

```
Predicting people's names on the test set
done in 0.060s
              precision    recall  f1-score   support

           0       0.84      0.94      0.89        71
           1       0.96      0.75      0.84        36
           2       0.86      0.96      0.90       159
           3       0.96      0.70      0.81        33
           4       0.88      0.67      0.76        43

    accuracy                           0.87       342
   macro avg       0.90      0.80      0.84       342
weighted avg       0.88      0.87      0.87       342

[[ 67   0   3   0   1]
 [  2  27   6   0   1]
 [  7   0 152   0   0]
 [  1   1   6  23   2]
 [  3   0  10   1  29]]
```

With many samples per class, and few classes, both perform relatively well. First model performs better.

```
              precision    recall  f1-score   support

           0       0.90      0.75      0.82        71
           1       1.00      0.42      0.59        36
           2       0.68      0.98      0.80       159
           3       1.00      0.48      0.65        33
           4       0.95      0.49      0.65        43

    accuracy                           0.76       342
   macro avg       0.91      0.62      0.70       342
weighted avg       0.82      0.76      0.75       342

========== LDA RESULT ==========
Accuracy score:0.87

========== LR RESULT ==========
Accuracy score:0.83

========== NB RESULT ==========
Accuracy score:0.72

========== KNN RESULT ==========
Accuracy score:0.66

========== DT RESULT ==========
Accuracy score:0.40

========== SVM RESULT ==========
Accuracy score:0.76
```

LFW, min samples/person = 100, reduce classes to 4

```
Predicting people's names on the test set
done in 0.051s
              precision    recall  f1-score   support

           0       0.86      0.94      0.90        71
           1       0.87      0.72      0.79        36
           2       0.92      0.95      0.93       159
           3       1.00      0.82      0.90        33

    accuracy                           0.91       299
   macro avg       0.91      0.86      0.88       299
weighted avg       0.91      0.91      0.90       299

[[ 67   0   4   0]
 [  6  26   4   0]
 [  5   3 151   0]
 [  0   1   5  27]]
```

Reducing the number of classes increases the accuracy.

```
              precision    recall  f1-score   support

           0       0.93      0.79      0.85        71
           1       1.00      0.44      0.62        36
           2       0.75      0.98      0.85       159
           3       1.00      0.48      0.65        33

    accuracy                           0.82       299
   macro avg       0.92      0.67      0.74       299
weighted avg       0.85      0.82      0.80       299

========== LDA RESULT ==========
Accuracy score:0.88

========== LR RESULT ==========
Accuracy score:0.86

========== NB RESULT ==========
Accuracy score:0.78

========== KNN RESULT ==========
Accuracy score:0.73

========== DT RESULT ==========
Accuracy score:0.53

========== SVM RESULT ==========
Accuracy score:0.82
```

LFW, min samples/person = 100, reduce samples to 100

```
Predicting people's names on the test set
done in 0.008s
              precision    recall  f1-score   support

           0       0.73      0.73      0.73        30
           1       0.81      0.87      0.84        30
           2       0.79      0.63      0.70        30
           3       0.81      0.83      0.82        30
           4       0.76      0.83      0.79        30

    accuracy                           0.78       150
   macro avg       0.78      0.78      0.78       150
weighted avg       0.78      0.78      0.78       150

[[22  2  2  1  3]
 [ 0 26  1  2  1]
 [ 4  3 19  2  2]
 [ 1  1  1 25  2]
 [ 3  0  1  1 25]]
```

Reducing the number of samples decreases the accuracy (even though we are equalizing the number of samples for all classes). However, the models have around the same accuracy now (will come back to this potential error at the end).

```
              precision    recall  f1-score   support

           0       0.73      0.73      0.73        30
           1       0.81      0.83      0.82        30
           2       0.83      0.83      0.83        30
           3       0.71      0.67      0.69        30
           4       0.71      0.73      0.72        30

    accuracy                           0.76       150
   macro avg       0.76      0.76      0.76       150
weighted avg       0.76      0.76      0.76       150

========== LDA RESULT ==========
Accuracy score:0.76

========== LR RESULT ==========
Accuracy score:0.73

========== NB RESULT ==========
Accuracy score:0.71

========== KNN RESULT ==========
Accuracy score:0.53

========== DT RESULT ==========
Accuracy score:0.39

========== SVM RESULT ==========
Accuracy score:0.76
```

LFW, min samples/person = 20, reduce classes to 40, reduce samples to 20

```
Predicting people's names on the test set
done in 0.036s
              precision    recall  f1-score   support

           0       0.50      0.50      0.50         6
           1       0.50      0.17      0.25         6
           2       0.50      0.17      0.25         6
           3       0.33      0.33      0.33         6
           4       0.27      0.50      0.35         6
           5       1.00      0.83      0.91         6
           6       0.00      0.00      0.00         6
           7       0.57      0.67      0.62         6
           8       0.43      0.50      0.46         6
           9       0.75      0.50      0.60         6
          10       0.33      0.17      0.22         6
          11       0.40      0.33      0.36         6
          12       0.12      0.17      0.14         6
          13       0.57      0.67      0.62         6
          14       0.57      0.67      0.62         6
          15       0.18      0.33      0.24         6
          16       1.00      0.67      0.80         6
          17       0.33      0.50      0.40         6
          18       0.20      0.33      0.25         6
          19       0.60      0.50      0.55         6
          20       0.00      0.00      0.00         6
          21       0.20      0.17      0.18         6
          22       0.11      0.17      0.13         6
          23       1.00      0.33      0.50         6
          24       0.29      0.33      0.31         6
          25       0.57      0.67      0.62         6
          26       0.67      0.33      0.44         6
          27       0.11      0.17      0.13         6
          28       0.60      0.50      0.55         6
          29       0.50      0.67      0.57         6
          30       1.00      0.67      0.80         6
          31       0.40      0.67      0.50         6
          32       0.50      0.33      0.40         6
          33       0.60      0.50      0.55         6
          34       1.00      0.50      0.67         6
          35       0.80      0.67      0.73         6
          36       1.00      0.67      0.80         6
          37       0.83      0.83      0.83         6
          38       0.50      0.17      0.25         6
          39       0.36      0.67      0.47         6

    accuracy                           0.44       240
   macro avg       0.51      0.44      0.45       240
weighted avg       0.51      0.44      0.45       240

[[3 0 0 ... 0 0 1]
 [0 1 0 ... 0 0 1]
 [0 0 1 ... 0 0 0]
 ...
 [0 0 0 ... 5 0 0]
 [0 0 0 ... 0 1 0]
 [0 0 0 ... 0 0 4]]
```

With many classes and few samples, both models perform poorly.

```
              precision    recall  f1-score   support

           0       0.22      0.33      0.27         6
           1       0.38      0.50      0.43         6
           2       1.00      0.67      0.80         6
           3       0.33      0.17      0.22         6
           4       0.29      0.33      0.31         6
           5       1.00      0.50      0.67         6
           6       0.18      0.33      0.24         6
           7       1.00      0.67      0.80         6
           8       0.29      0.33      0.31         6
           9       0.67      0.67      0.67         6
          10       0.50      0.50      0.50         6
          11       0.29      0.33      0.31         6
          12       0.50      0.33      0.40         6
          13       1.00      0.33      0.50         6
          14       0.43      0.50      0.46         6
          15       0.16      0.50      0.24         6
          16       0.67      0.33      0.44         6
          17       0.00      0.00      0.00         6
          18       0.24      0.67      0.35         6
          19       0.25      0.17      0.20         6
          20       0.60      0.50      0.55         6
          21       0.50      0.33      0.40         6
          22       0.00      0.00      0.00         6
          23       0.50      0.50      0.50         6
          24       0.29      0.33      0.31         6
          25       0.75      0.50      0.60         6
          26       0.60      0.50      0.55         6
          27       0.33      0.33      0.33         6
          28       1.00      0.17      0.29         6
          29       0.80      0.67      0.73         6
          30       1.00      0.50      0.67         6
          31       0.20      0.17      0.18         6
          32       0.33      0.50      0.40         6
          33       1.00      0.33      0.50         6
          34       0.62      0.83      0.71         6
          35       1.00      0.33      0.50         6
          36       0.50      0.83      0.62         6
          37       1.00      0.50      0.67         6
          38       0.20      0.17      0.18         6
          39       0.40      0.33      0.36         6

    accuracy                           0.41       240
   macro avg       0.53      0.41      0.43       240
weighted avg       0.53      0.41      0.43       240

========== LDA RESULT ==========
Accuracy score:0.47

========== LR RESULT ==========
Accuracy score:0.43

========== NB RESULT ==========
Accuracy score:0.39

========== KNN RESULT ==========
Accuracy score:0.20

========== DT RESULT ==========
Accuracy score:0.11

========== SVM RESULT ==========
Accuracy score:0.41
```

LFW, min samples/person = 20, reduce classes to 10, reduce samples to 20

```
Predicting people's names on the test set
done in 0.002s
              precision    recall  f1-score   support

           0       0.33      0.33      0.33         6
           1       0.80      0.67      0.73         6
           2       0.60      0.50      0.55         6
           3       0.00      0.00      0.00         6
           4       0.50      0.50      0.50         6
           5       0.56      0.83      0.67         6
           6       0.20      0.33      0.25         6
           7       1.00      0.67      0.80         6
           8       0.57      0.67      0.62         6
           9       0.60      0.50      0.55         6

    accuracy                           0.50        60
   macro avg       0.52      0.50      0.50        60
weighted avg       0.52      0.50      0.50        60

[[2 0 1 0 0 1 2 0 0 0]
 [0 4 0 1 0 0 1 0 0 0]
 [2 0 3 0 1 0 0 0 0 0]
 [0 1 0 0 0 0 3 0 0 2]
 [0 0 1 1 3 0 1 0 0 0]
 [1 0 0 0 0 5 0 0 0 0]
 [0 0 0 1 2 0 2 0 1 0]
 [0 0 0 0 0 1 0 4 1 0]
 [0 0 0 0 0 2 0 0 4 0]
 [1 0 0 0 0 0 1 0 1 3]]
```

Reducing the number of classes increases the accuracy (in model 2, as expected).

```
              precision    recall  f1-score   support

           0       0.75      0.50      0.60         6
           1       0.75      1.00      0.86         6
           2       0.71      0.83      0.77         6
           3       0.43      0.50      0.46         6
           4       0.60      0.50      0.55         6
           5       0.62      0.83      0.71         6
           6       0.50      0.33      0.40         6
           7       0.67      0.67      0.67         6
           8       0.83      0.83      0.83         6
           9       0.80      0.67      0.73         6

    accuracy                           0.67        60
   macro avg       0.67      0.67      0.66        60
weighted avg       0.67      0.67      0.66        60

========== LDA RESULT ==========
Accuracy score:0.65

========== LR RESULT ==========
Accuracy score:0.50

========== NB RESULT ==========
Accuracy score:0.48

========== KNN RESULT ==========
Accuracy score:0.38

========== DT RESULT ==========
Accuracy score:0.33

========== SVM RESULT ==========
Accuracy score:0.67
```

LFW, min samples/person = 20, reduce classes to 5, reduce samples to 20

```
Predicting people's names on the test set
done in 0.001s
              precision    recall  f1-score   support

           0       0.38      0.50      0.43         6
           1       0.40      0.33      0.36         6
           2       0.60      0.50      0.55         6
           3       0.33      0.33      0.33         6
           4       0.50      0.50      0.50         6

    accuracy                           0.43        30
   macro avg       0.44      0.43      0.43        30
weighted avg       0.44      0.43      0.43        30

[[3 0 0 3 0]
 [1 2 1 1 1]
 [1 0 3 0 2]
 [2 2 0 2 0]
 [1 1 1 0 3]]
```

Further reducing the number of classes does not increase the accuracy. Model 1 performs worse, will come back to this potential error at the end.

```
              precision    recall  f1-score   support

           0       0.50      0.67      0.57         6
           1       0.50      0.67      0.57         6
           2       1.00      1.00      1.00         6
           3       0.67      0.33      0.44         6
           4       0.80      0.67      0.73         6

    accuracy                           0.67        30
   macro avg       0.69      0.67      0.66        30
weighted avg       0.69      0.67      0.66        30

========== LDA RESULT ==========
Accuracy score:0.70

========== LR RESULT ==========
Accuracy score:0.70

========== NB RESULT ==========
Accuracy score:0.57

========== KNN RESULT ==========
Accuracy score:0.53

========== DT RESULT ==========
Accuracy score:0.33

========== SVM RESULT ==========
Accuracy score:0.67
```

LFW, min samples/person = 100, reduce samples to 20

```
Predicting people's names on the test set
done in 0.001s
              precision    recall  f1-score   support

           0       0.40      0.33      0.36         6
           1       0.25      0.33      0.29         6
           2       0.75      1.00      0.86         6
           3       0.60      0.50      0.55         6
           4       0.25      0.17      0.20         6

    accuracy                           0.47        30
   macro avg       0.45      0.47      0.45        30
weighted avg       0.45      0.47      0.45        30

[[2 2 1 0 1]
 [3 2 0 0 1]
 [0 0 6 0 0]
 [0 1 1 3 1]
 [0 3 0 2 1]]
```

With classes that look more similar to each other, the accuracy decreases (in model 2, as expected).

```
              precision    recall  f1-score   support

           0       0.42      0.83      0.56         6
           1       0.60      0.50      0.55         6
           2       0.67      0.67      0.67         6
           3       0.50      0.33      0.40         6
           4       0.00      0.00      0.00         6

    accuracy                           0.47        30
   macro avg       0.44      0.47      0.43        30
weighted avg       0.44      0.47      0.43        30

========== LDA RESULT ==========
Accuracy score:0.43

========== LR RESULT ==========
Accuracy score:0.40

========== NB RESULT ==========
Accuracy score:0.50

========== KNN RESULT ==========
Accuracy score:0.33

========== DT RESULT ==========
Accuracy score:0.40

========== SVM RESULT ==========
Accuracy score:0.47
```

Potential error: for all the tests where the number of samples were reduced, model 1 (the left column) behaved much worse relative the model 2. When the samples weren't reduced, model 1 performed better. When the samples were reduced, model 2 performed the same or worse while displaying irregular behavior, while model 2 exhibited the expected behavior. Will test this potential error by formulating curated dataset, so that the reduceClassesAndSamples() function will not have to be used.