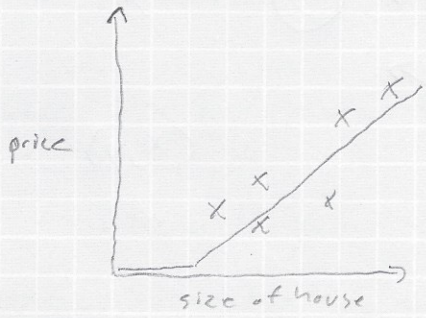
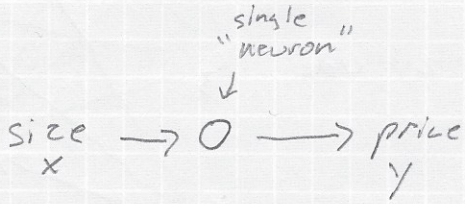
Deep Learning Specialization DeepLearning.ai Andrew Ng
Course 1: Neural Networks and Deep Learning
Week 1: Introduction to Deep Learning

What is a neural network?

Deep learning refers to N.N.s sometimes very large N.N.s.

Lets say you want to predict Housing Prices





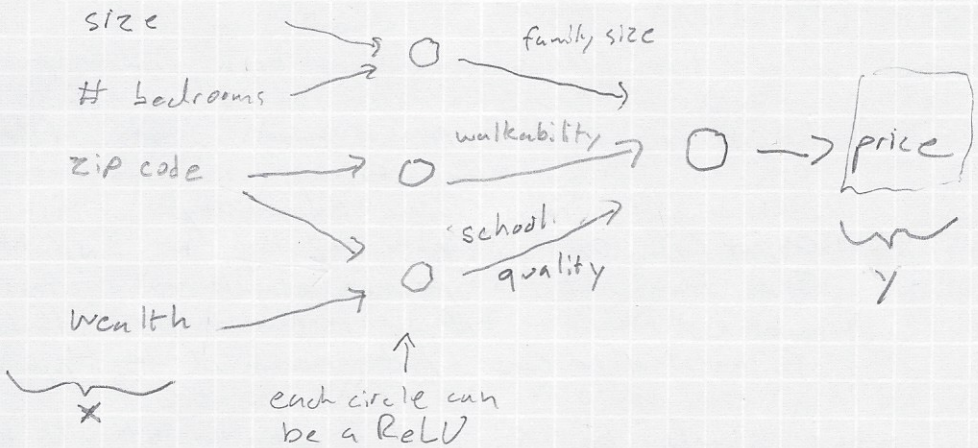
You want to fit a function to these points. In linear regression we would fit a straight line. with no possible zero values. This is almost the most simple NN possible.

All the single neuron does is it inputs the size, computes this linear function, takes a max of zero, and outputs the estimated price.

The function which goes at zero for sometime then takes off at a straight line is seen a lot in NN literature. It's called a ReLU function standing for rectified linear units. Just means taking a max of zero.

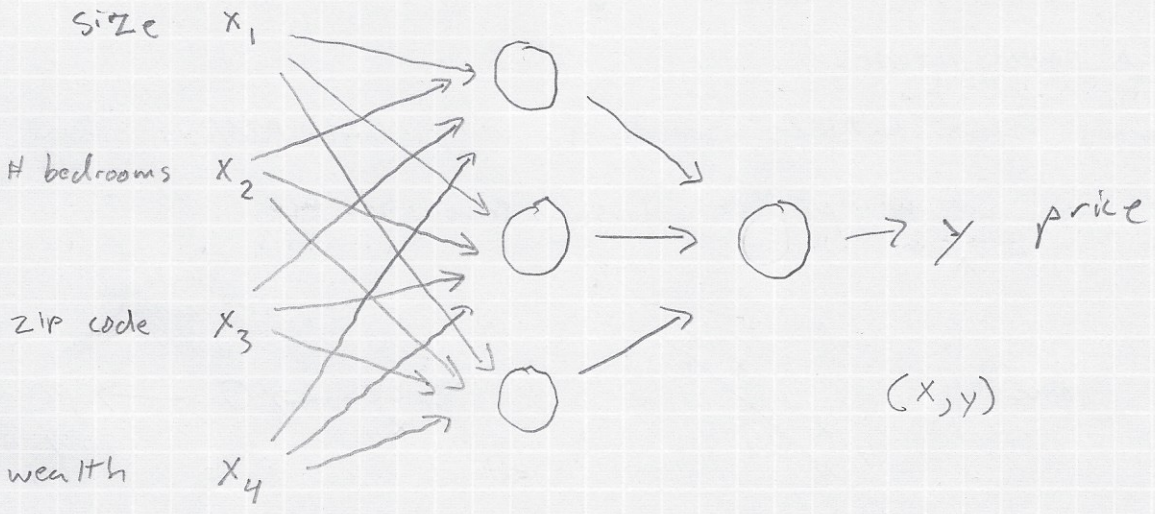
A larger N.N. is formed by taking many of these single neurons and stacking them together, like lego bricks.

Lets say you know other features about the houses



Part of the magic of NNs is you give it just the input x and the output y. All of the things in the middle (fam size, walkability school quality, etc) will get figured out by the network.

What you actually implement is this



4 inputs

1 layer
3 hidden units

Each hidden unit takes all 4 input features. The NN decides what it wants to be. We say they are densly connected because each input feature is connected to each circle it the middle, each hidden unit in our single layer.

The remarable thing about neural networks is that given enough data about x and y, enough training examples, Neural networks are remarably good at figuring out functions that accurately map from x to y.

They are most powerful in supervised learning settings. $x \rightarrow y$

Suprivesed Learning with Neural Networks

Most of the economic value from NN so far has been from supervised learning.

Input (x)	Output (y)	Application	NN Type
Home features	Price	Real estate	standard
Ad, user info	Click on ad? (0/1)	Online Advertising	standard
Image	Object (1, ..., 1000)	Photo tagging	C.N.N.
Audio	Text transcript	Speech recognition	R.N.N.
English	Chinese	Machine translation	R.N.N.
Image, Radar info	Position of other cars	Autonomous driving	hybrid / custom

Cleverly selecting what should be x and what should be y for your particular problem, and then fitting this supervised learning component into often a bigger system such as an autonomous vehicle.

Slightly different types of NN are useful for different applications. Sequence data will often use a RNN recurrent neural network.

Convolutional networks CNNs are often used for image data.

Structured data vs Unstructured data

eg. database with columns
each feature is well defined

raw audio, image, text

humans are really good at interpretting this, with NN computers are much better than they were 2 or 3 years ago

a lot of the short term economic gain from NN

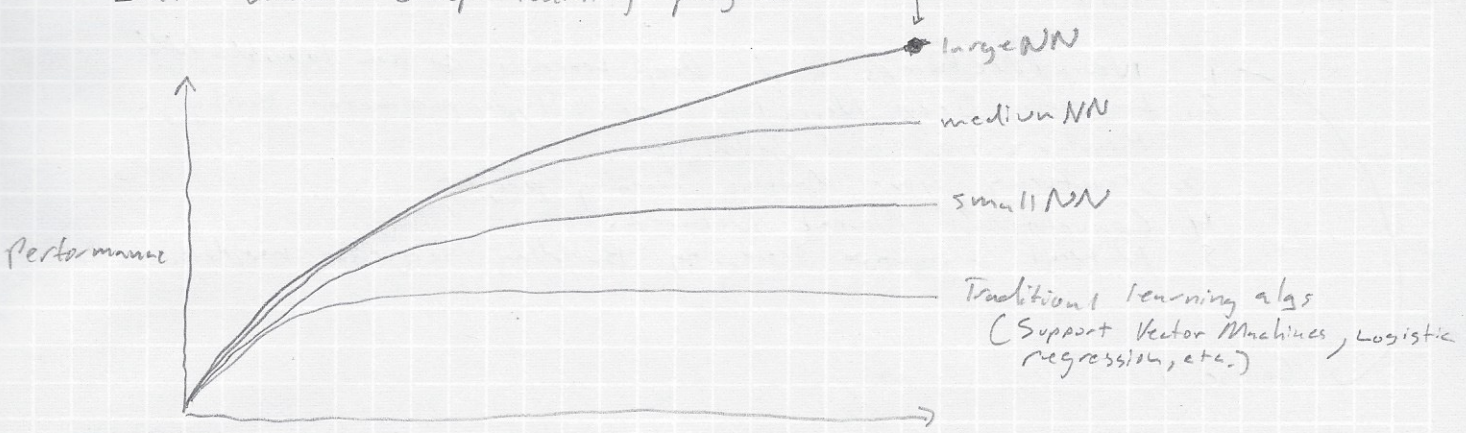
For explaining the algorithms we will focus on unstructured data, but think about structured data applications as well because there is a lot of economic value to find.

N.N. have transformed supervised learning

Why is Deep Learning taking off?

The basic ideas behind deep learning have been around for decades. It's taking off now because the performance of NN.

Scale drives deep learning progress



In the last 10 years the digitization of our society means we have much more data than before. Activity on digital devices generates data. Photos, accelerometers, sensors I.o.T. etc.

If you want to hit the high point in performance you need two things. You need to be able to train a big enough NN to take advantage of the the huge amount of data. Second, you do need a lot of data.

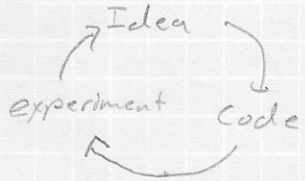
- Size of NN (a lot of hidden units / parameters / connections)
- Amount of data

In the smaller data regime it's possible to hand engineer features that outperform NN, but in the big data regimes (large m) we consistently see large NN dominating other approaches.

Amount of data and computation power have made a big difference but a lot of the recent innovations have been to the algorithms. These algorithmic innovations have been largely focused on making NN. run faster.

Eg. Swithing from sigmoid to ReLU gives a speed-up because you avoid very small gradients that are slow to update.

The process of building a model is also highly iterative so being able to run computations quickly really matters.



10min or 1day is much better than 1 month to try an idea. Helps with both research and in practice.

Optmistic that deep learning will keep getting better for many years to come.

The 5 courses will cover

1. Neural Networks and Deep Learning ← how to build a NN
2. Improving Deep Neural Networks: Hyperparameter tuning, Regularization and Optimisation
3. Structuring your Machine learning project
4. Convolutional Neural Networks
5. Natural Language Processing: Building sequence models.

→ Course 1

Week 1 Introduction
Week 2 Basics of NN (code an see work)
week 3 One hidden layer NNs "
week 4 Deep NN "