Report of classification task on CAFE Dataset

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Abstract

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1 Introduction

conclusions section

1.1 Introduction

In this report, we focus on a set of classification tasks on California Facial Expresion(CAFE) dataset. Two tasks are solved, which are

- Two face classification: Use logistic regression to separate 2 kinds of facial expressions
- Six face classification: Use softmax regression to classify 6 emotional faces

2 Methods

In this section, we would show the basic pipeline of two task solutions.

2.1 Test methods and dataset building

In order to test the robustness of the algorithm and parameter selection, we test over all the subjects by making each one as testee once. And report the averaged 10 accuracies over the 10 runs.

Since different task require various facial expressions, we decide to build data in a dynamical way. This shall follow these two steps

- Screen out useless data: Filter out the facial expressions labeled by 'neutral' and 'happy'.
- Split data: Divide the dataset in terms of 10 subjects with ratio of 80%, 10%, 10% each for training, holdout and test dataset, respectively.
- Facial ecpression selection: Select task-related facial expressions according to the requirements

Specifically, in the second step, we iterate through all the 10 subjects and build test dataset from each subject exactly once. The holdout dataset is selected from the rest of the subjects, and all the other 8 subjects are used as training data.

Thus, we would have 10 randomly built dataset with different testee appeared exactly once.

To be specific, for each selection of testee, the numerical features of dataset constitution should be as in Table 1.

Table 1: Dataset constitution

Train	Holdout	Test
8 subjects 48 images	1 subject 6 images	1 subject 6 images

2.2 Data preprocessing

After loading all the images, we carry out following pre-processing methods.

- Centerize data: Calculate the mean over training dataset, and subtract this value from training, holdout and test dataset to get centerized data.
- PCA: Fit PCA model with centerized training data, and perform transformation(compression) over training, holdout and test dataset.

We describe some detailed implementation in PCA.

1 Avoid high dimentional matrix calculation
By following the instruction in this article, we avoided the calculation of a matrix of size 91200 by 91200

2 Each principle vector is scaled by the standard diviation.

3 Only use the training data to compute the principle components
Reason: To prevent overfitting, which means the model performs very well on training dataset but terrible on testing data. The test and validation data shouold only be used to measure the performance of the model trained on train dataset. If the test or holdout dataset are exposed to PCA algorithm, the final eigen vectors would have 'learned' from test / holdout, which would cause the performance to be falsely biased on validation and test dataset.

2.3 Two face logistic classification

We used logistic classification over 2 sets of facial expressions.

- Happy VS Maudlin
- Afraid VS Surprised

We performed SGD and batch gradient descent on both datasets. Here's the parameters we used

$$learning\,rate =$$
$$epoches = 10$$

2.4 Six face softmax classification

We performed SGD and batch gradient descent on the dataset. Here's the parameters we used

$$learning\,rate =$$
$$epoches = 10$$

3 Results

In this part, we report the required statistics over the two tasks described above.

3.1 Two face logistic classification

3.2 Six face softmax classification