Drexel University

CS499I

Advanced Neural Networks

Facial Recognition With Artificial Neural Networks

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April 20, 2017

1 Datasets

Yale Faces Database This dataset contains 165 grayscale images in GIF format of 15 individuals with 11 images per person. There is one image per each of the following configurations: center-light, w/glasses, happy, left-light, w/no glasses, normal, right-light, sad, sleepy, surprised, and wink.

2 Testing Parameters

The following variants are tested for accuracy:

1. With and without a bias node at the input layer
2. With and without a bias node at the hidden layer
3. With and without standardizing features
4. With and without applying PCA to reduce the number of features to 95%

Empirical data was generated to optimize the following parameters:

1. Image size
2. Hidden layer size
3. Termination criteria

3 Baseline Accuracy

The baseline accuracy was created using the negative form of all variants with the exception of data standardization. The baseline parameters were as follows: 40 by 40 sized images, a hidden layer size of 20, and 1000 training iterations.

Input layer bias node	N
Hidden layer bias node	N
Standardization of features	Y
PCA applied	N
Testing Accuracy	0.800000

Table 1: Baseline Testing Accuracy

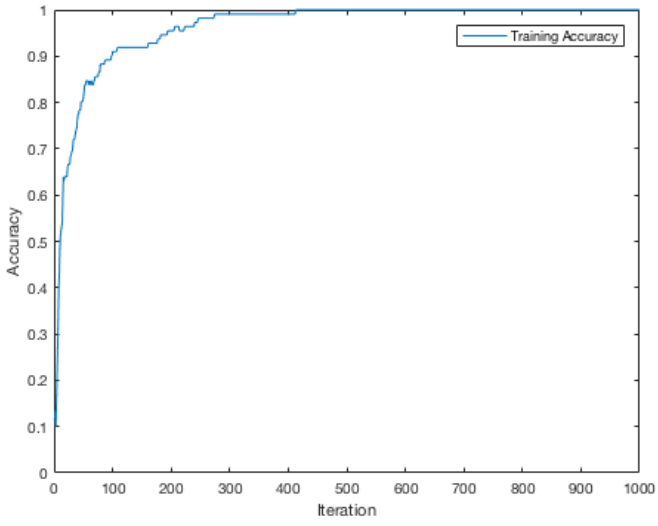


Figure 1: Baseline Training Accuracy

4 Variant Accuracy Testing

All variants were tested using 40 by 40 sized images, a hidden layer size of 20, and 1000 training iterations.

Input layer bias node	N
Hidden layer bias node	N
Standardization of features	N
PCA applied	N
Testing Accuracy	0.1455

Table 2: NNNN Testing Accuracy

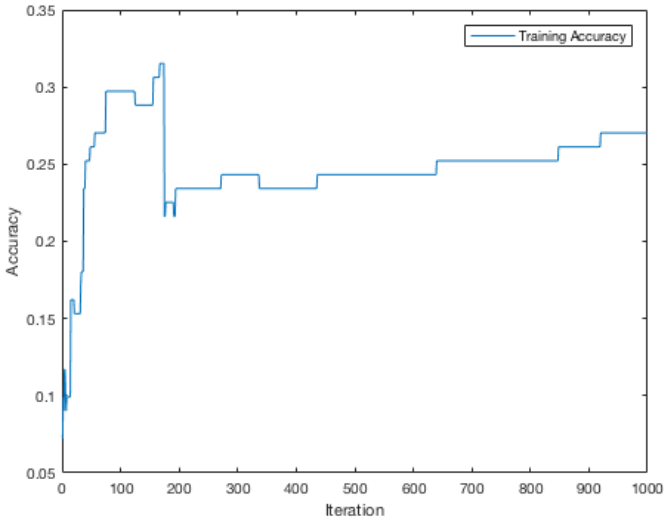


Figure 2: NNNN Training Accuracy

Input layer bias node	Y
Hidden layer bias node	N
Standardization of features	N
PCA applied	N
Testing Accuracy	0.2727

Table 3: YNNN Testing Accuracy

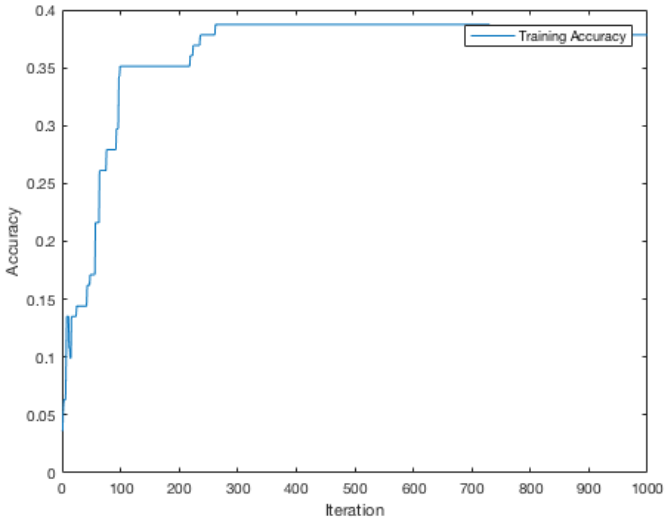


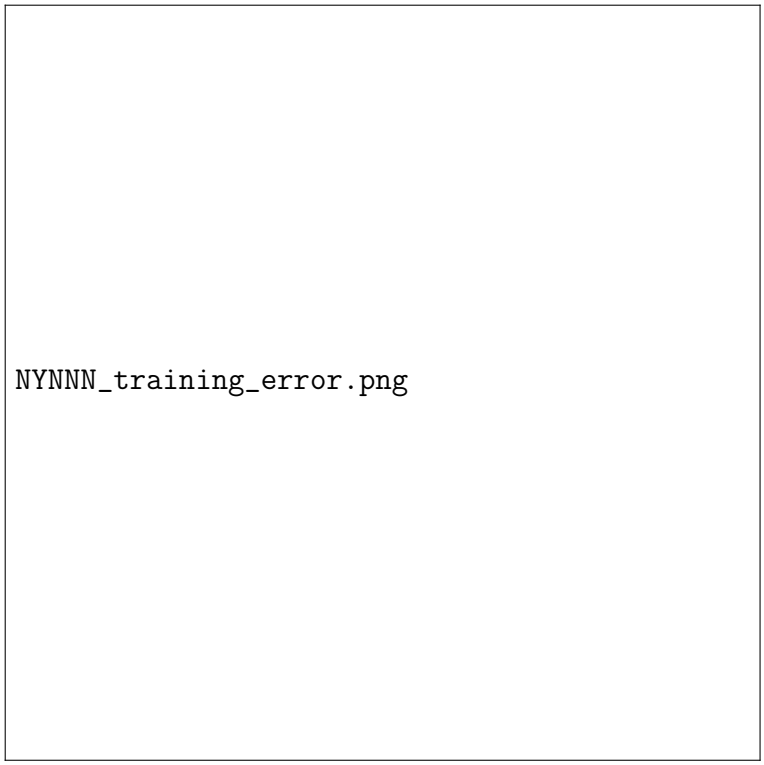
Figure 3: YNNN Training Accuracy

NNNNN0.1454550.854545NNNNN accuracy and testing

Figure 4: Plot of NNNNN training error

YNNNN0.2727270.727273YNNNN accuracy and testing

Figure 5: Plot of YNNNN training error



NYNNN0.1818180.818182NYNNN accuracy and testing

Figure 6: Plot of NYNNN training error

NNNYN_training_error.png

Figure 7: Plot of NNNYN training error

NNNYN0.2545450.745455NNNYN accuracy and testing

YYNNN_training_error.png

Figure 8: Plot of YYNNN training error

YYNNN0.4000000.600000YYNNN accuracy and testing

YNYNN_training_error.png

YNYNN0.8181820.181818YNYNN accuracy and testing

Figure 9: Plot of YNYNN training error

YNNYN0.2000000.800000YNNYN
accuracy and testing

Figure 10: Plot of YNNYN training error

NYYNN0.8181820.181818NYYNN
accuracy and testing

Figure 11: Plot of NYYNN training error

NYNYN_training_error.png

NYNYN0.2545450.745455NYNYN accuracy and testing

Figure 12: Plot of NYNYN training error

NNYYN0.1454550.854545NNYYN accuracy and testing

Figure 13: Plot of NNYYN training error

YYYNN0.8000000.200000YYYNN accuracy and testing

Figure 14: Plot of YYYNN training error

YYNYN0.2000000.800000YYNYN accuracy and testing

Figure 15: Plot of YYNYN training error

YNYYN_training_error.png

YNYYN0.1818180.818182YNYYN accuracy and testing

Figure 16: Plot of YNYYN training error

NYYYN_training_error.png

NYYYN0.1454550.854545NYYYN accuracy and testing

Figure 17: Plot of NYYYN training error

YYYYN0.1818180.818182YYYYN accuracy and testing

Figure 18: Plot of YYYYN training error

5 Empirical Parameter Accuracy Testing

All empirical data was gathered using the following variant which had the highest accuracy from the variant testing:

YNYNN0.8181820.181818YNYNN accuracy and testing

Figure 19: Plot of YNYNN training error

1. Number of Training Iterations The number of training iterations was varied from 0 to 10,000 by 100. The number of hidden nodes was 20 and the image size was 40 by 40. The following is a plot of the accuracy as number of training iterations increases.

Figure 20: Plot of accuracy as number of training iterations increases

2. Number of Hidden Nodes The number of hidden nodes was varied from 0 to 1600 (the number of features) by 20. The number of training iterations was 1000 and the image size was 40 by 40. The following is a plot of the accuracy as number of hidden nodes increases.

Figure 21: Plot of accuracy as number of hidden nodes increases

3. Image Size