Final Report

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CS165B

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Introduction

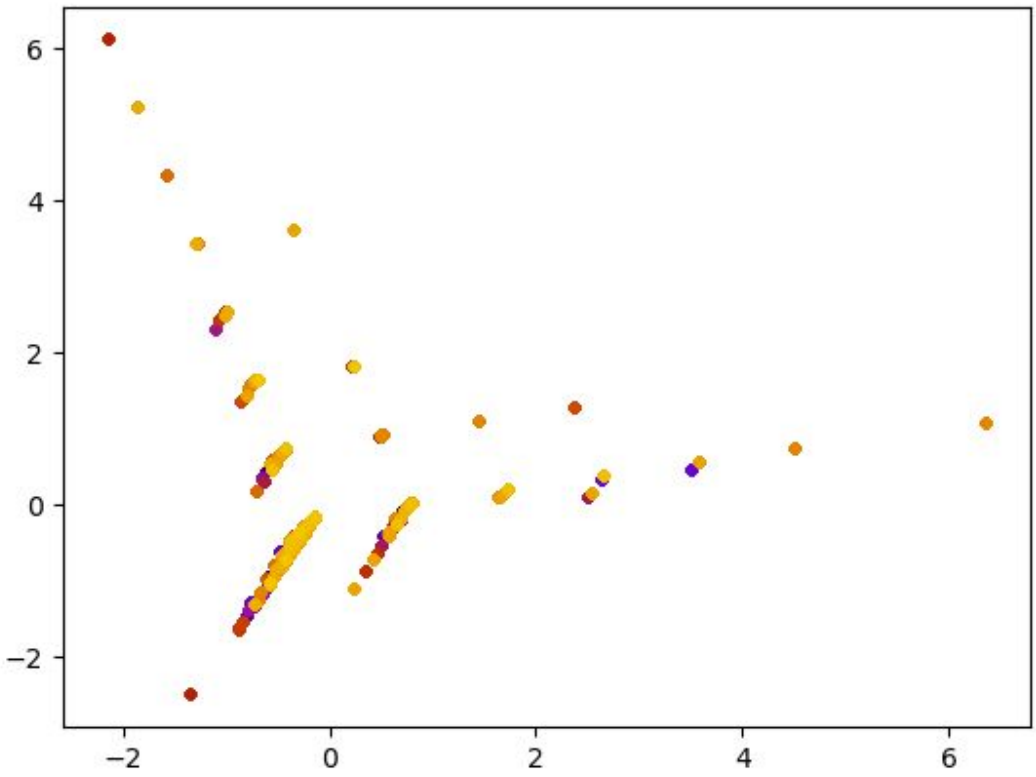
In this project, I classified the Caltech-101 dataset. The first step was to use SIFT features to extract useful information from every image. Next, I applied K-Means to cluster features into groups with a similar meaning. This helped me generate a visual dictionary of visual features. Then I used SVM to do the classification and PCA to do dimensionality reduction.

Experiment Result

There were two hyperparameters, which are **k** and **dictionary**. K means number of SIF features extracted from every image. Dictionary size means size of the visual dictionary.
I tested my method with 3 values of k(2,10,20) and 3 sizes of dictionary (10,50,200) for a total of 9 experiments. Each experiment includes 10 tests.

To measure the run time of each experiment, I imported a datetime method. I have deleted it in the final version. Most of the experiments are run on my local machine because it takes too long to run those experiments in the csil machine.

1. k =2 dictionary size=10



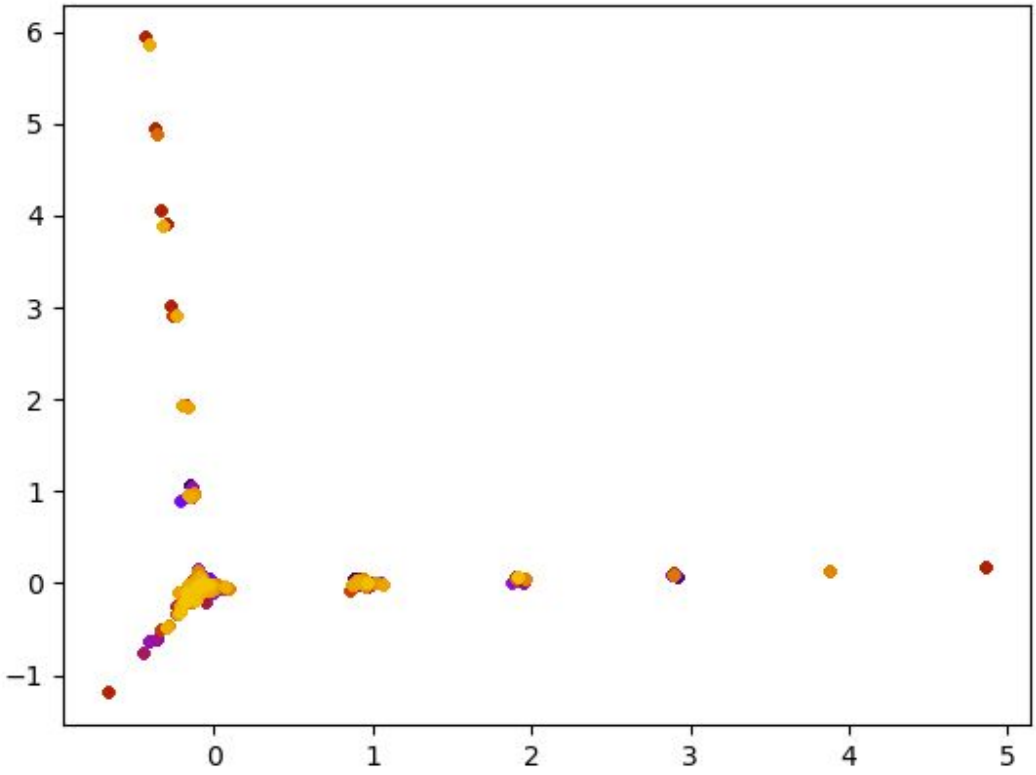
The result of the first test:

```
new_Final accuracy of the model k=2, dictionary_size=10 is: 0.11059907834101383
run time in sec:  174
```

The average result of 10 tests:

```
new_Final accuracy of the model k=2, dictionary_size=10 is: 0.11059907834101382
run time in sec:  4245
```

2. k =2 dictionary size=50



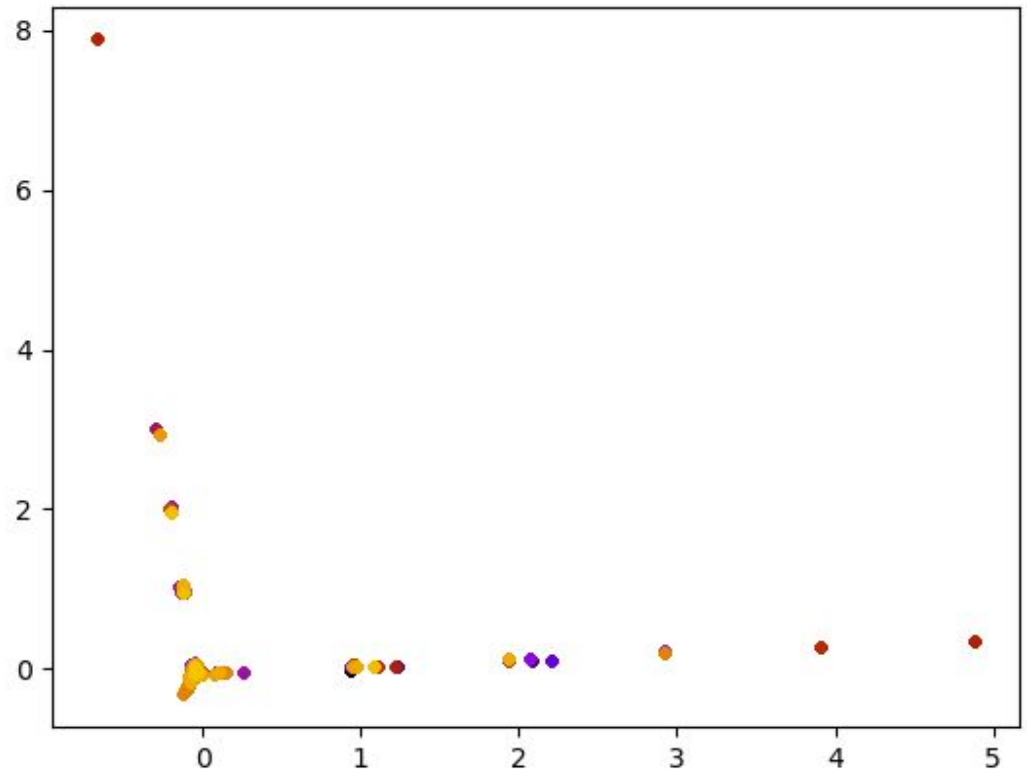
The result of the first test:

```
new_Final accuracy of the model k=2, dictionary_size=50 is: 0.13786482334869432
run time in sec:  181
```

The average result of 10 tests:

```
new_Final accuracy of the model k=2, dictionary_size=50 is: 0.13786482334869432
run time in sec:  4556
```

3. k =2 dictionary size=200



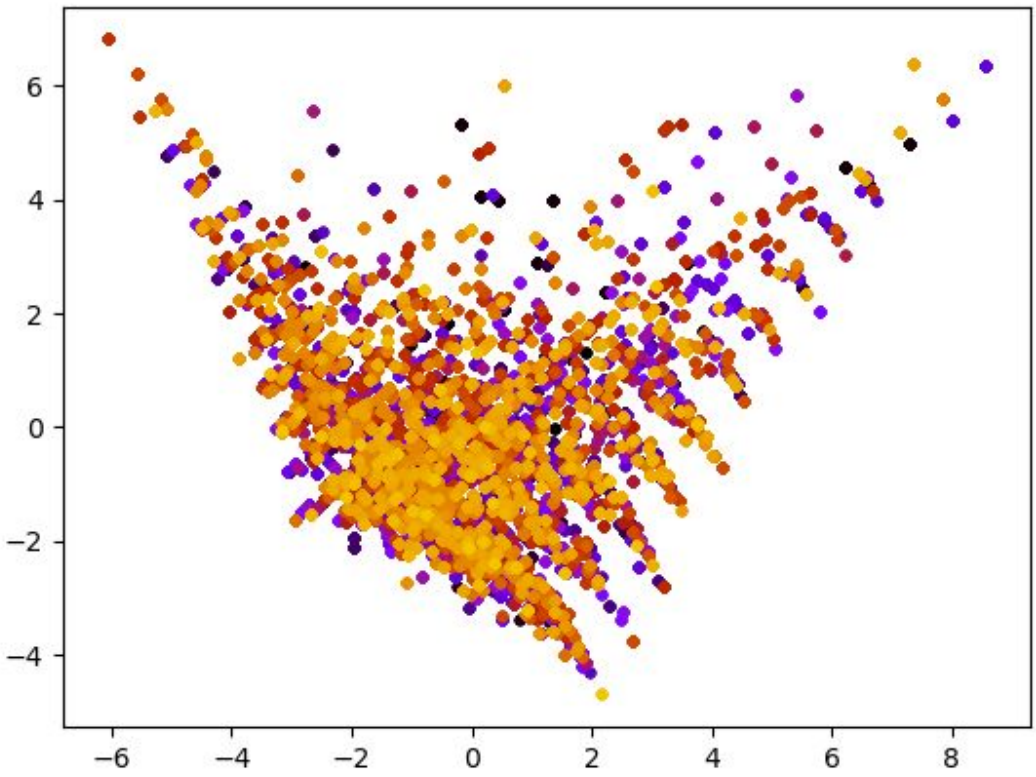
The result of the first test:

```
new_Final accuracy of the model k=2, dictionary_size=200 is: 0.1497695852534562
run time in sec:  262
```

The average result of 10 tests:

```
new_Final accuracy of the model k=2, dictionary_size=200 is: 0.15072964669738864
run time in sec:  5251
```

4. k =10 dictionary size=10



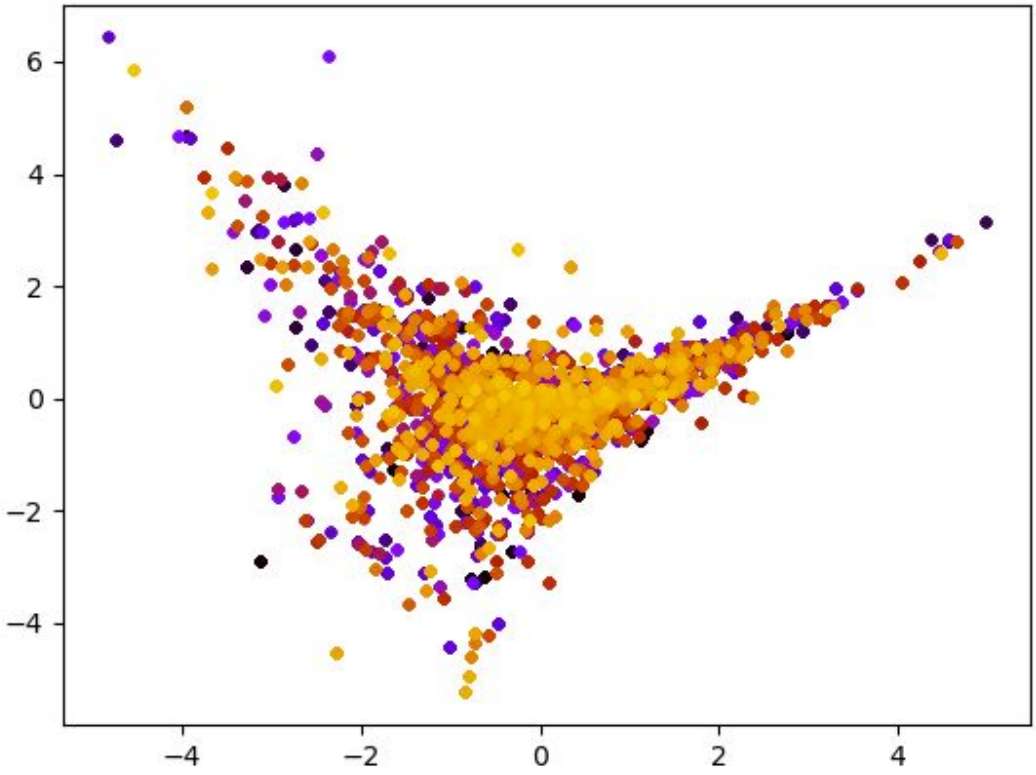
The result of the first test:

```
new_Final accuracy of the model k=10, dictionary_size=10 is: 0.14055299539170507
run time in sec:  228
```

The average result of 10 tests:

```
new_Final accuracy of the model k=10, dictionary_size=10 is: 0.14051459293394777
run time in sec:  4656
```

5. k =10 dictionary size=50



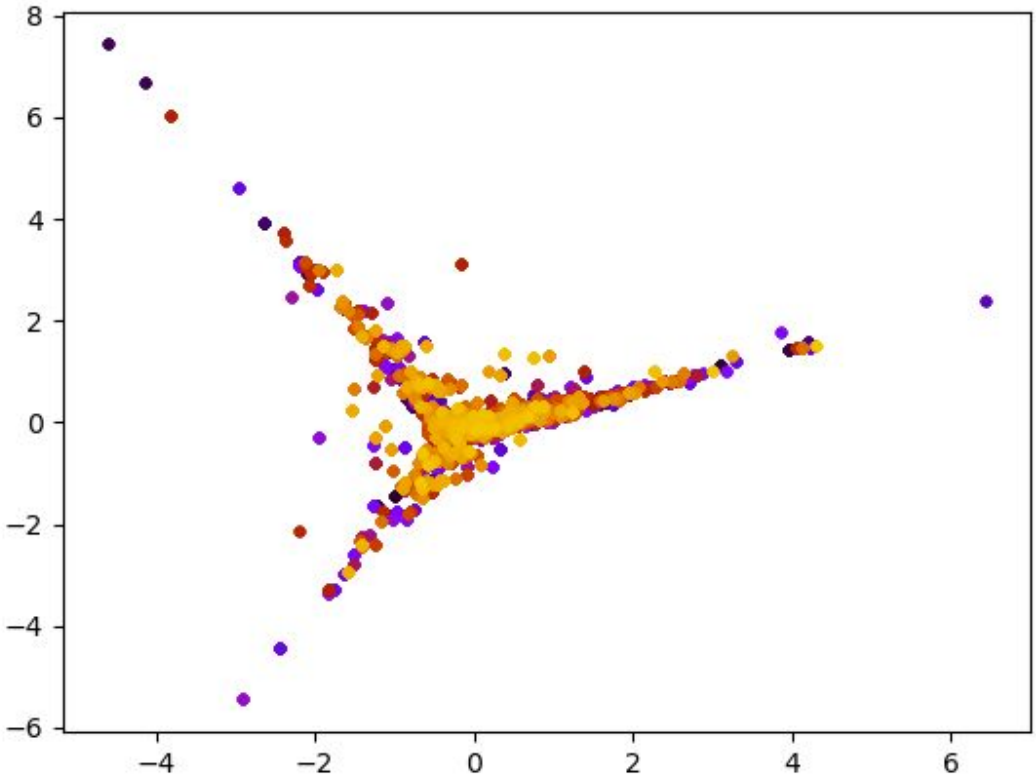
The result of the first test:

```
new_Final accuracy of the model k=10, dictionary_size=50 is: 0.1816436251920123
run time in sec:  260
```

The average result of 10 tests:

```
new_Final accuracy of the model k=10, dictionary_size=50 is: 0.18056835637480803
run time in sec:  5301
```

6. k =10 dictionary size=200



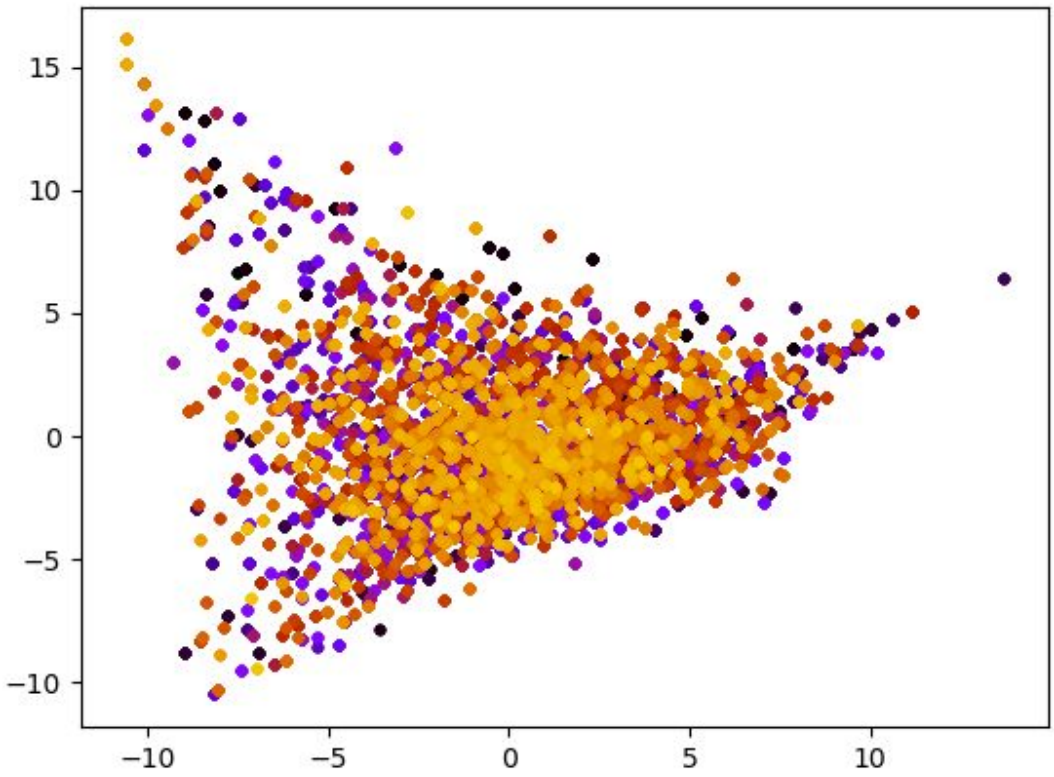
The result of the first test:

```
new_Final accuracy of the model k=10, dictionary_size=200 is: 0.20583717357910905
run time in sec:  353
```

The average result of 10 tests:

```
new_Final accuracy of the model k=10, dictionary_size=200 is: 0.20583717357910908
run time in sec:  6784
```

7. k =20 dictionary size=10



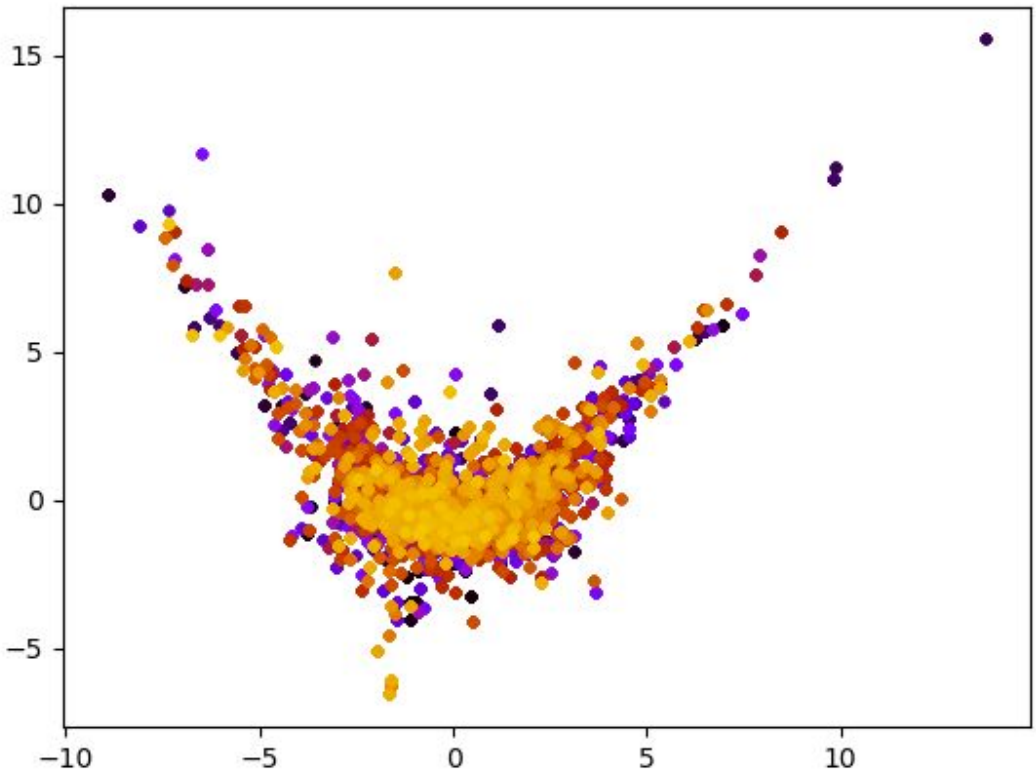
The result of the first test:

```
new_Final accuracy of the model k=20, dictionary_size=10 is: 0.16167434715821813
run time in sec:  239
```

The average result of 10 tests:

```
new_Final accuracy of the model k=20, dictionary_size=10 is: 0.1616743471582181
run time in sec:  4823
```

8. k =20 dictionary size=50



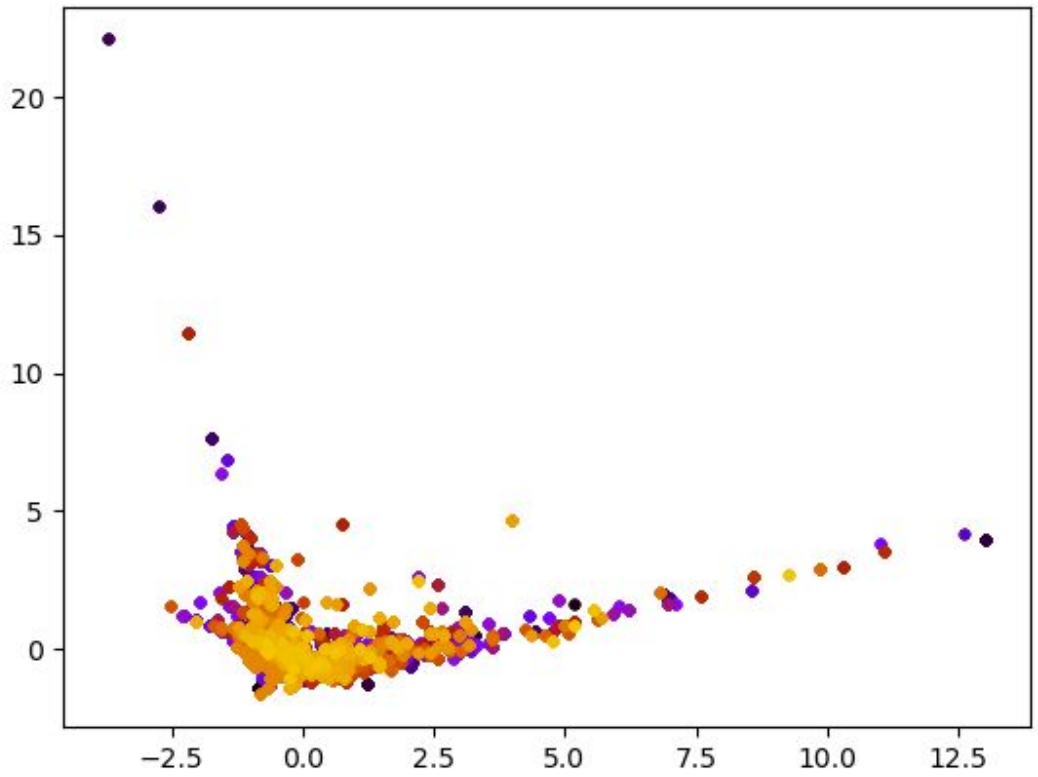
The result of the first test:

```
new_Final accuracy of the model k=20, dictionary_size=50 is: 0.21274961597542244
run time in sec:  305
```

The average result of 10 tests:

```
new_Final accuracy of the model k=20, dictionary_size=50 is: 0.212173579109063
run time in sec:  5899
```

9. k =20 dictionary size=200



The result of the first test:

```
new_Final accuracy of the model k=20, dictionary_size=200 is: 0.24423963133640553
run time in sec:  481
```

The average result of 10 tests:

```
new_Final accuracy of the model k=20, dictionary_size=200 is: 0.24435483870967745
run time in sec:  7963
```

Discussion & Conclusion

When k=2 and dictionary_size=10, the model reached its lowest accuracy, which was about 11.1%. When k was fixed, as the dictionary size got bigger, the accuracy got higher. When k=20 and dictionary_size=200, the model reached its highest accuracy, which was about 24.4%.

When k=2 and dictionary_size=10, the run time for one test was the shortest, which was about 174 seconds. When k was fixed, as the dictionary size got bigger, the runtime became longer. When k=20 and dictionary_size=200, the run time for one test was the longest, which was about 481 seconds.