

# Machine Learning



Mark Powers  
Dane Linskey

# What is a Neural Network?

- Procedurally Generated Function
- Complex Adaptive System

## Uses

- Pattern Recognition
- Forecasting events
- Controlling vehicles
- Anomaly Detection

# Building Your Own Neural Network

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# Perceptron

- Takes multiple inputs and gives an output
- Inputs are weighted between -1 and 1, then summed to generate the output
- Additionally, perceptrons can include a bias.
- Can only solve linearly separable problems

$x = 12$  weight = 0.5

$y = 4$  weight = -1

$12(0.5) + 4(-1) = 6 + -4$

Output = 2

# Generating Weights

1. Provide the perceptron with inputs for which there is a known answer
2. Ask the perceptron to guess an answer
3. Compute the error
4. Adjust all weights according to the error
5. Repeat

# Methods of Learning

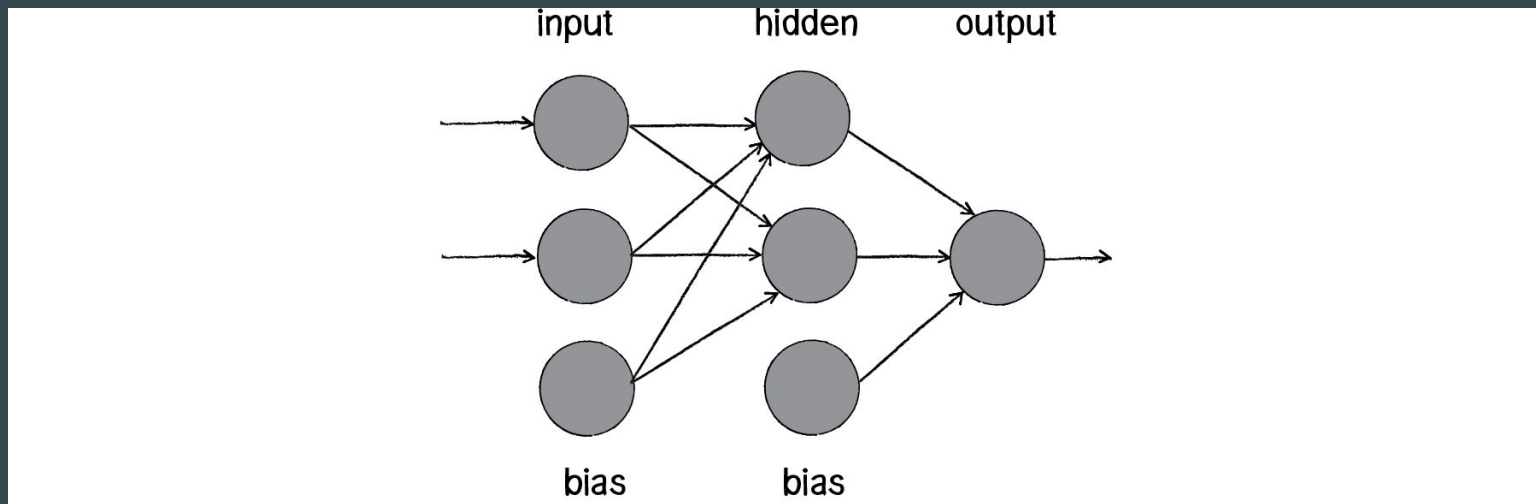
- Supervised
- Unsupervised
- Reinforcement

## Decision Classifiers

- Chose a classifier based on the type of problem which you are trying to solve

# Networks

- \*\*\*\*\*Perceptrons can only solve linearly separable problems.\*\*\*\*\*
- Networks of perceptrons are needed to solve more complex problems.
- Input Layer, Hidden Layers, Output layers



# Adjusting Network Weights

- Achieved by using back propagation
- The weights are adjusted based on the error of the network, so in order to adjust weights properly you must start at the output layer and work backwards
- Achieved through a sigmoid function





<Cnn:  
the game  
changer>

# Python Guide

```
$ wget www.cs.hope.edu/~dane.linsky/student.zip
```

Declare a dictionary.....`dict = {}`

Declare a list.....`list = []`

For each.....`for item in list:`

Add to dictionary....`dict[key] = value`

Add to list .....`list.append(item)`

Get from dictionary.....`dict[key]`

- You do not declare types
- You do not end lines with ;
- You do not put ( and ) around loop conditions
- Instead of using { and } for blocks you use indentation

# Limitations With Neural Networks

- Over-Fitting
- Often actual algorithm exists
- Not 100% accurate
- Requires a lot of training