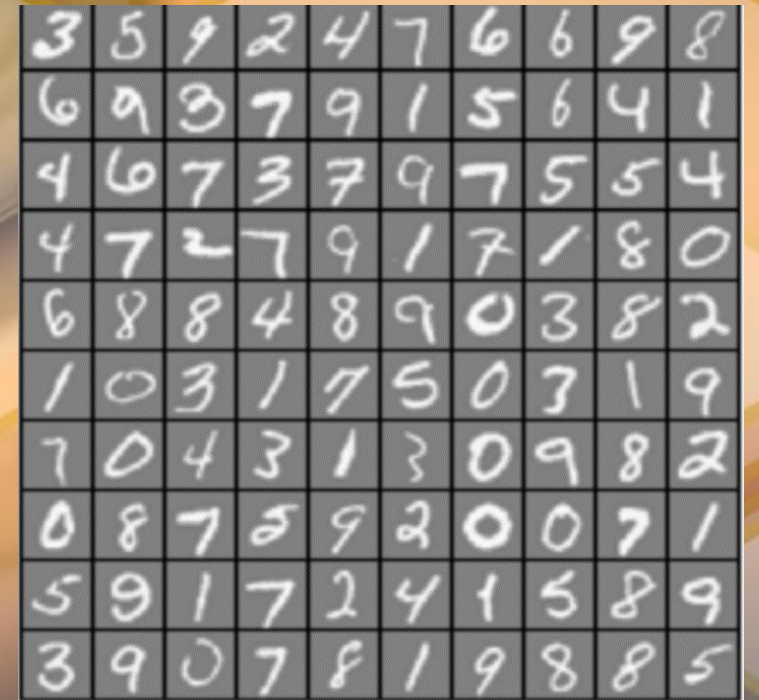


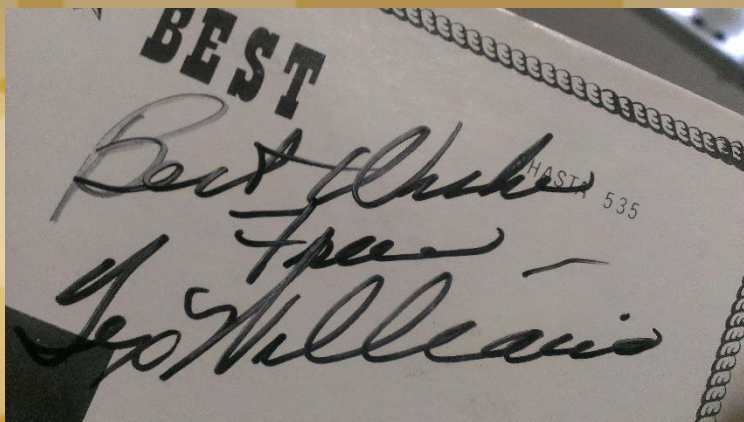
Neural Network For Handwrites Recognition

Chen Yuxuan 1W15BG12



3	5	9	2	4	7	6	6	9	8
6	9	3	7	9	1	5	6	4	1
4	6	7	3	7	9	7	5	5	4
4	7	2	7	9	1	7	1	8	0
6	8	8	4	8	9	0	3	8	2
1	0	3	1	7	5	0	3	1	9
7	0	4	3	1	3	0	9	8	2
0	8	7	5	9	2	0	0	7	1
5	9	1	7	2	4	1	5	8	9
3	9	0	7	8	1	9	8	8	5

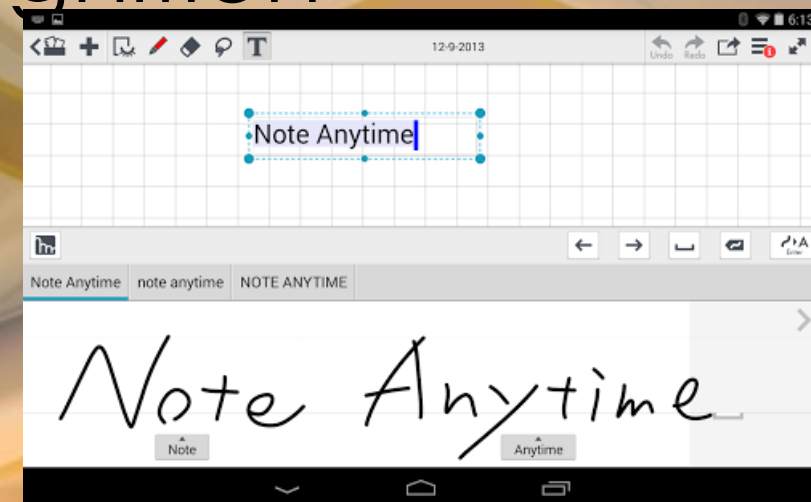
Definition and Engine of Recognition



Signature of country star, Tex Williams



Numbers of Recognition



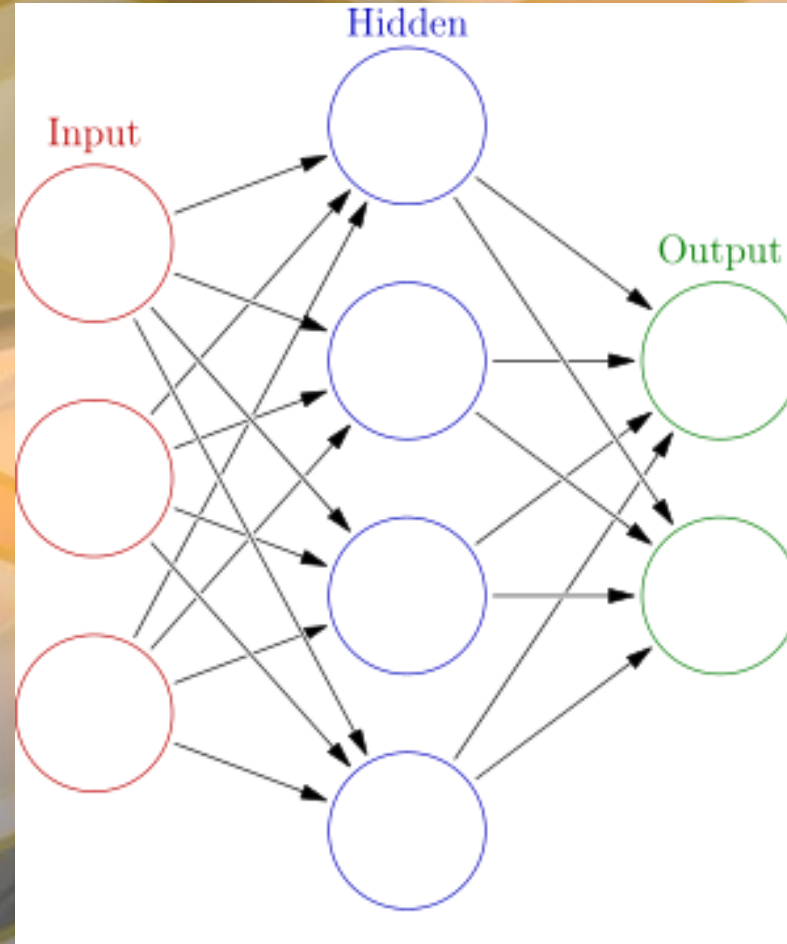
OCR software

Artificial Neural Network

Neural Networks as the Brain

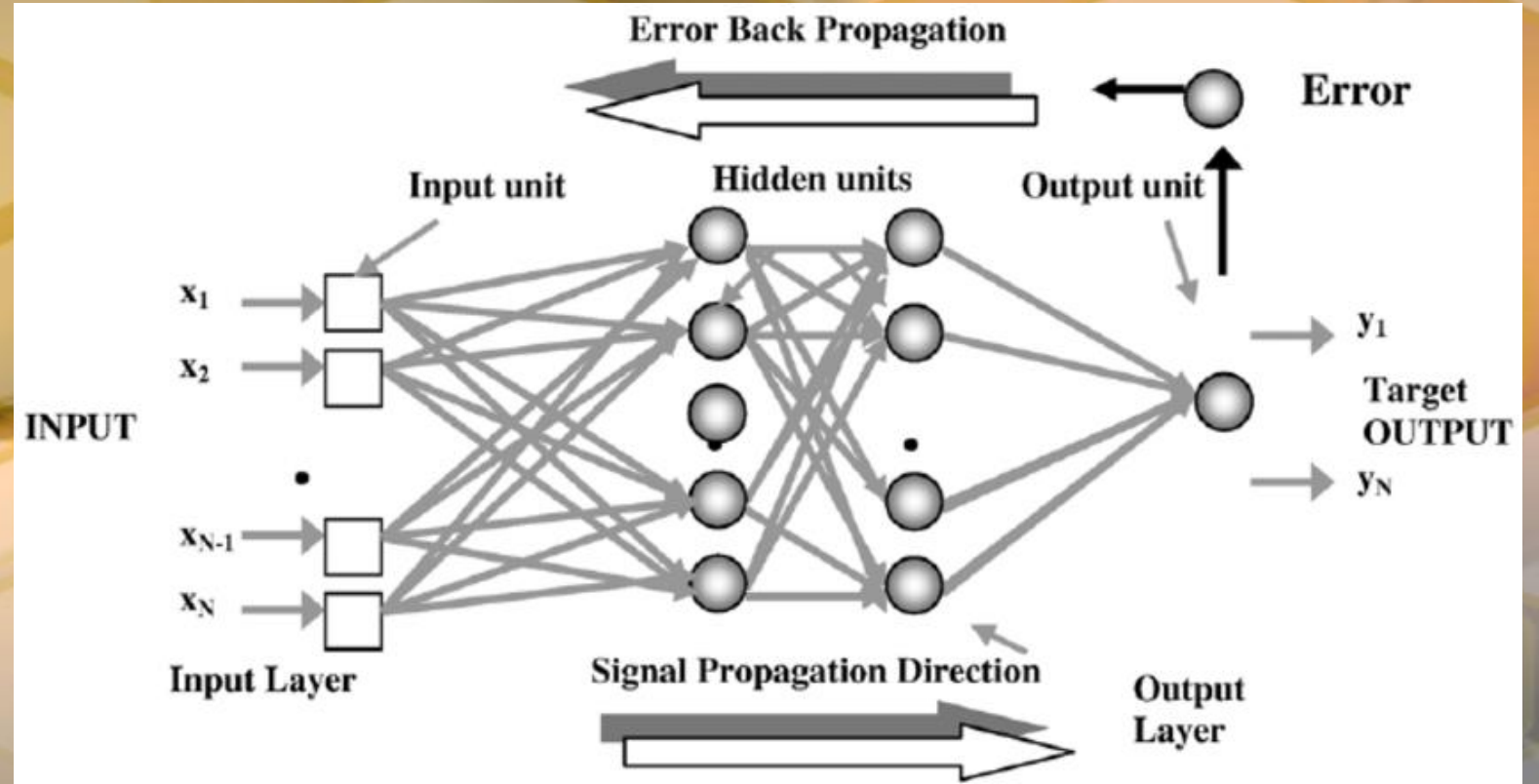
- Basic Concepts
- Configuration
- Cost Function

Each circular node represents an artificial neuron and an arrow represents a connection from the output of one neuron to the input of another



Neural Networks and Common Algorithm

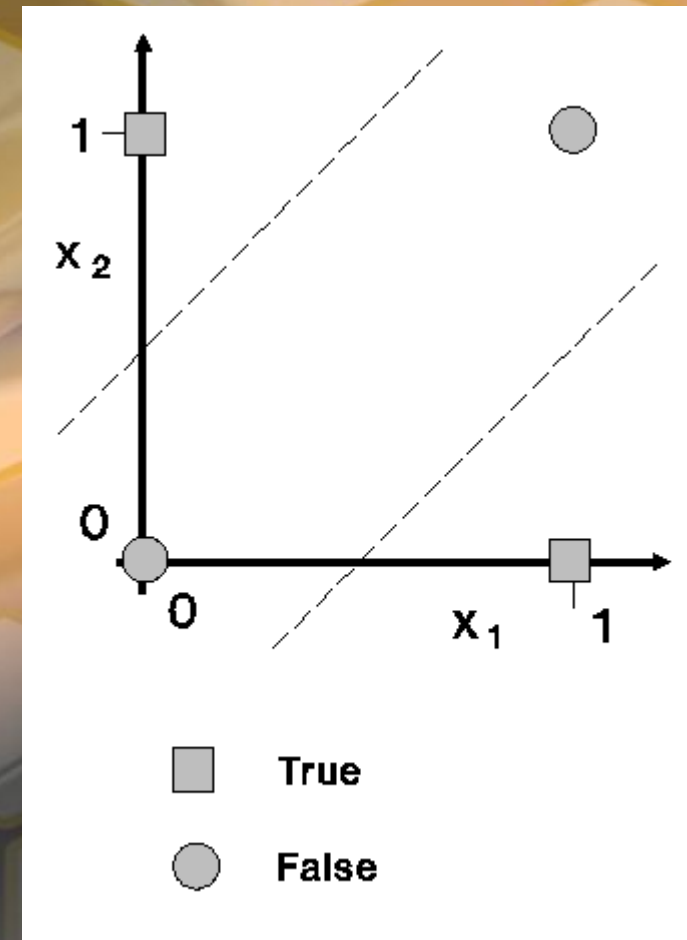
1. Backpropagation, is a common method of training artificial neural networks
2. Optimization method such as gradient descent



A simple example of Neural Network: XOR problem

- A neural network that can learn to produce the correct output given the XOR problem.

Given this input		Produce this output
x_1	x_2	y
0	0	0
0	1	1
1	0	1
1	1	0



Successfully Trained XOR problem

Iterations	Result of 0,0	Deviation J
1000	0.47689	0.69423
68000	0.026558	0.037856
100000	0.019090	0.025859

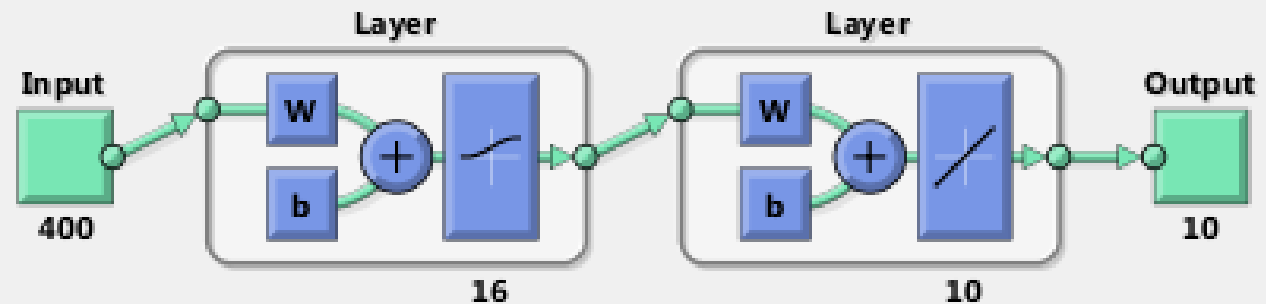
- Network guesses small numbers (close to 0) for the first and last XOR examples and high (close to 1)
- Result is more accurate when Iterations is larger.
- Successfully trained!

Handwritten Digits Recognition

3	5	9	2	4	7	6	6	9	8
6	9	3	7	9	1	5	6	4	1
4	6	7	3	7	9	7	5	5	4
4	7	2	7	9	1	7	1	8	0
6	8	8	4	8	9	0	3	8	2
1	0	3	1	7	5	0	3	1	9
7	0	4	3	1	3	0	9	8	2
0	8	7	5	9	2	0	0	7	1
5	9	1	7	2	4	1	5	8	9
3	9	0	7	8	1	9	8	8	5

- AIM: Build a neural network that can successfully learn to produce the correct output given the MNIST handwritten digits.

Neural Network



Algorithms

Data Division: Index (divideind)
Training: Levenberg-Marquardt (trainlm)
Performance: Mean Squared Error (mse)
Derivative: Default (defaultderiv)

Trained Handwritten Digits Recognition

Accuracy	Samples	Hidden Neruons
23.3%	120	4
66.7%	120	16
95.5%	5000	25

```
TRAINLM, Epoch 0/200, MSE 0.902926/0, Gradient 600.48/1e-010  
TRAINLM, Epoch 21/200, MSE 0.0738405/0, Gradient 0.0262333/1e-010  
TRAINLM, Validation stop.
```

SIMULATION...

Training Set Accuracy: 23.333333

>> |

- Training set accuracy is around 63% with the small sample (120) and small hidden neurons (16).
- While, larger sample (5000), and more hidden neurons (25) yields 95%.
- Sucessfully Trained!

What we learned so far... And more

So Far:

- Basic Concepts of Neural Network
- A Neural Network For XOR problem
- A Neural Network For Handwrites Recognition

Future:

- More Difficult Recognition
- Possibilities of solving any problems.
- Neural Network that can exceed human beings.