

Machine Learning
BITS F-464

Assignment #2

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Face Recognition
using
Artificial Neural Network
(Back-propagation Algorithm)

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Submitted to:
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1. Sunglasses recognizer:

A **960 * 3 * 4** Artificial Neural Network was used with **stochastic back-propagation algorithm**.

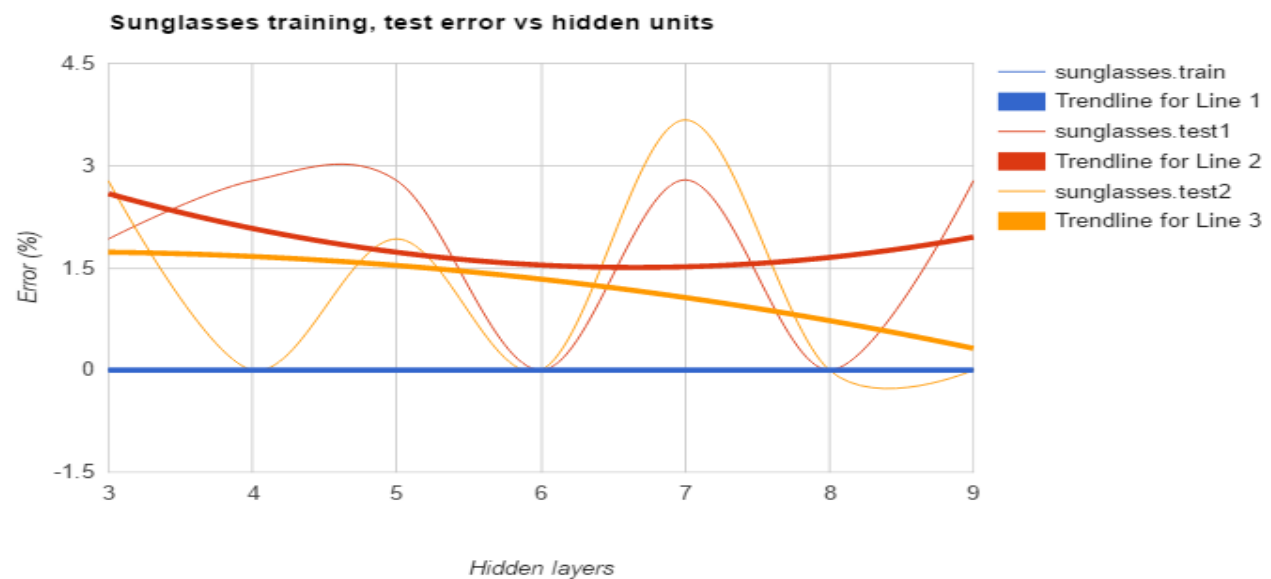
The observed accuracy of ANN depends upon various factors for maximum accuracy for all the testing sets we choose :

ANN Structure for sunglasses	
Input Layer	960 (units)
Hidden layer	6 (units)
Output layer	4 (units)
Alpha	0.3 (momentum)
Eta	0.3 (learning rate)
Iterations (epochs)	50000 (741 epochs)

where each iteration consists of an image.

Sensitivity Analysis:

Hidden layers	sunglasses.train	sunglasses.test1	sunglasses.test2
3	100	98.0769	97.2222
4	100	97.2222	100
5	100	97.22	98.0766
6	100	100	100
7	100	97.21	96.33
8	100	100	100
9	100	97.22	100



The above diagram shows the error rate against the number of hidden layers.

2. Face recogniser:

A **960*60*4 Artificial Neural Network** was used with stochastic back-propagation algorithm. For maximum accuracy for all the testing sets we choose :

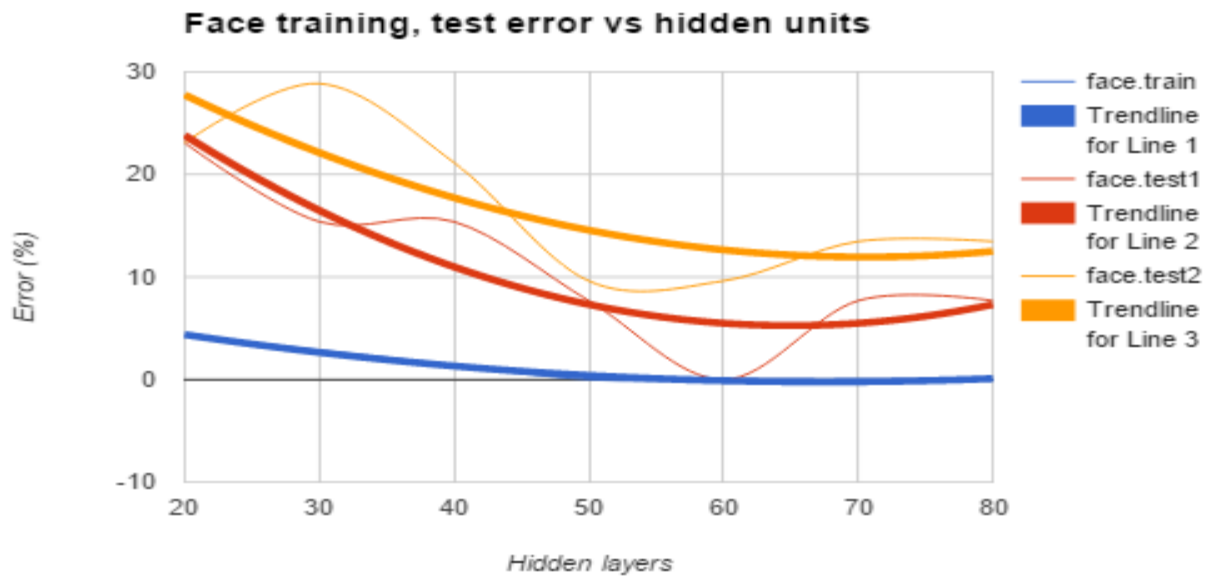
ANN Structure for Face Recognizer	
Input Layer	960 (units)
Hidden layer	60 (units)
Output layer	4 (units)
Alpha	0.3 (momentum)
Eta	0.3 (learning rate)
Iterations (epochs)	10000 (200 epochs on an average)

Where each iteration consists of an image.

Sensitivity Analysis:

The following are the accuracies at different number of hidden layers:

Hidden layers	face.train	face.test1	face.test2
20	95.7143	76.9231	76.9231
30	97.1429	84.6145	71.1538
40	98.5714	84.6154	78.8462
50	100	92.3077	90.3846
60	100	100	90.3846
70	100	92.3077	86.5385
80	100	92.3077	86.5385



The above diagram shows the error rate against the number of hidden layers.

3. Pose recogniser:

A **960*64*4 Artificial Neural Network** was used with stochastic back-propagation algorithm. For maximum accuracy for all the testing sets we choose :

ANN Structure for Pose Recognizer	
Input Layer	960 (units)
Hidden layer	64 (units)
Output layer	4 (units)
Alpha	0.3 (momentum)
Eta	0.3 (learning rate)
Iterations (epochs)	10000 (200 epochs on an average)

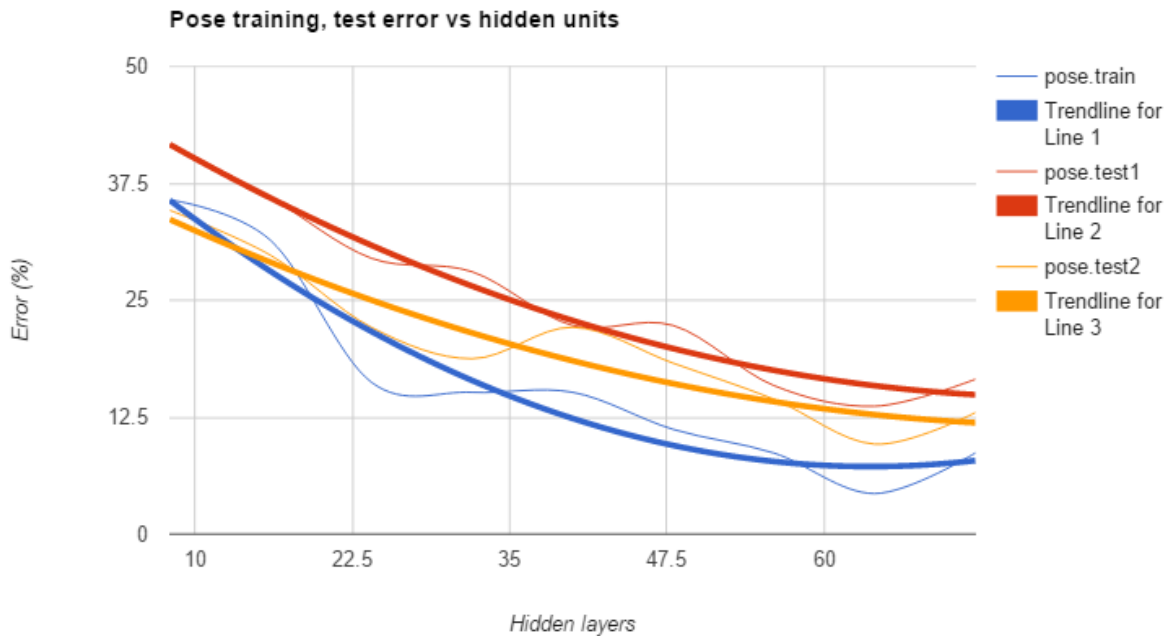
where each iteration consists of an image.

Sensitivity Analysis:

The following are the accuracies at different number of hidden layers:

Hidden layers	pose.train	pose.test1	pose.test2
8	64.2599	58.2734	65.3846
16	68.5921	64.0288	70.1923
24	83.7545	70.5036	77.8846

32	84.8375	71.9424	81.25
40	84.8375	77.6978	77.8846
48	88.8087	77.6978	81.7308
56	91.3357	84.1227	85.5769
64	95.6679	86.3309	90.3846
72	91.3357	83.4532	87.0192



The above diagram shows the error rate against the number of hidden layers.

COMPILATION AND RUNNING INSTRUCTIONS

1. For compiling,

Run on terminal:

```
g++ ml_bp_sunglasses.cpp -o sun
```

```
g++ ml_bp_face.cpp -o face
```

```
g++ ml_bp_pose.cpp -o pose
```

for compiling sunglasses faces and pose respectively.

2. For running the code,

Run on terminal:

```
./sun
```

```
./face  
./pose
```

For running sunglasses faces and pose respectively.

- 3. Choose the appropriate options from the menu after code is running.**
- 4. To change the training and testing set, change the training_set and testing_set macro values to desired file names.**

Example:

```
#define training_set "train_sunglasses.txt"  
#define testing_set "test_sunglasses2.txt"
```

This will train on train_sunglasses.txt and will test on test_sunglasses2.txt.

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