

1 Network Structure

The network is a stochastic gradient descent back-propagation schema using $15360 + 1$ input nodes, 5 hidden nodes, and a single output node. The $15360 + 1$ input nodes are the 15360 pixels coming from the input files with a single bias node tagged on that is a constant value of 1 for the bias weighting. The 5 hidden nodes were chosen as somewhat arbitrarily, as hidden nodes between 3 to 5 all gave closely accurate answers. The single output node is encoded as 0.8 for MALE and 0.2 for FEMALE. All nodes are fully connected.

The output of the hidden nodes and output node uses the sigmoid unit $\frac{1}{1+e^{-Y}}$ where $Y = \sum_n x_i \cdot w_{ij}$ where n is the number of nodes in the current layer, i is the node in the current layer, and j is the node in the next layer. Weights are updated per the algorithm description using back-propagated errors.

File Name: SODONE.java

Run by using:

```
java SODONE -train
```

```
java SODONE -test
```

```
java SODONE -crossTest (takes roughly 1.25 hours)
```

The program looks for /Male, /Female, and /Test folders in the .java file's current directory.

4 Hidden Layer Visualization

The weights that are learnt within the algorithm are essentially an importance weighting of how important certain parts and colors of the picture actually are. With 5 hidden units, the algorithm is basically partitioning the image into 5 "sections" that it "learns" from the training part of the algorithm. With the 5 hidden weights, the weight with the highest value is basically the most "important" section of pixels. The same happens to all 15361 weights that are being fed into the hidden layer, but to a lesser degree. Those weights give an importance weighting to colors, while the hidden layer gives a weighting for the specific sections of the image.

2 5-Fold Cross-Validation Results: Error and STD Deviation

Run #1:

	Mean % Error	Standard Deviation	Mean % Correct
Training	1.48%	0.54	-
Test	25.19%	12.37	75.81%

Run #2:

	Mean % Error	Standard Deviation	Mean % Correct
Training	1.29%	0.35	-
Test	22.59%	12.02	77.41%

Run #3:

	Mean % Error	Standard Deviation	Mean % Correct
Training	1.30%	0.35	-
Test	24.44%	11.79	75.56%

Run #4:

	Mean % Error	Standard Deviation	Mean % Correct
Training	1.30%	0.61	-
Test	25.18%	11.98	74.82%

Run #5:

	Mean % Error	Standard Deviation	Mean % Correct
Training	1.39%	0.51	-
Test	23.70%	11.32	76.3%

Run #6:

	Mean % Error	Standard Deviation	Mean % Correct
Training	1.30%	0.35	-
Test	21.48%	12.75	78.52%

Run #7:

	Mean % Error	Standard Deviation	Mean % Correct
Training	1.48%	0.68	-
Test	25.92%	11.65	74.08%

Run #8:

	Mean % Error	Standard Deviation	Mean % Correct
Training	1.39%	0.71	-
Test	26.67%	10.78	73.33%

Run #9:

	Mean % Error	Standard Deviation	Mean % Correct
Training	1.38%	0.50	-
Test	24.81%	11.98	75.19%

Run #10:

	Mean % Error	Standard Deviation	Mean % Correct
Training	1.30%	0.35	-
Test	23.70%	12.80	76.30 %

3 Test Output

Confidence's are found using the % distance away from the target value of 0.8 MALE and 0.2 FEMALE.

Prediction: MALE Confidence: 96.15%

Prediction: FEMALE Confidence: 54.37%

Prediction: MALE Confidence: 99.74%

Prediction: MALE Confidence: 89.80%

Prediction: MALE Confidence: 98.52%

Prediction: MALE Confidence: 98.01%
Prediction: MALE Confidence: 95.39%
Prediction: MALE Confidence: 92.69%
Prediction: MALE Confidence: 89.59%
Prediction: MALE Confidence: 98.41%
Prediction: MALE Confidence: 95.66%
Prediction: MALE Confidence: 99.02%
Prediction: MALE Confidence: 93.80%
Prediction: MALE Confidence: 98.79%
Prediction: MALE Confidence: 97.91%
Prediction: MALE Confidence: 98.71%
Prediction: MALE Confidence: 96.16%
Prediction: MALE Confidence: 96.83%
Prediction: MALE Confidence: 99.96%
Prediction: MALE Confidence: 97.66%
Prediction: MALE Confidence: 97.24%
Prediction: MALE Confidence: 85.68%
Prediction: MALE Confidence: 71.75%
Prediction: MALE Confidence: 81.92%
Prediction: FEMALE Confidence: 65.99%
Prediction: FEMALE Confidence: 57.80%
Prediction: FEMALE Confidence: 71.08%
Prediction: FEMALE Confidence: 71.36%
Prediction: FEMALE Confidence: 70.11%
Prediction: FEMALE Confidence: 68.15%
Prediction: MALE Confidence: 92.29%
Prediction: MALE Confidence: 96.18%
Prediction: MALE Confidence: 87.74%
Prediction: MALE Confidence: 76.74%
Prediction: MALE Confidence: 82.65%
Prediction: MALE Confidence: 96.83%
Prediction: MALE Confidence: 91.76%
Prediction: MALE Confidence: 73.91%
Prediction: FEMALE Confidence: 40.95%
Prediction: FEMALE Confidence: 63.57%