Drexel University

CS499I

Advanced Neural Networks

Facial Recognition With Artificial Neural Networks

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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%
5. With and without applying LDA to maximize data separability

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
LDA applied	N
Accuracy	0.800000
Testing Error	0.200000

Table 1: Baseline accuracy and testing

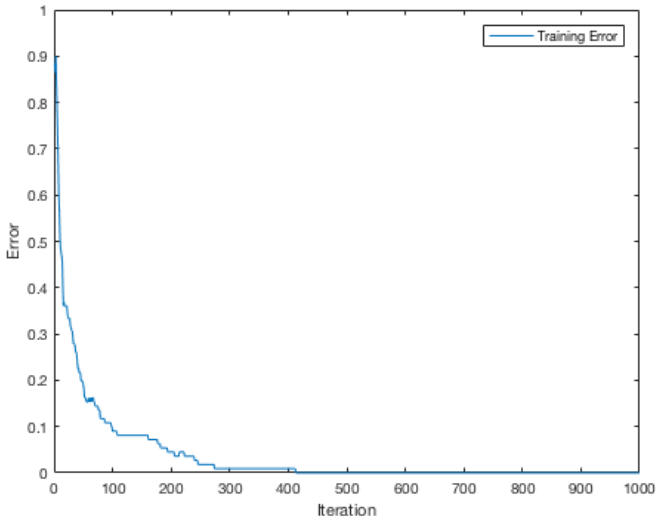

Figure 1: Plot of baseline training error

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
LDA applied	N
Accuracy	0.145455
Testing Error	0.854545

Table 2: NNNNN accuracy and testing

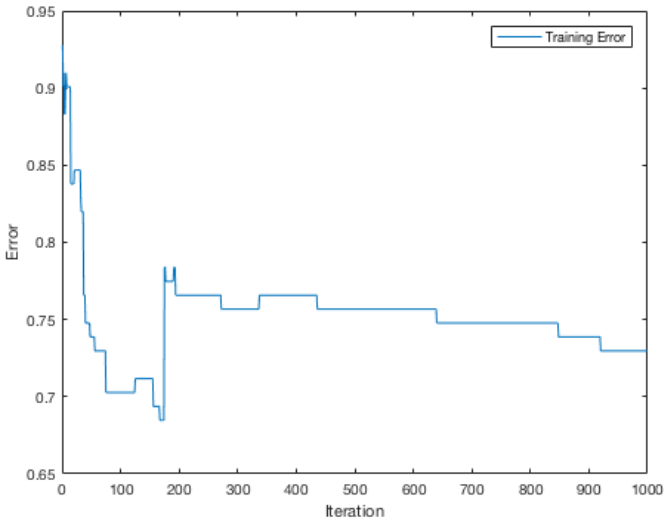

Figure 2: Plot of NNNNN training error

Input layer bias node	Y
Hidden layer bias node	N
Standardization of features	N
PCA applied	N
LDA applied	N
Accuracy	0.272727
Testing Error	0.727273

Table 3: YNNNN accuracy and testing

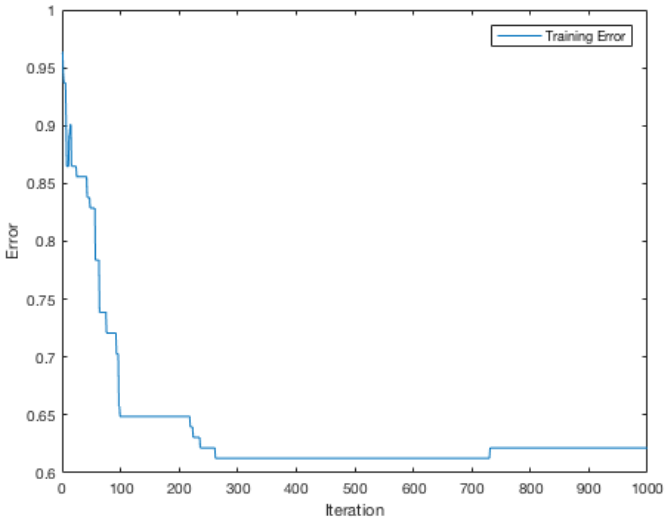

Figure 3: Plot of YNNNN training error

Input layer bias node	N
Hidden layer bias node	Y
Standardization of features	N
PCA applied	N
LDA applied	N
Accuracy	0.181818
Testing Error	0.818182

Table 4: NYNNN accuracy and testing

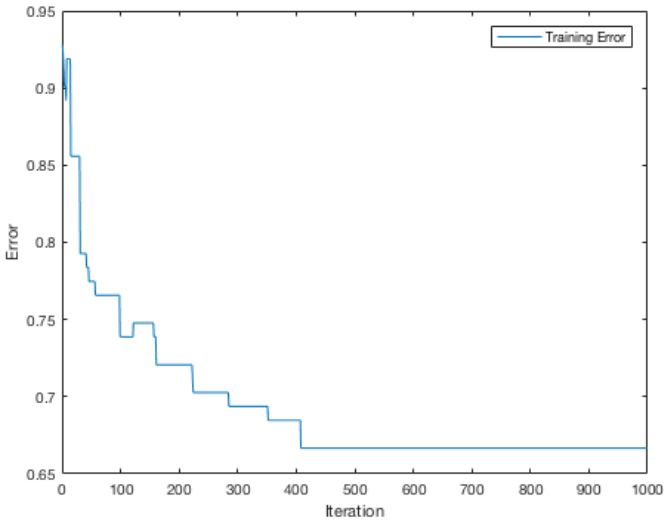

Figure 4: Plot of NYNNN training error

Input layer bias node	N
Hidden layer bias node	N
Standardization of features	Y
PCA applied	N
LDA applied	N
Accuracy	0.800000
Testing Error	0.200000

Table 5: NNYNN accuracy and testing

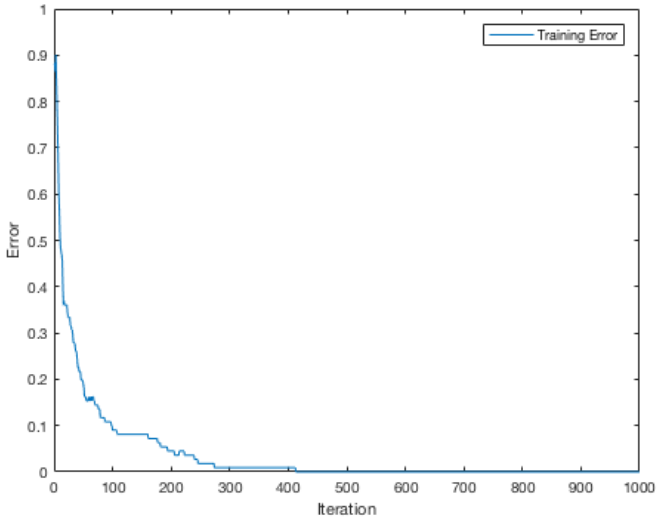

Figure 5: Plot of NNYNN training error

Input layer bias node	N
Hidden layer bias node	N
Standardization of features	N
PCA applied	Y
LDA applied	N
Accuracy	0.254545
Testing Error	0.745455

Table 6: NNNYN accuracy and testing

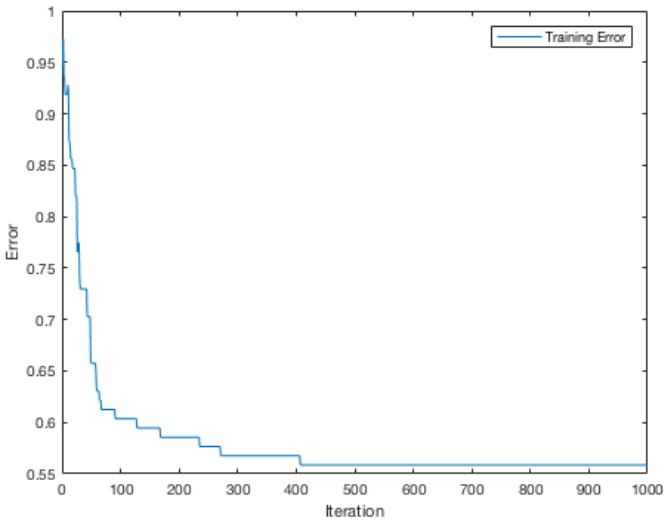

Figure 6: Plot of NNNYN training error

Input layer bias node	Y
Hidden layer bias node	Y
Standardization of features	N
PCA applied	N
LDA applied	N
Accuracy	0.400000
Testing Error	0.600000

Table 7: YYNNN accuracy and testing

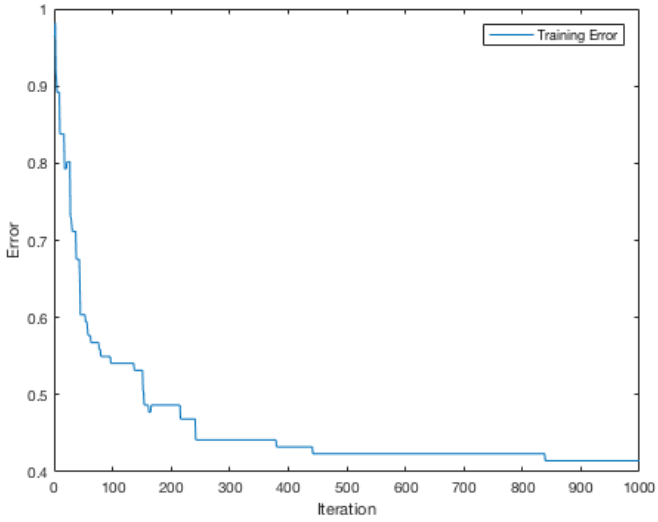

Figure 7: Plot of YYNNN training error

Input layer bias node	Y
Hidden layer bias node	N
Standardization of features	Y
PCA applied	N
LDA applied	N
Accuracy	0.818182
Testing Error	0.181818

Table 8: YNYNN accuracy and testing

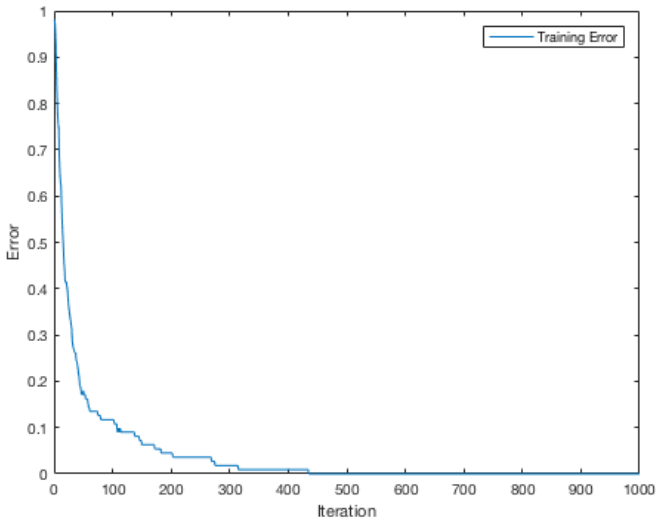

Figure 8: Plot of YNYNN training error

Input layer bias node	Y
Hidden layer bias node	N
Standardization of features	N
PCA applied	Y
LDA applied	N
Accuracy	0.200000
Testing Error	0.800000

Table 9: YNNYN accuracy and testing

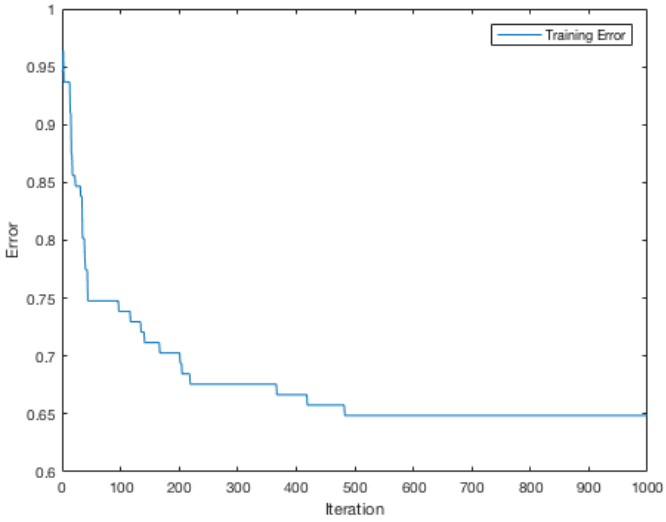

Figure 9: Plot of YNNYN training error

Input layer bias node	N
Hidden layer bias node	Y
Standardization of features	Y
PCA applied	N
LDA applied	N
Accuracy	0.818182
Testing Error	0.181818

Table 10: NYYNN accuracy and testing

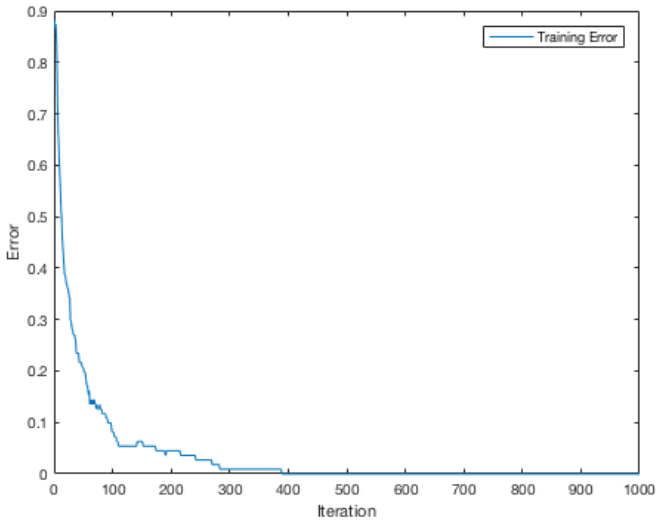

Figure 10: Plot of NYYNN training error

Input layer bias node	N
Hidden layer bias node	Y
Standardization of features	N
PCA applied	Y
LDA applied	N
Accuracy	0.254545
Testing Error	0.745455

Table 11: NYNYN accuracy and testing

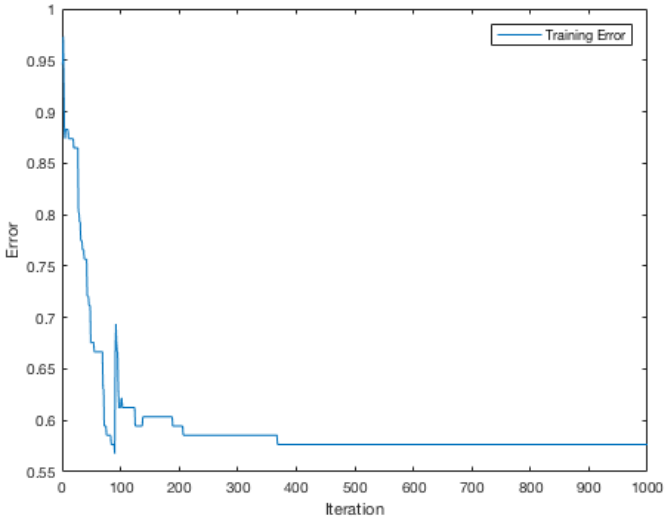

Figure 11: Plot of NYNYN training error

Input layer bias node	N
Hidden layer bias node	N
Standardization of features	Y
PCA applied	Y
LDA applied	N
Accuracy	0.145455
Testing Error	0.854545

Table 12: NNYYN accuracy and testing

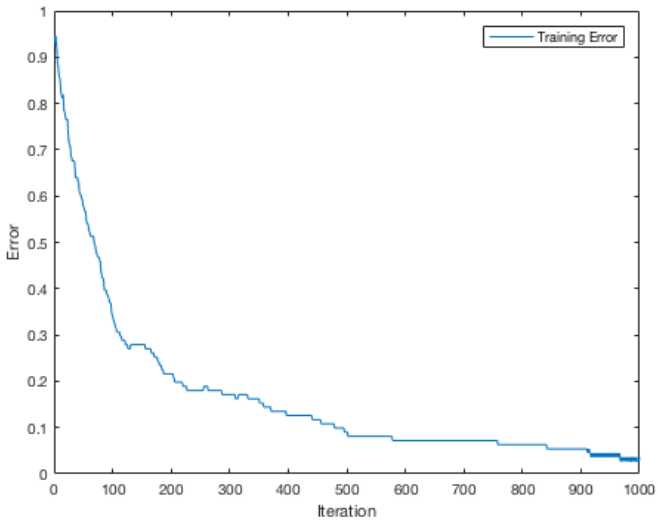

Figure 12: Plot of NNYYN training error

Input layer bias node	Y
Hidden layer bias node	Y
Standardization of features	Y
PCA applied	N
LDA applied	N
Accuracy	0.800000
Testing Error	0.200000

Table 13: YYYNN accuracy and testing

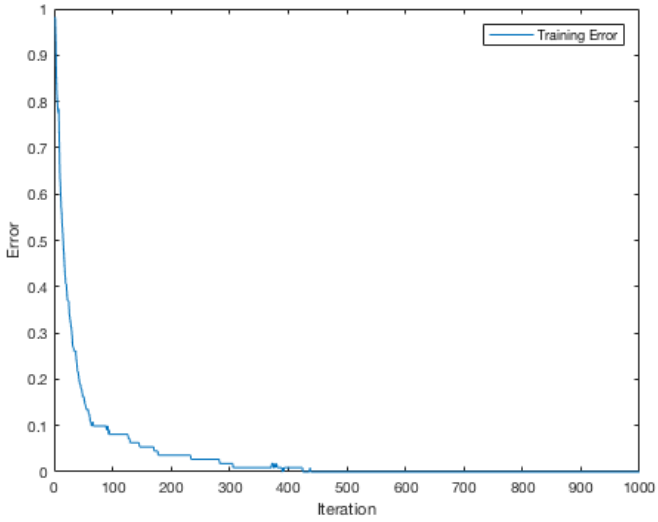

Figure 13: Plot of YYYNN training error

Input layer bias node	Y
Hidden layer bias node	Y
Standardization of features	N
PCA applied	Y
LDA applied	N
Accuracy	0.200000
Testing Error	0.800000

Table 14: YYNYN accuracy and testing

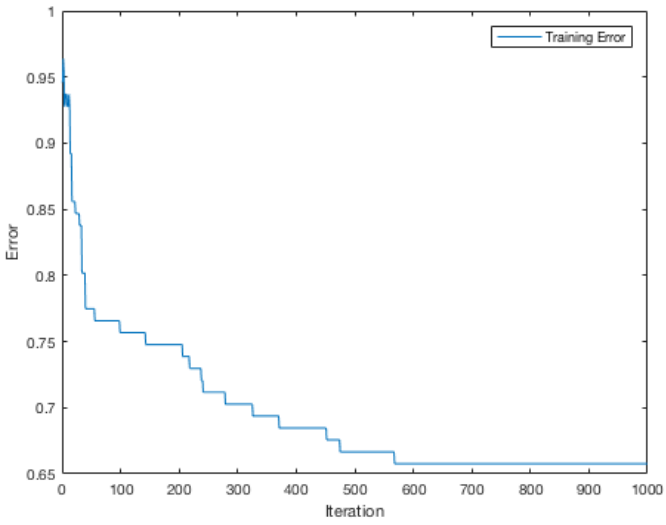

Figure 14: Plot of YYNYN training error

Input layer bias node	Y
Hidden layer bias node	N
Standardization of features	Y
PCA applied	Y
LDA applied	N
Accuracy	0.181818
Testing Error	0.818182

Table 15: YNYYN accuracy and testing

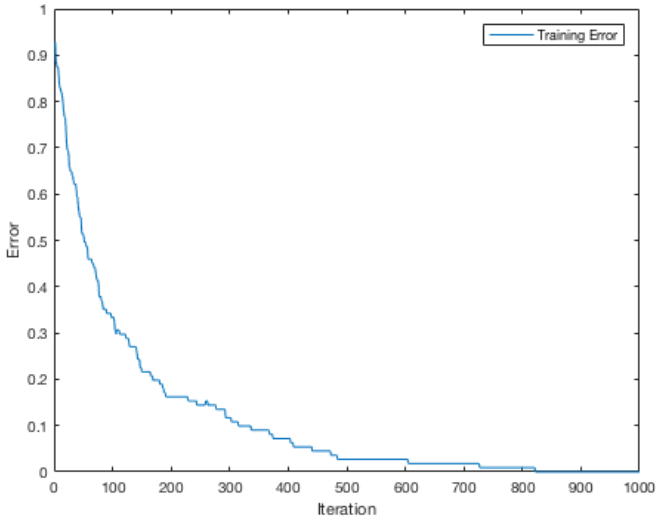

Figure 15: Plot of YNYYN training error

Input layer bias node	N
Hidden layer bias node	Y
Standardization of features	Y
PCA applied	Y
LDA applied	N
Accuracy	0.145455
Testing Error	0.854545

Table 16: NYYYN accuracy and testing

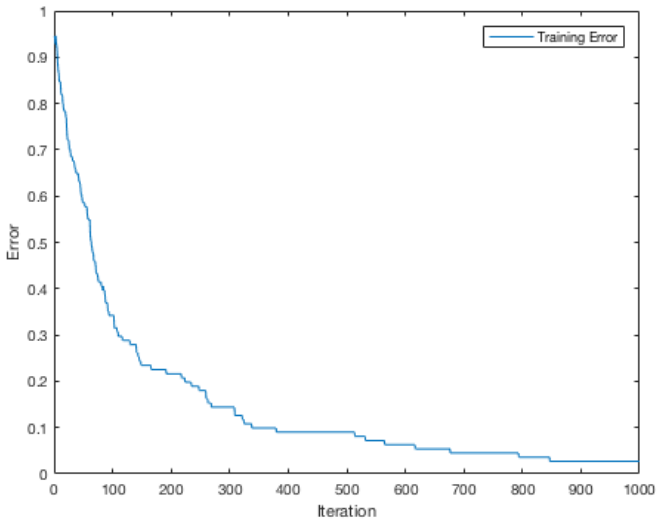

Figure 16: Plot of NYYYN training error

Input layer bias node	Y
Hidden layer bias node	Y
Standardization of features	Y
PCA applied	Y
LDA applied	N
Accuracy	0.181818
Testing Error	0.818182

Table 17: YYYYN accuracy and testing

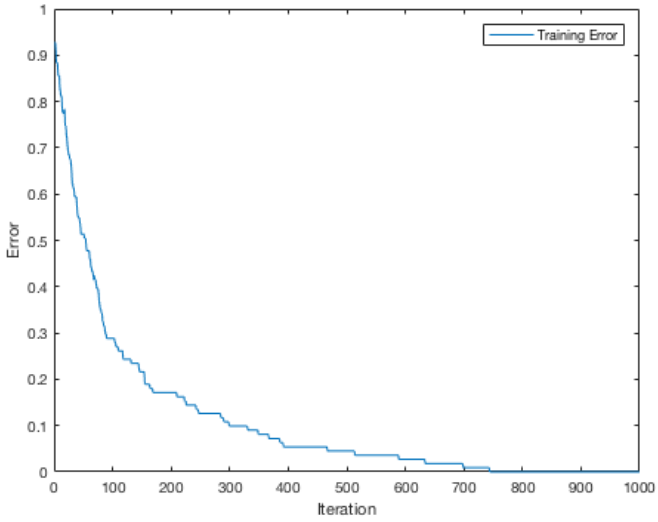

Figure 17: Plot of YYYYN training error