Introduction to Machine Learning

Welcome to CS 200!

BOSTON UNIVERSITY
MACHINE INTELLIGENCE
COMMUNITY

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What Is This Course?

Machine learning has recently been successfully applied to many real-world applications. In this course, we will introduce machine learning topics through hands-on interactive workshops and projects. Example topics include neural networks, computer vision models, generative models, sequential models, and reinforcement learning. This is a 1 credit, pass-fail course, so the expectation of prior knowledge and work commitment is lower than existing ML courses. Lecture time is spent evenly on workshops, coding tutorials, and working on projects.

Syllabus

What's happening this semester! - **bit.ly/cs200-syllabus**

Who This Course Is For

Interested in ML and DL but don't have a strong background

Want to actually create something

How This Course Is Run

Who is the professor?

How This Course Is Run

Who is giving the workshops?

How This Course Is Run

How will grades work?

Pass by attending class (3 freebies) and completing a project

How to take this course

Show up and create a project!

Intro to Machine Learning

What is Machine Learning?

Machine Learning is the field of study that gives computers the capability to learn without being explicitly programmed
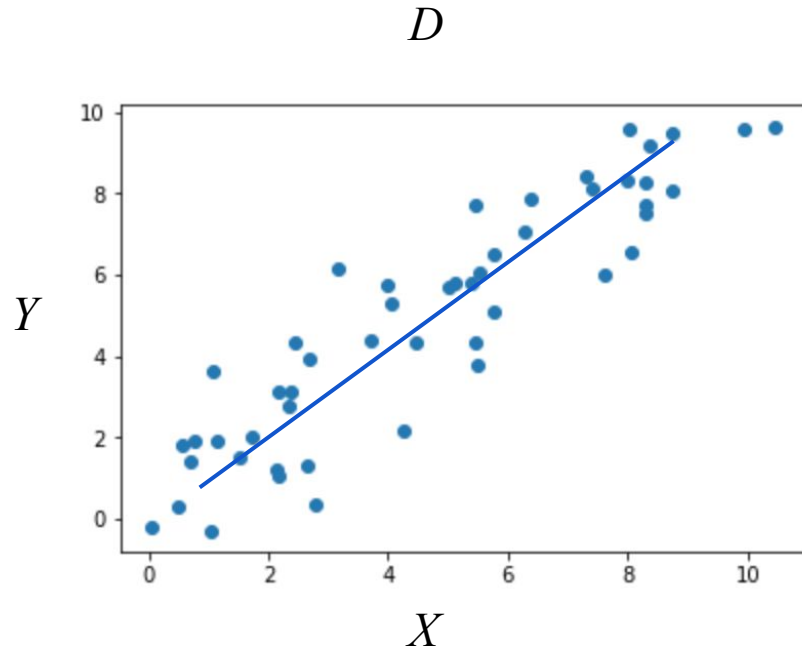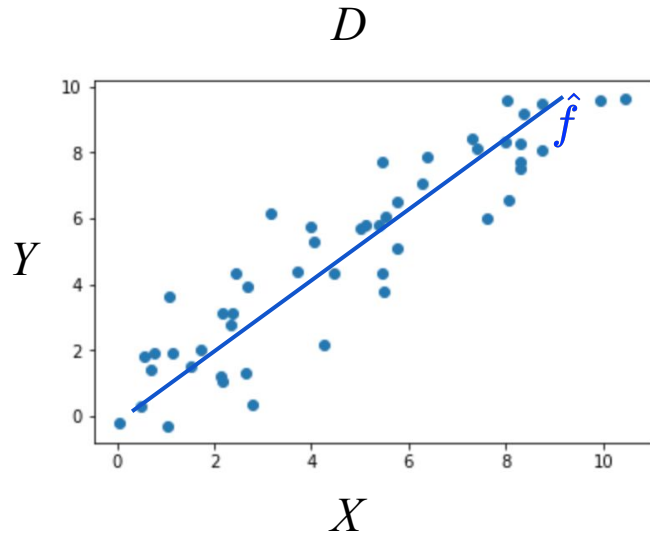
Learning from data

We have some data D

D

Y

X
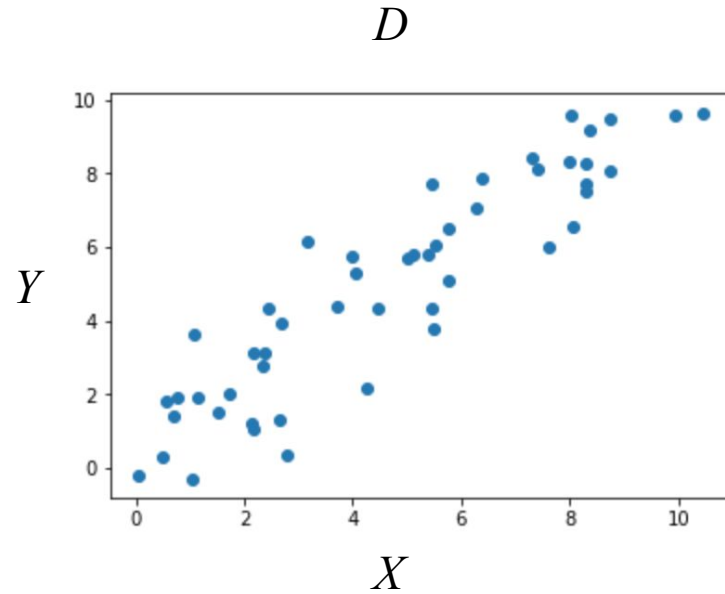
Make an assumption about D

D

$$y = b + mx$$

$$\downarrow$$

$$\hat{f} = \theta_0 + \theta_1 x$$

What is learning?

The approximation of some unknown function f based on some data D.
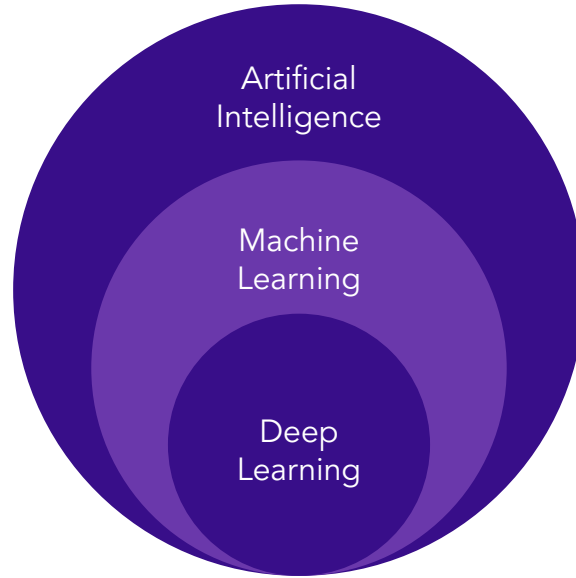

$$f : X \rightarrow Y$$

$$\hat{f} = \theta_0 + \theta_1 x$$

How do we set the parameters?
How do we know what assumptions to make?
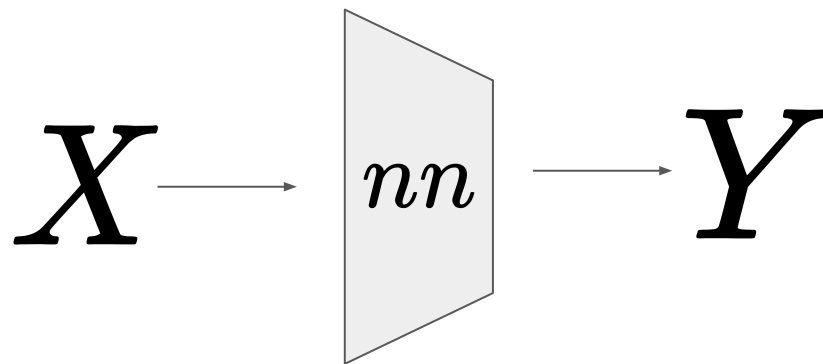
Intro to Deep Learning

What is Deep Learning

Deep learning is a subset of machine learning

What is Deep Learning

*Deep learning learns from data using a class of functions known as Neural Networks*

$$X \longrightarrow \boxed{nn} \longrightarrow Y$$

A neural network maps an input to an output

# Applications of Deep Learning

1. **Cool things using deep learning**
   a. Computer Vision
      i. Tesla recognizing items on a street
   b. Text generation
      i. An algorithm was trained to create a similar Shakespeare piece
   c. Image recognition
      i. Classifying what a certain picture contains
      ii. Facebook photo tagging
   d. Many more…
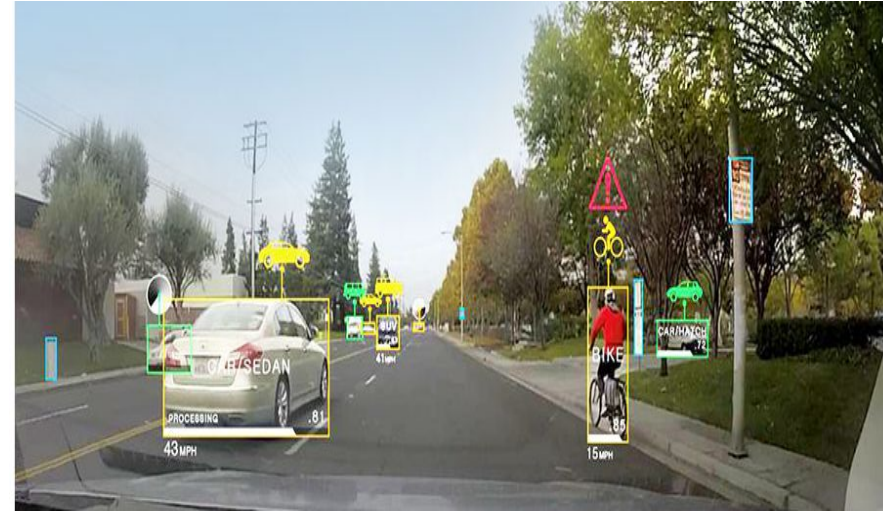
Hype In Deep Learning

What have you heard about deep learning?
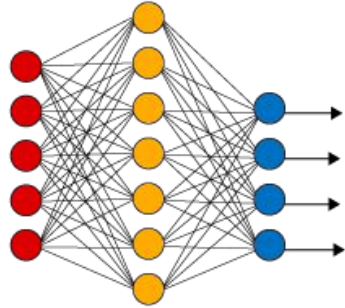
Biological Neuron vs. Artificial Neuron

Andrej Karpathy
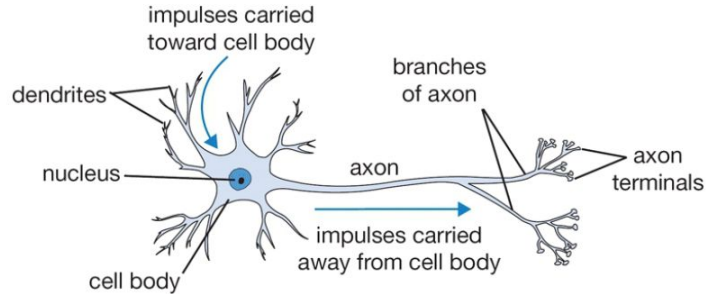
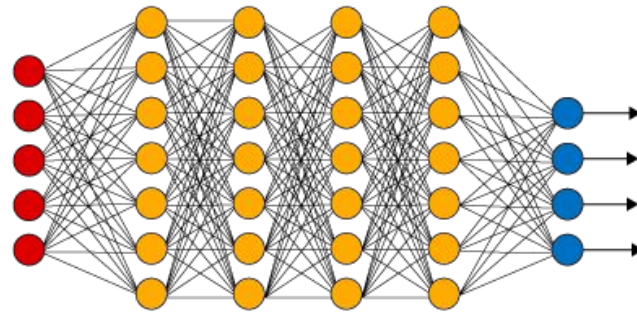A cartoon drawing of a biological neuron (left) and its mathematical model (right).
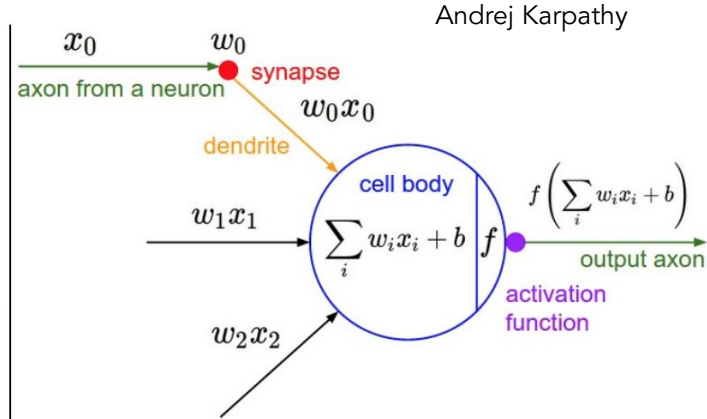
What is a Neural Network?

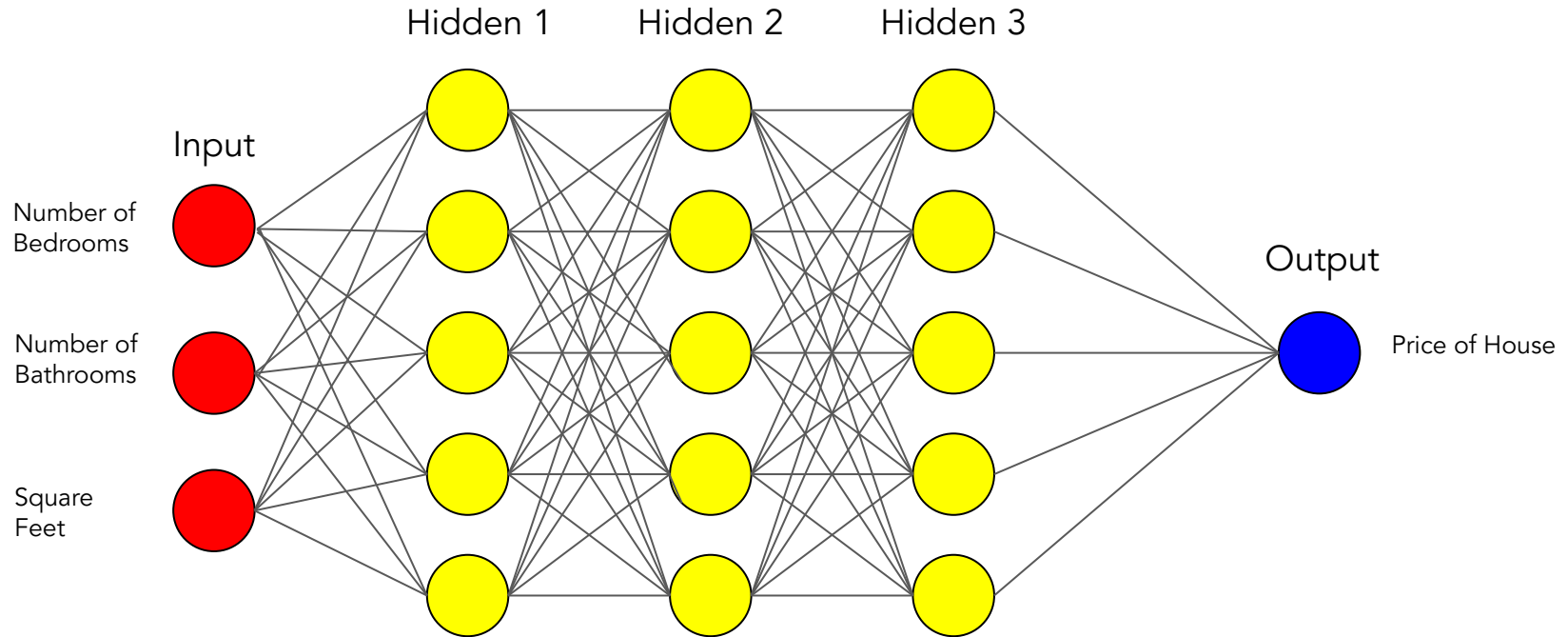Simple Neural Network — Deep Learning Neural Network
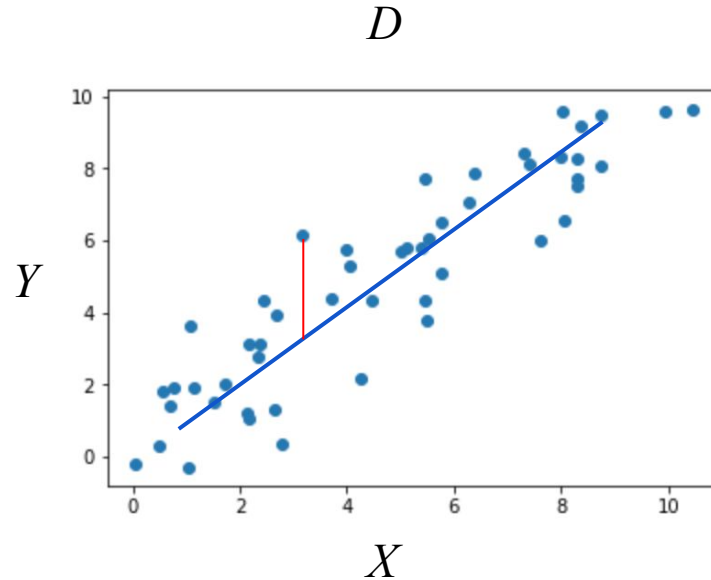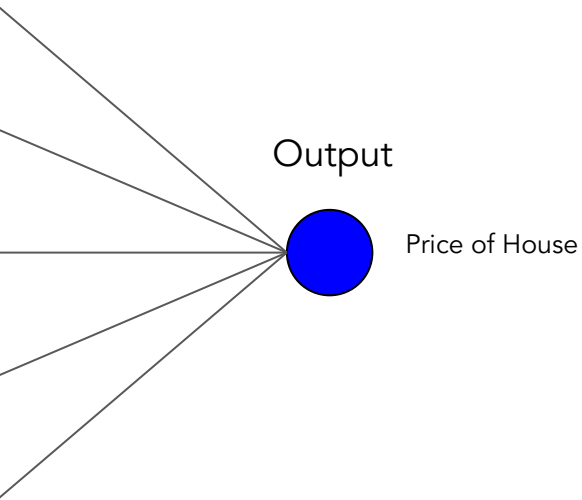Input Layer, Hidden Layer, Output Layer

Steps to Train a NN

Forward propagation

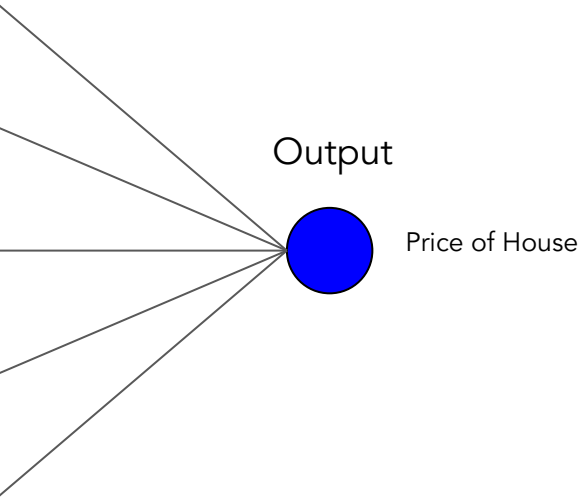Push example through the network to get a predicted output

Compute the cost

Calculate difference between predicted output and actual data

Compute the cost

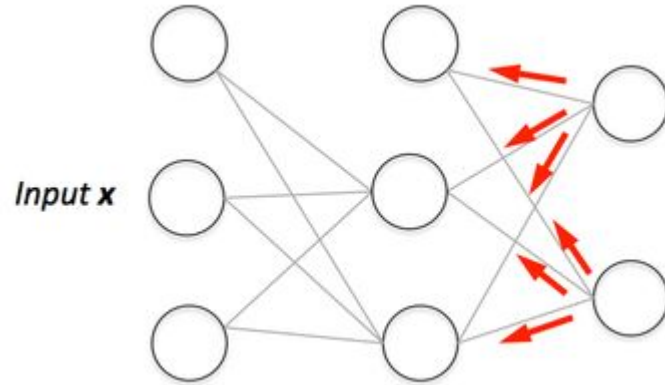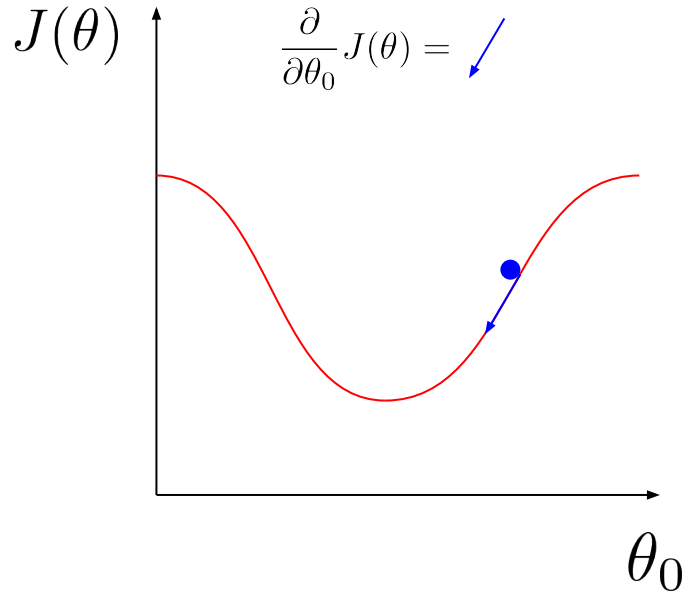Calculate difference between predicted output and actual data

Output

Price of House

$$J(\theta) = \frac{1}{2m} \sum_{i}^{m} (y_i - \hat{y}_i)^2$$

Where i is the ith training example and m is the number of training examples
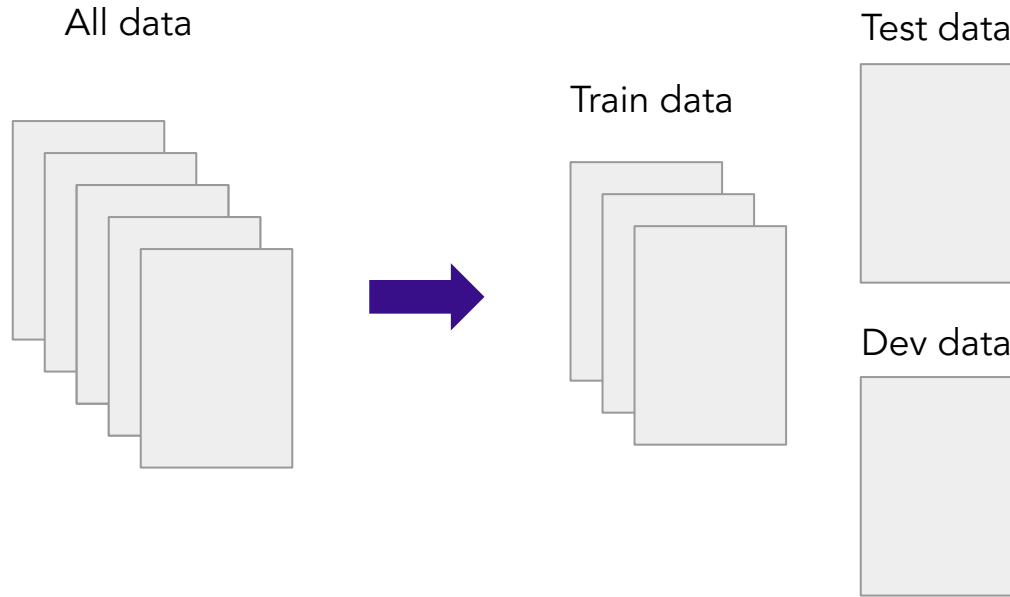
Backward propagation - "Update"

Push back the derivative of the error and apply to each weight, such that next time it will result in a lower error
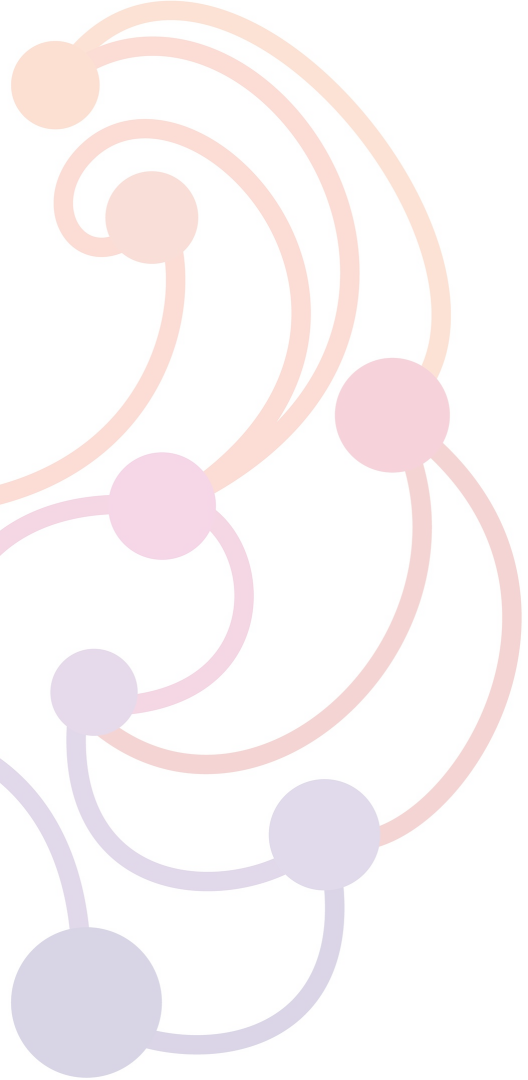
$$J(\theta)$$

$$\frac{\partial}{\partial \theta_0} J(\theta) =$$

$$\theta_0$$

Input **x**

Train / Dev / Test sets

All data

Train data

Test data

Dev data

Neural Networks In Depth Next Time!

Thank you for coming!