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Introduction to Deep Learning

Welcome

- AI is the new Electricity
- Electricity had once transformed countless industries: transportation, manufacturing, healthcare, communications, and more

- AI will now bring about an equally big transformation.

Andrew Ng

What you'll learn

Courses in this sequence (Specialization):

1. Neural Networks and Deep Learning
2. Improving Deep Neural Networks: Hyperparameter tuning, Regularization and Optimization
3. Structuring your Machine Learning project
4. Convolutional Neural Networks
5. Natural Language Processing: Building sequence models

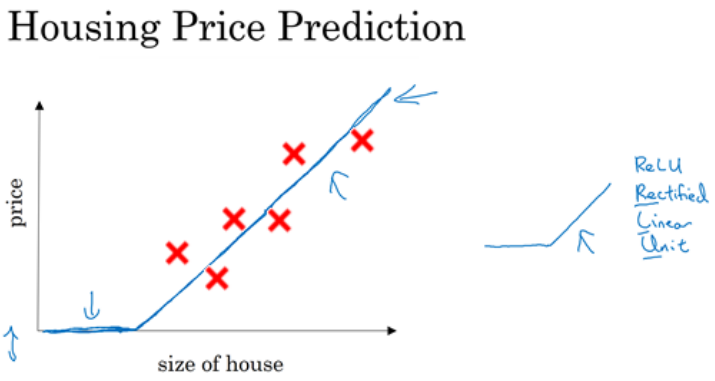
What is neural network?

It is a powerful learning algorithm inspired by how the brain works.

Example 1 – single neural network

Given data about the size of houses on the real estate market and you want to fit a function that will predict their price. It is a linear regression problem because the price as a function of size is a continuous output.

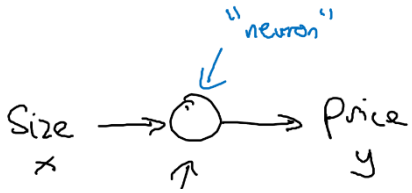
We know the prices can never be negative so we are creating a function called Rectified Linear Unit (ReLU) which starts at zero.



The input is the size of the house (x)

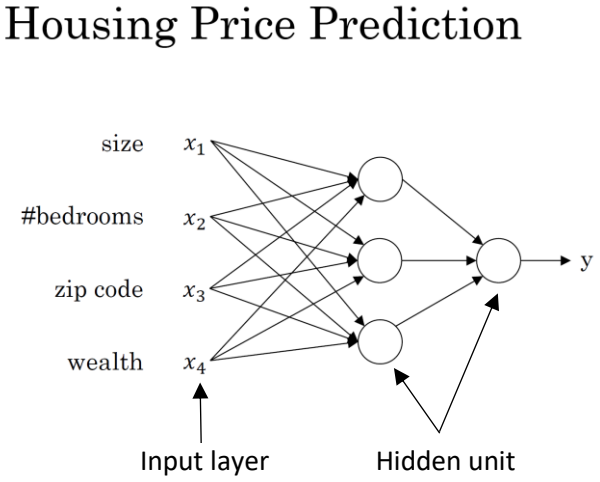
The output is the price (y)

The "neuron" implements the function ReLU (blue line)



Example 2 – Multiple neural network

The price of a house can be affected by other features such as size, number of bedrooms, zip code and wealth. The role of the neural network is to predicted the price and it will automatically generate the hidden units. We only need to give the inputs x and the output y.



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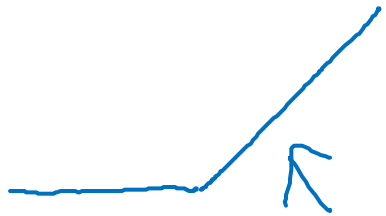
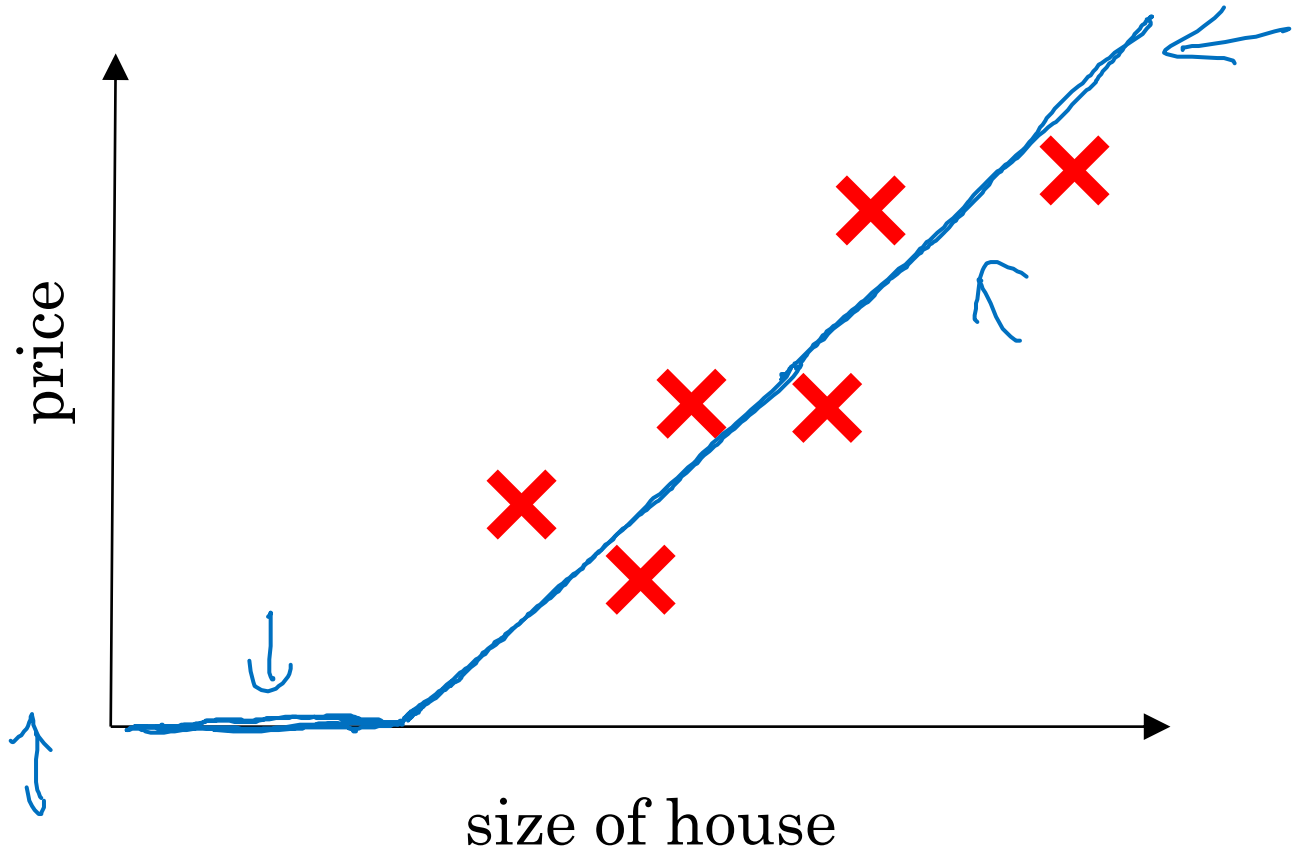
Introduction to Deep Learning

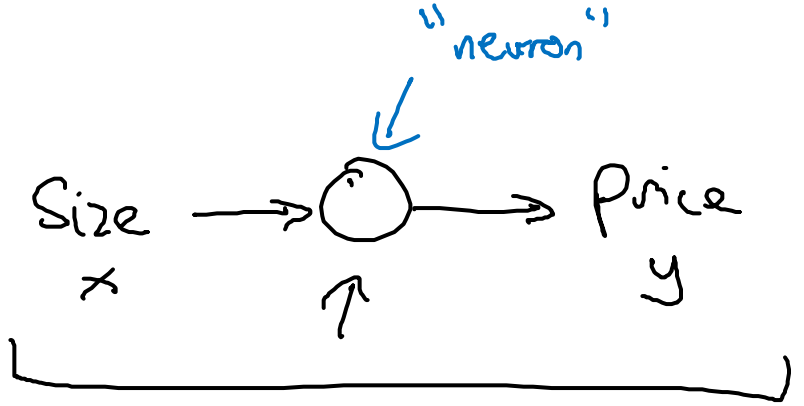
What is a Neural Network?

Housing Price Prediction

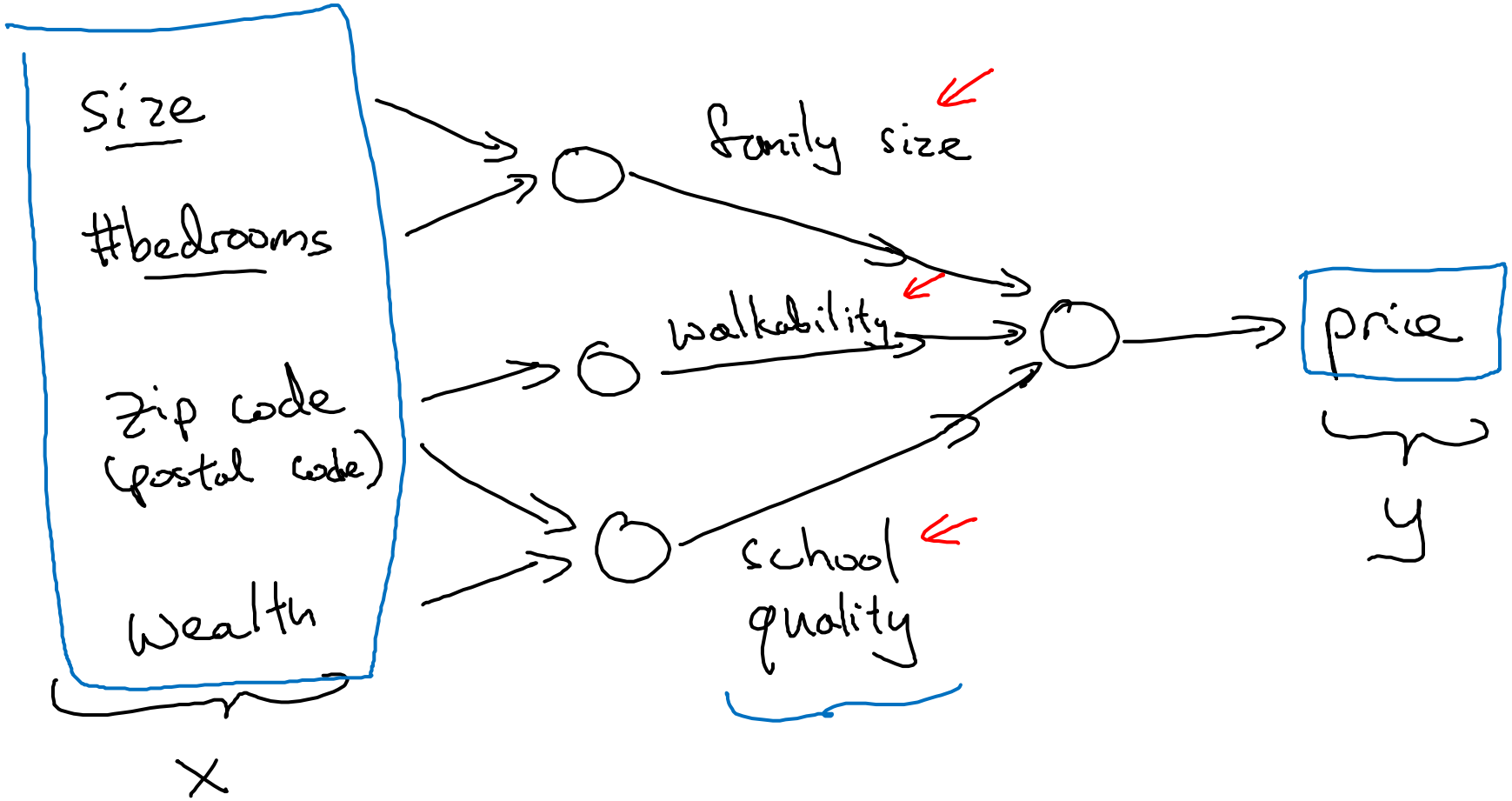


ReLU
Rectified
Linear
Unit



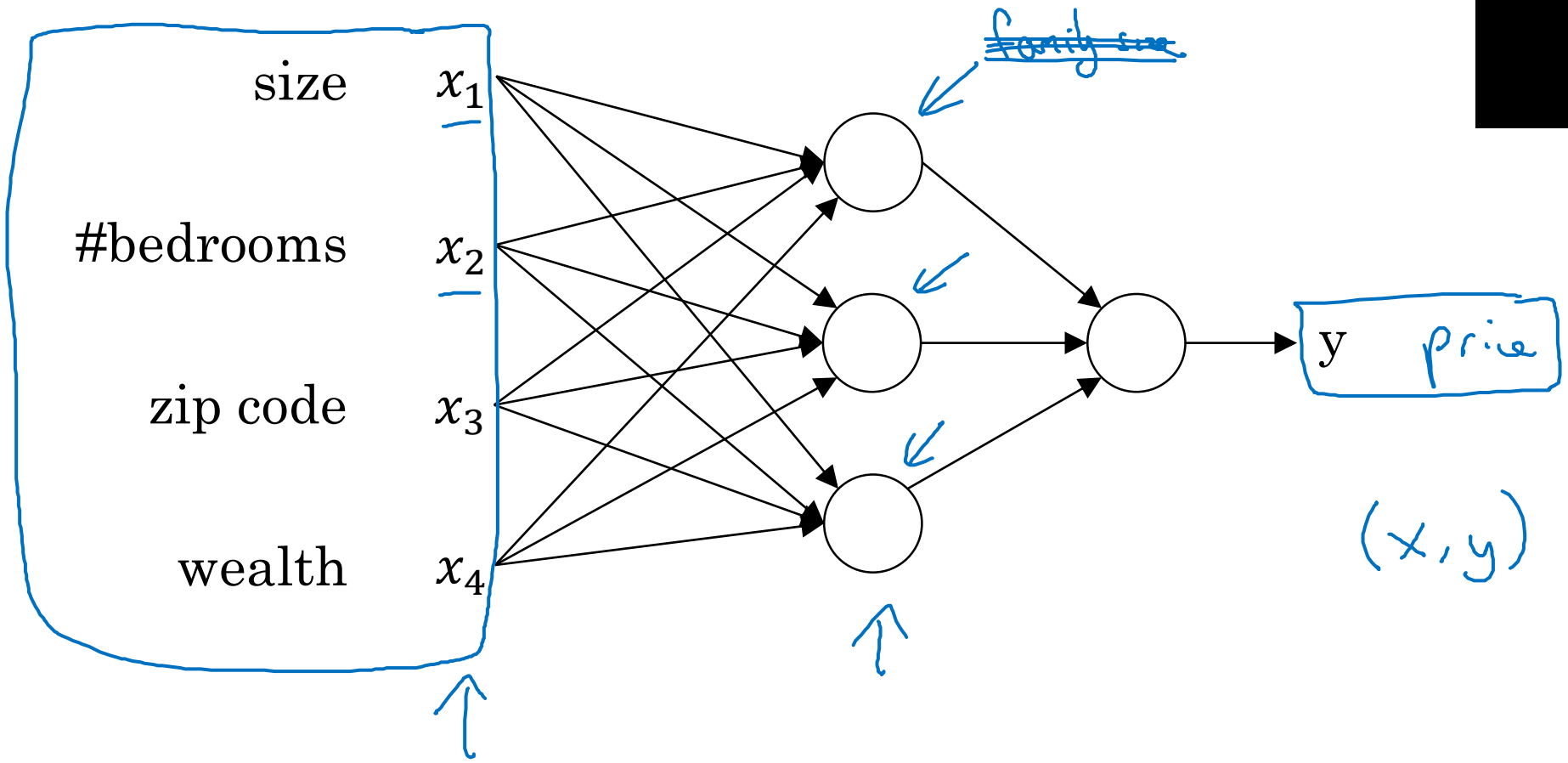


Housing Price Prediction



Housing Price Prediction

Drawing of previous Image



Supervised learning for Neural Network

In supervised learning, we are given a data set and already know what our correct output should look like, having the idea that there is a relationship between the input and the output.

Supervised learning problems are categorized into "regression" and "classification" problems. In a regression problem, we are trying to predict results within a continuous output, meaning that we are trying to map input variables to some continuous function. In a classification problem, we are instead trying to predict results in a discrete output. In other words, we are trying to map input variables into discrete categories.

Here are some examples of supervised learning

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

There are different types of neural network, for example Convolution Neural Network (CNN) used often for image application and Recurrent Neural Network (RNN) used for one-dimensional sequence data such as translating English to Chinses or a temporal component such as text transcript. As for the autonomous driving, it is a hybrid neural network architecture.

Structured vs unstructured data

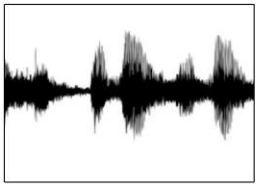
Structured data refers to things that has a defined meaning such as price, age whereas unstructured data refers to thing like pixel, raw audio, text.

Structured Data

Size	#bedrooms	...	Price (1000$s)
2104	3		400
1600	3		330
2400	3		369
⋮	⋮		⋮
3000	4		540

User Age	Ad Id	...	Click
41	93242		1
80	93287		0
18	87312		1
⋮	⋮		⋮
27	71244		1

Unstructured Data



Audio

Image

Four scores and seven years ago...

Text

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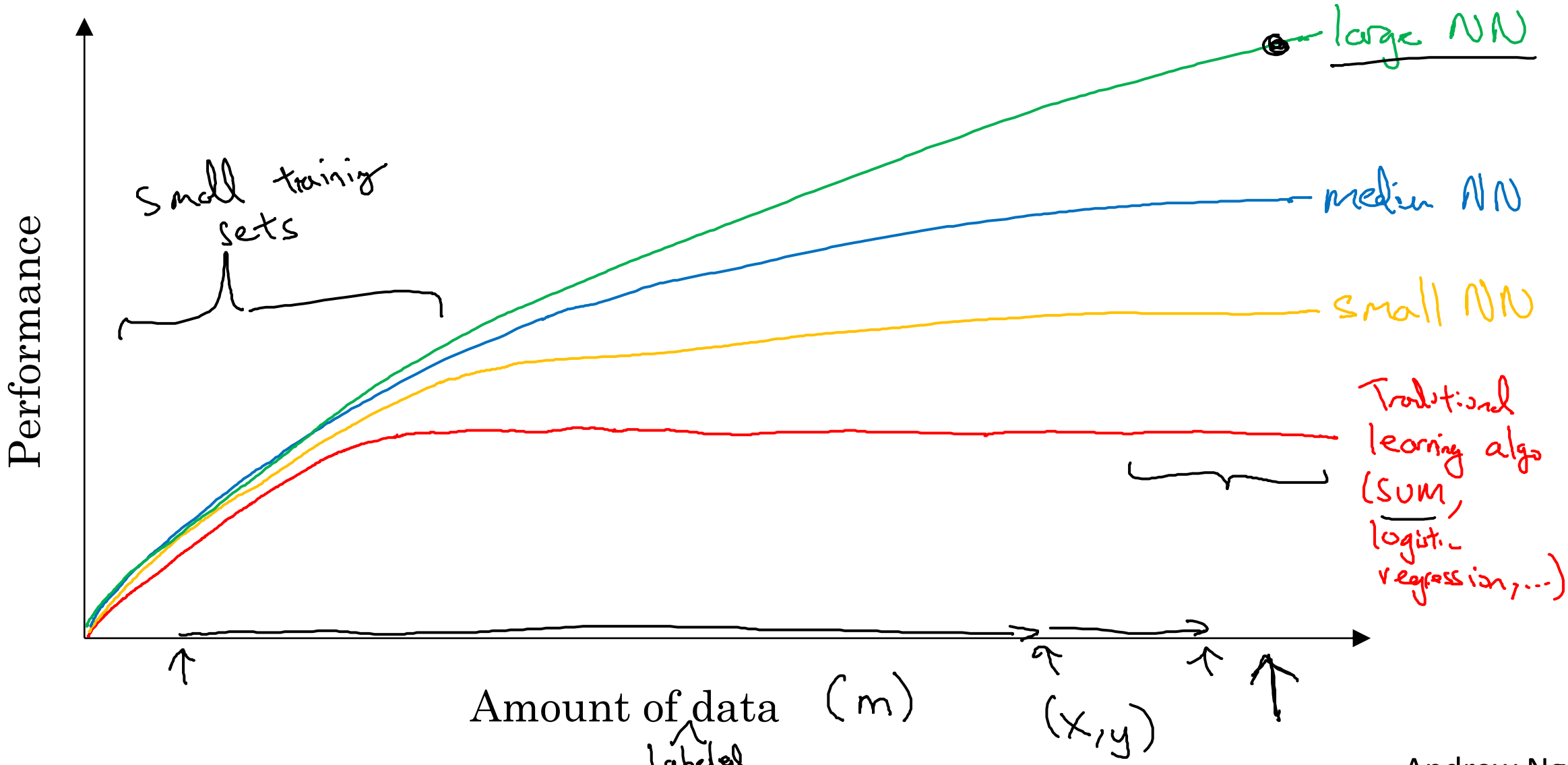
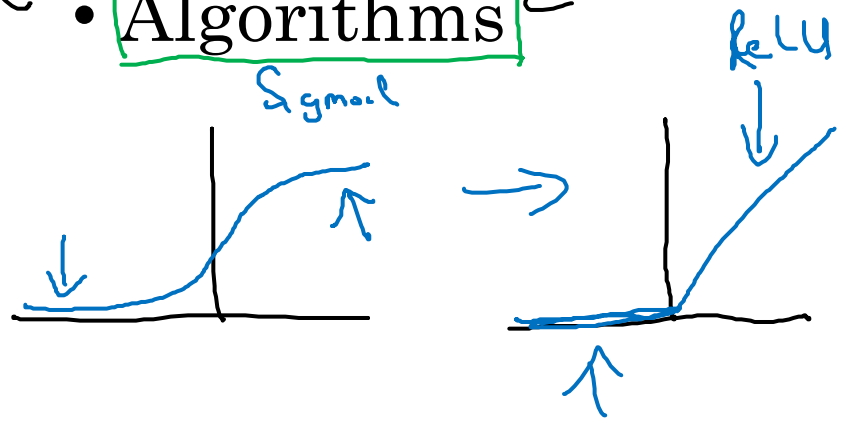
Why is Deep Learning taking off?

Scale drives deep learning progress

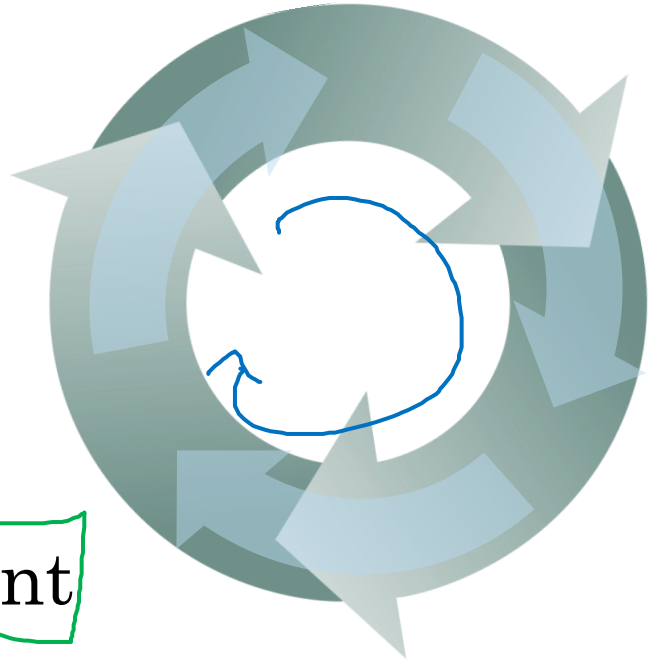


Scale drives deep learning progress

- Data
- Computation
- Algorithms



Idea



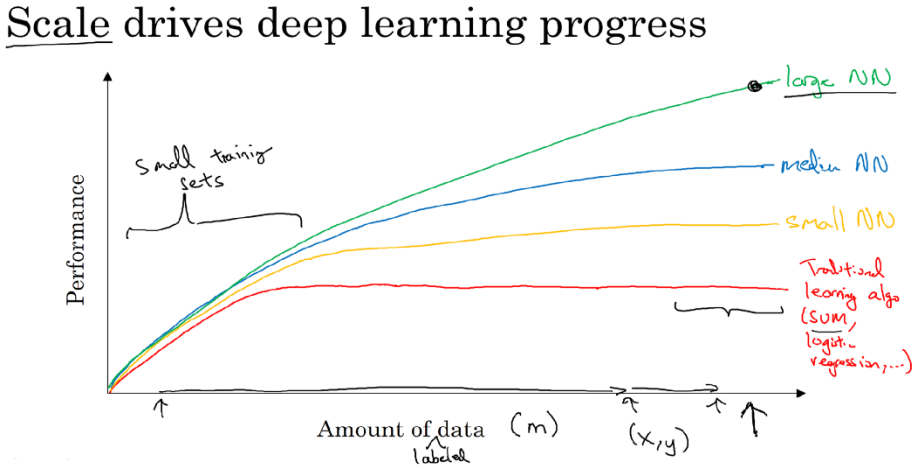
Experiment

Code

10 min
1 day
1 month

Why is deep learning taking off?

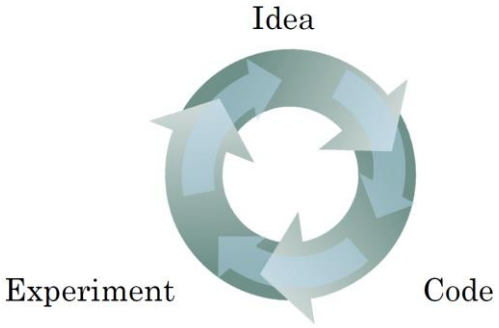
Deep learning is taking off due to a large amount of data available through the digitization of the society, faster computation and innovation in the development of neural network algorithm.



Two things have to be considered to get to the high level of performance:

1. Being able to train a big enough neural network
2. Huge amount of labeled data

The process of training a neural network is iterative.



It could take a good amount of time to train a neural network, which affects your productivity. Faster computation helps to iterate and improve new algorithm.

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Outline of this Course

Week 1: Introduction

Week 2: Basics of Neural Network programming

Week 3: One hidden layer Neural Networks

Week 4: Deep Neural Networks

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Course resources

Course Resources

Discussion forum

- Questions, technical discussions, bug reports, etc.

Wiki (in-progress lecture notes)

- deeplearning.ai/wiki

Contact us: feedback@deeplearning.ai

Companies: enterprise@deeplearning.ai

Universities: academic@deeplearing.ai

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