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Setting up your ML application

Train/dev/test sets

Applied ML is a highly iterative process

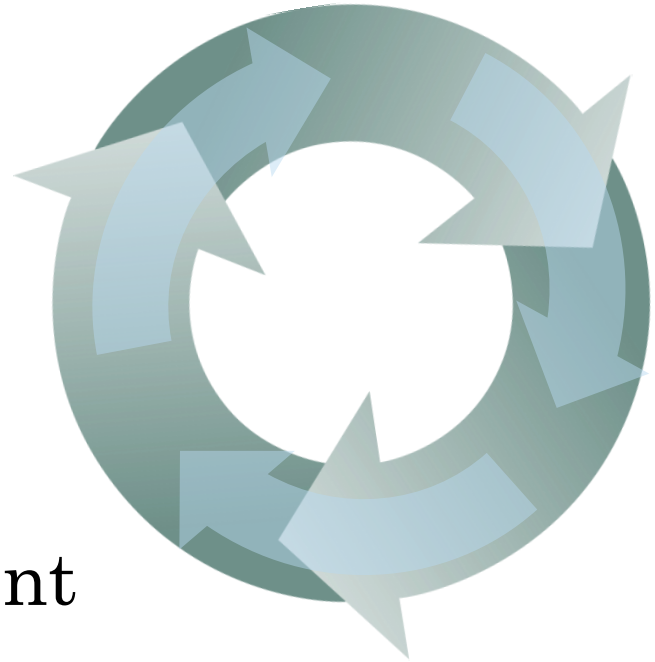
layers

hidden units

learning rates

activation functions

…



Train/dev/test sets

Mismatched train/test distribution

Training set:
Cat pictures from webpages

Dev/test sets:
Cat pictures from users using your app

Not having a test set might be okay. (Only dev set.)

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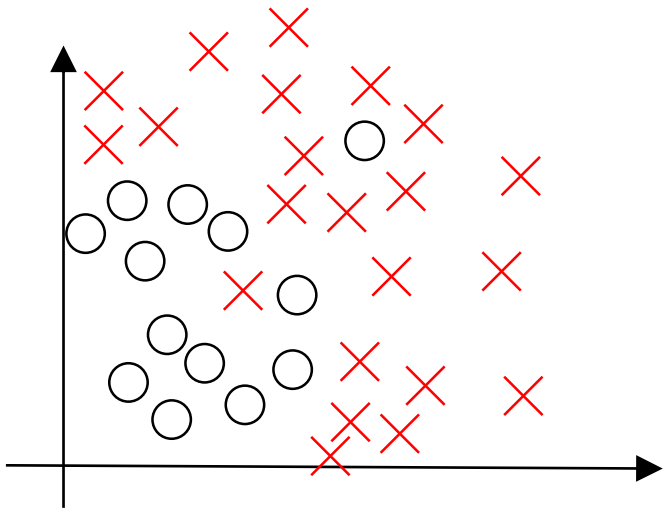
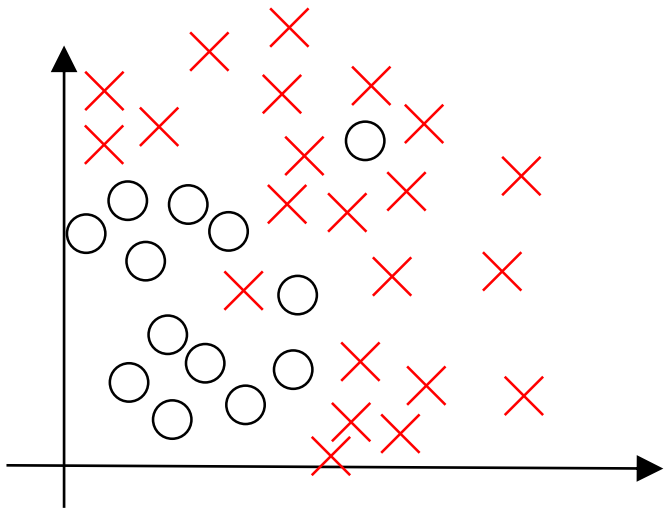
Setting up your ML application

Bias/Variance

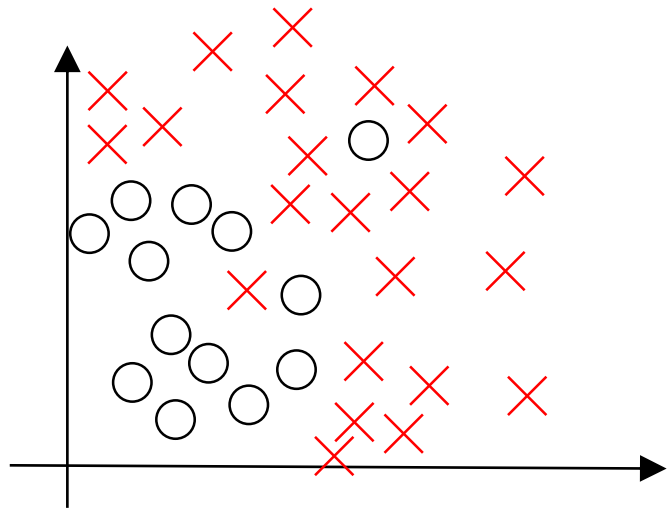
Bias and Variance



high bias



“just right”



high variance

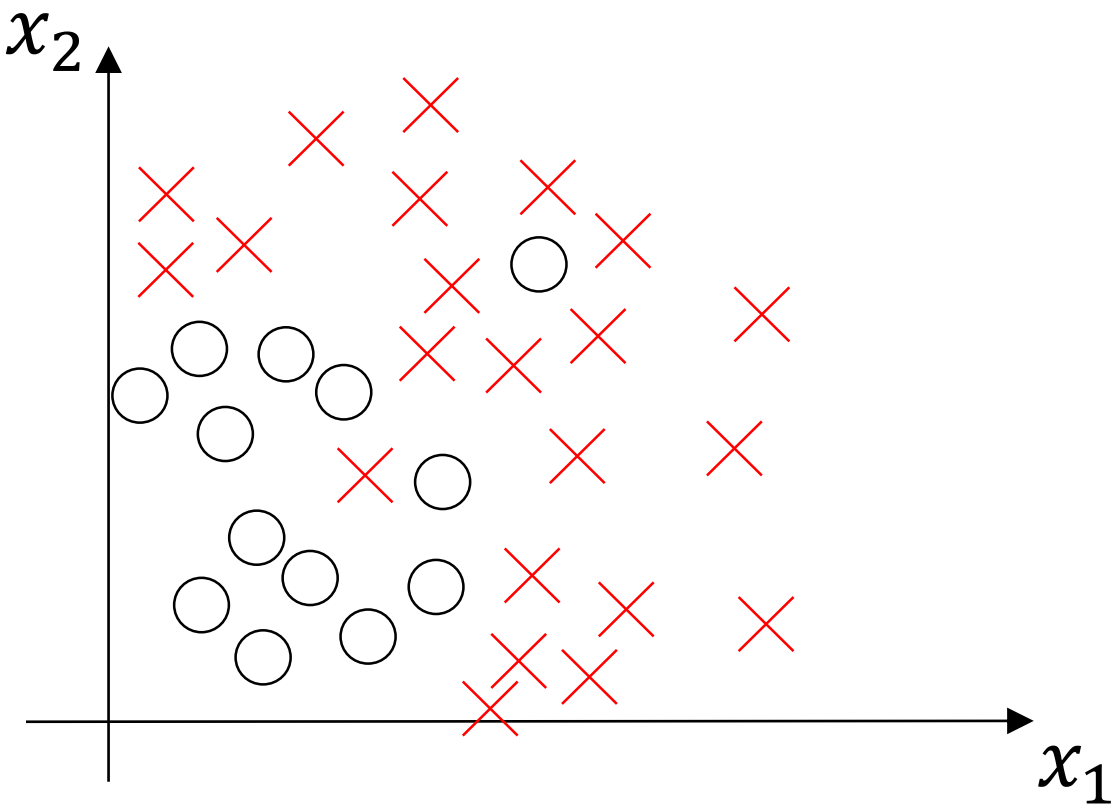
Bias and Variance

Cat classification

Train set error:

Dev set error:

High bias and high variance



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Setting up your ML application

Basic “recipe” for machine learning

Basic “recipe” for machine learning

Basic recipe for machine learning

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Regularizing your neural network

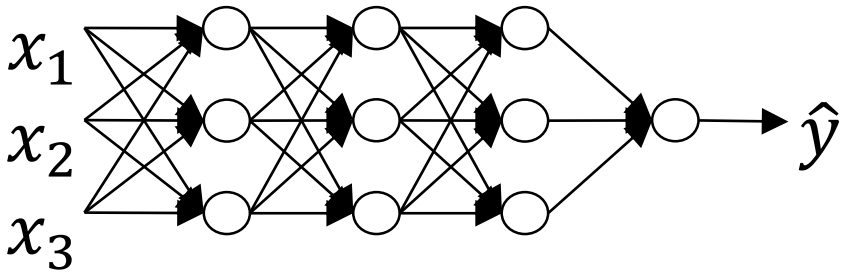
Regularization

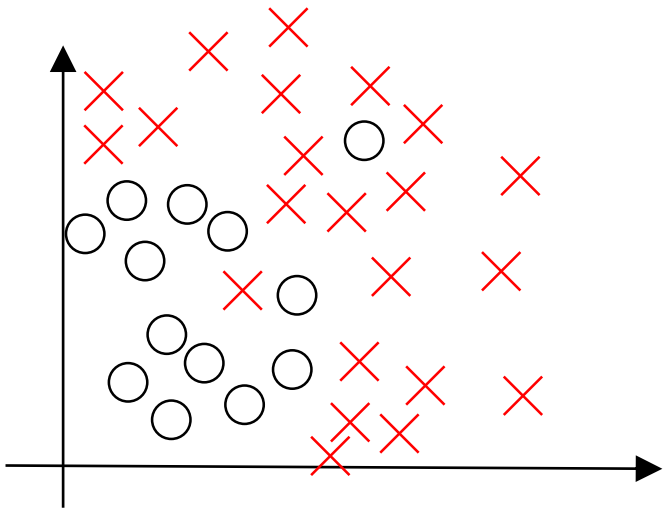
Logistic regression

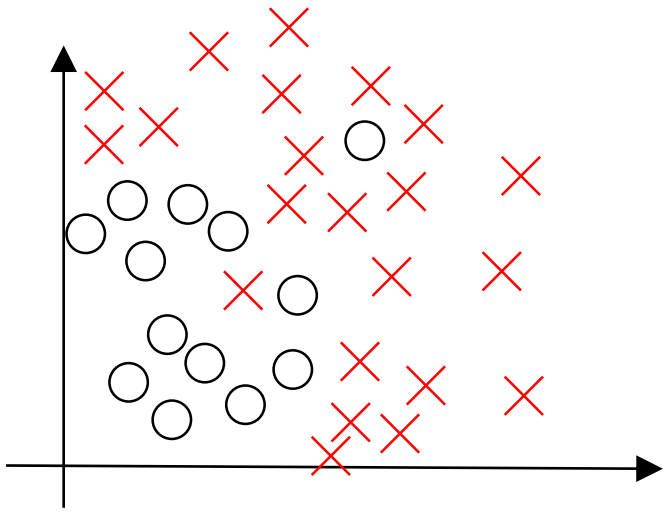
$$\min_{w,b} J(w,b)$$

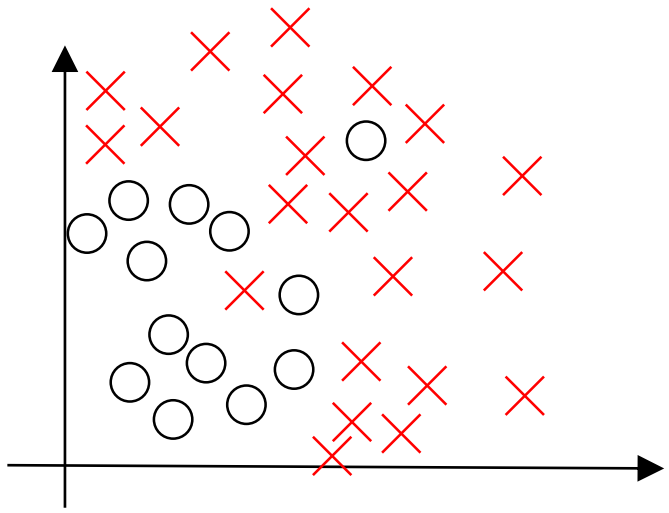
Neural network

How does regularization prevent overfitting?









How does regularization prevent overfitting?

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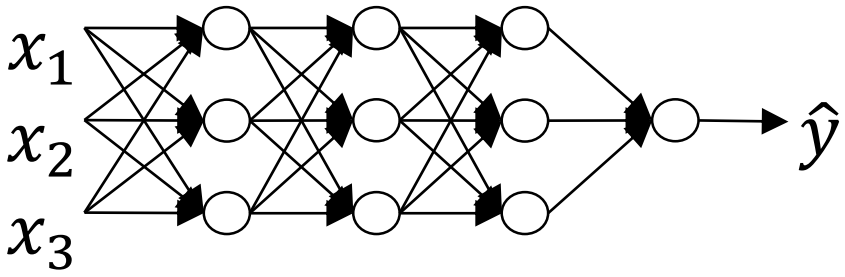
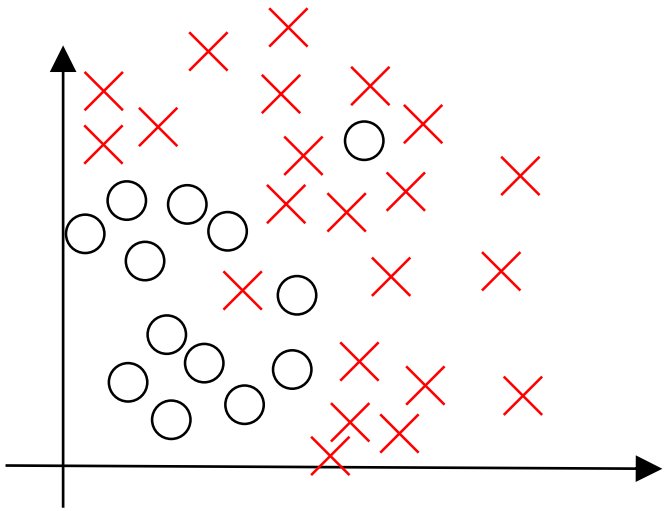
Regularizing your neural network

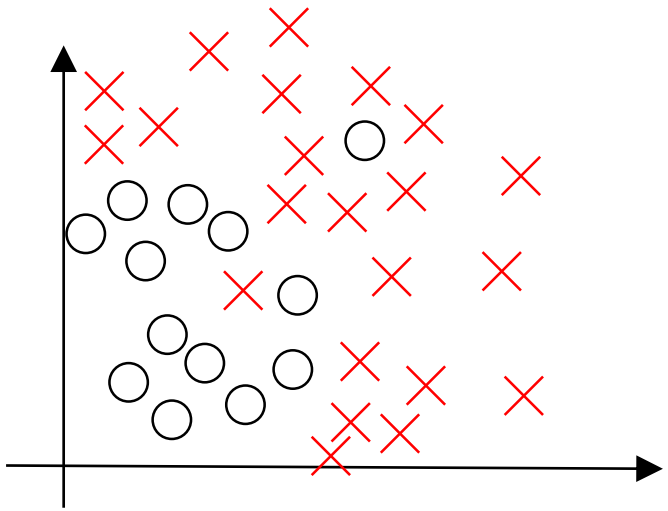
Why regularization reduces overfitting

How does regularization prevent overfitting?

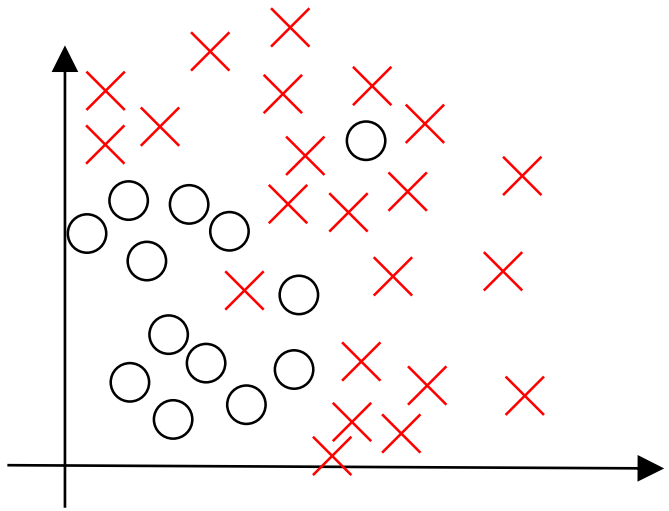




high bias



“just right”



high variance

How does regularization prevent overfitting?

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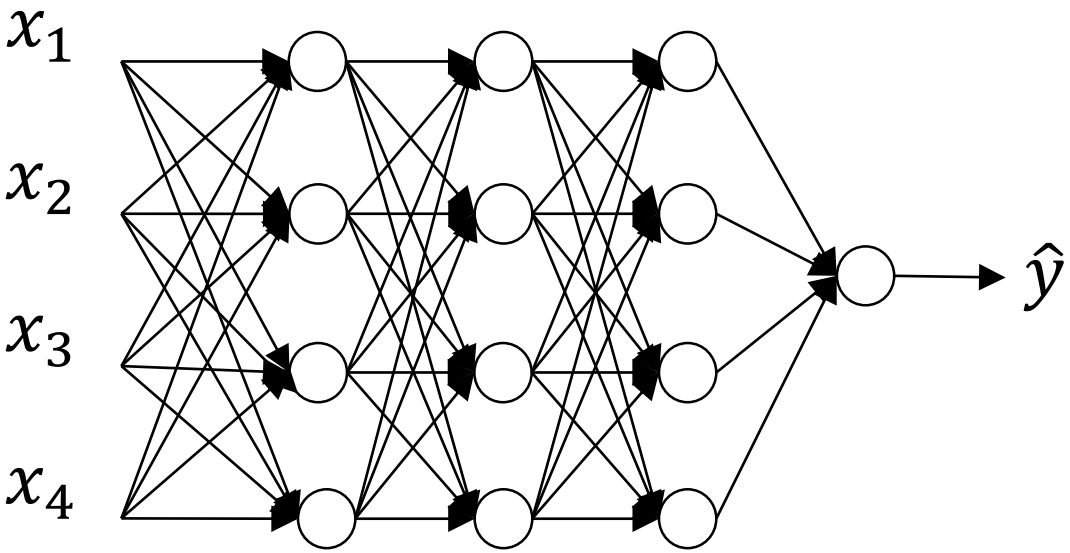
Regularizing your neural network

Dropout regularization

Dropout regularization



Implementing dropout (“Inverted dropout”)

Making predictions at test time

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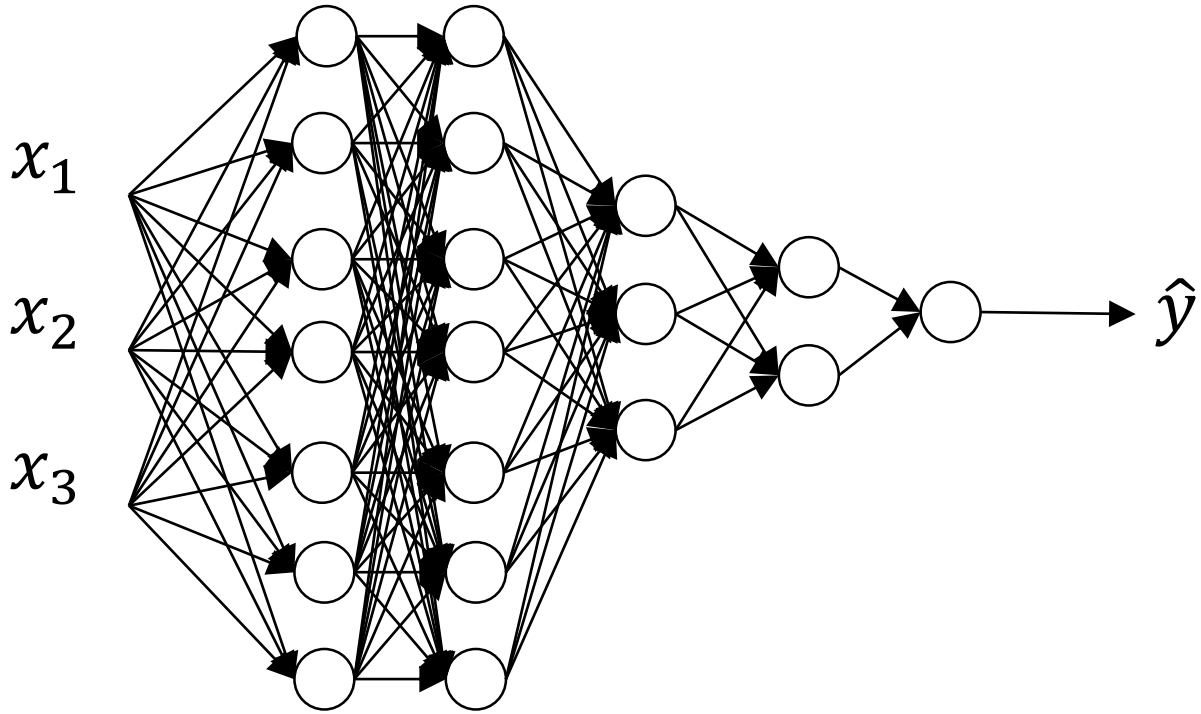
Regularizing your neural network

Understanding dropout

Why does drop-out work?

Intuition: Can't rely on any one feature, so have to spread out weights.



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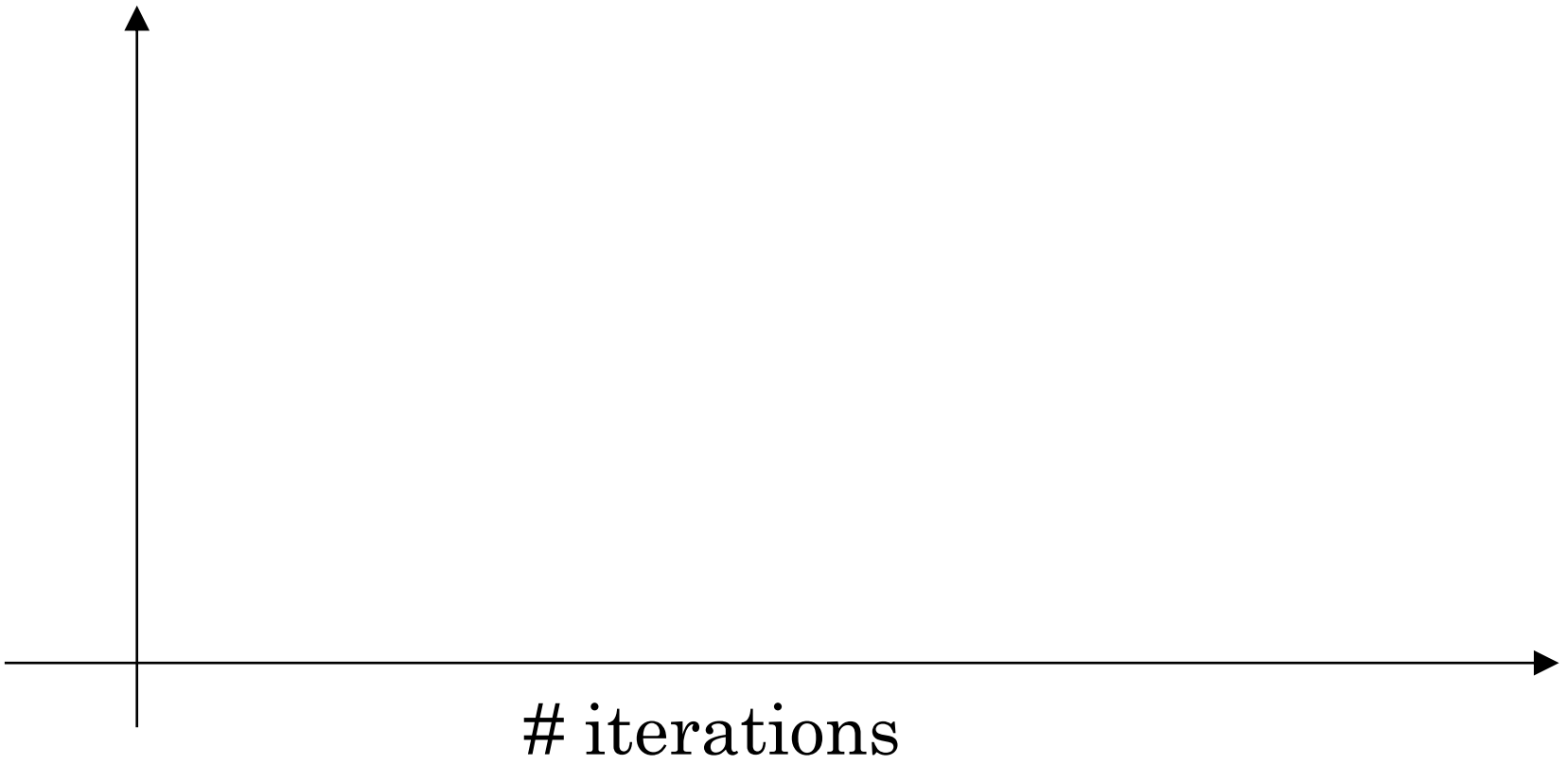
Regularizing your neural network

Other regularization methods

Data augmentation

4

Early stopping



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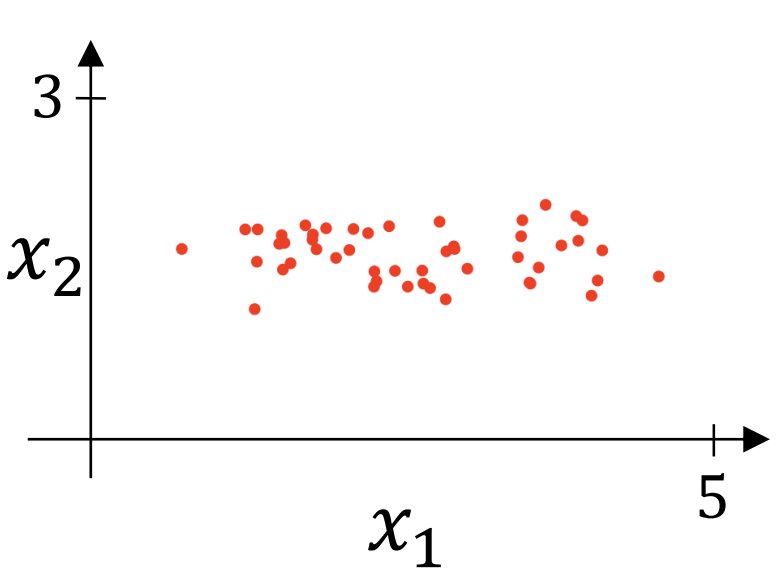
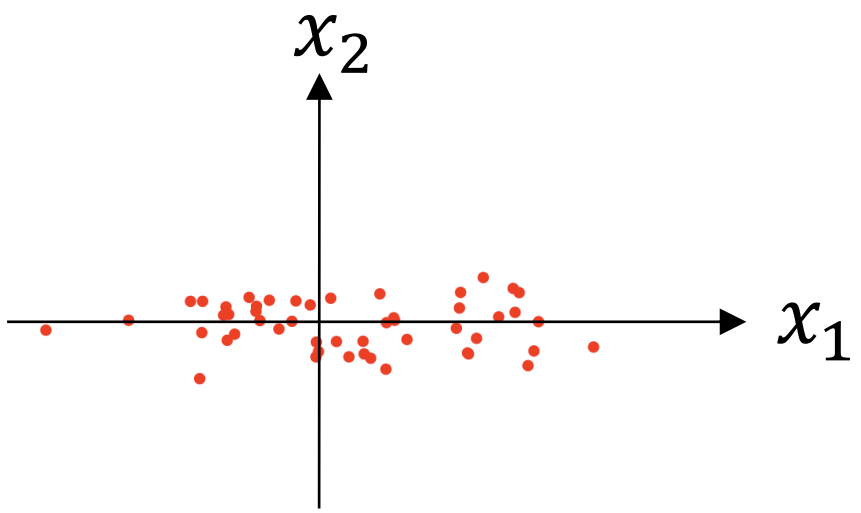
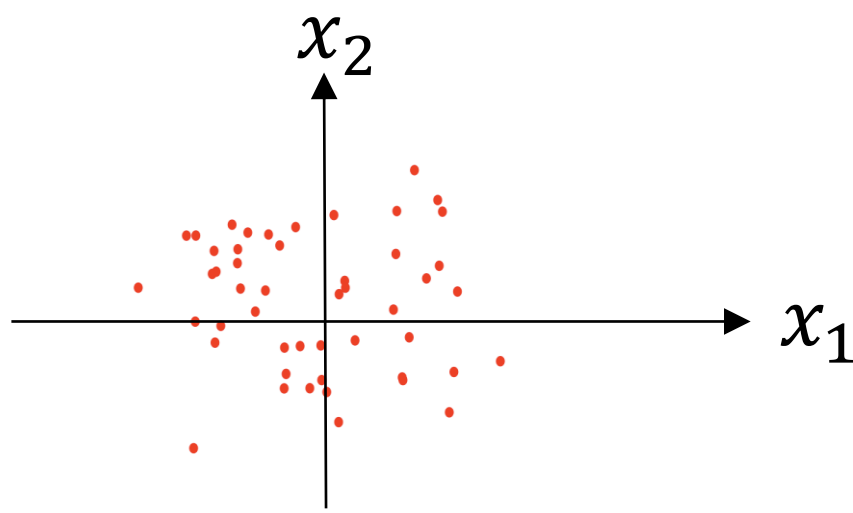
Setting up your optimization problem

Normalizing inputs

Normalizing training sets



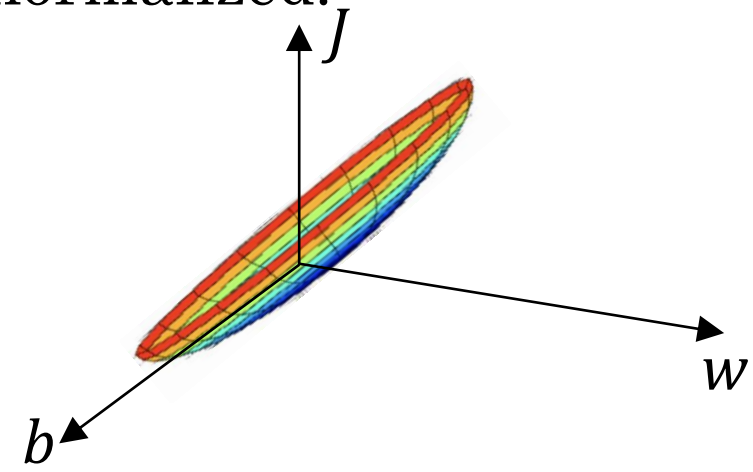


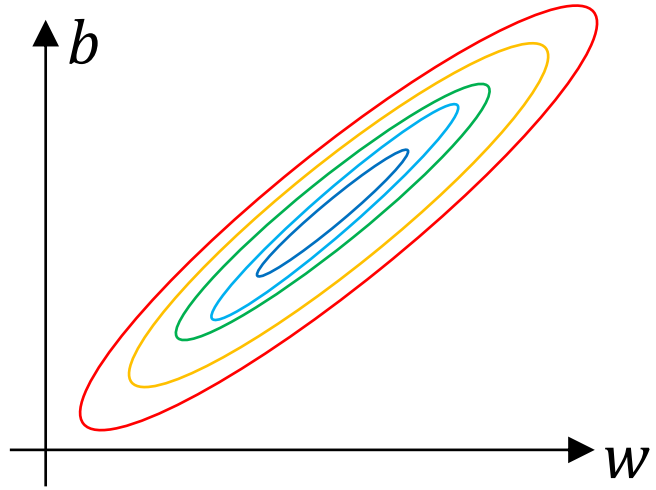


Why normalize inputs?

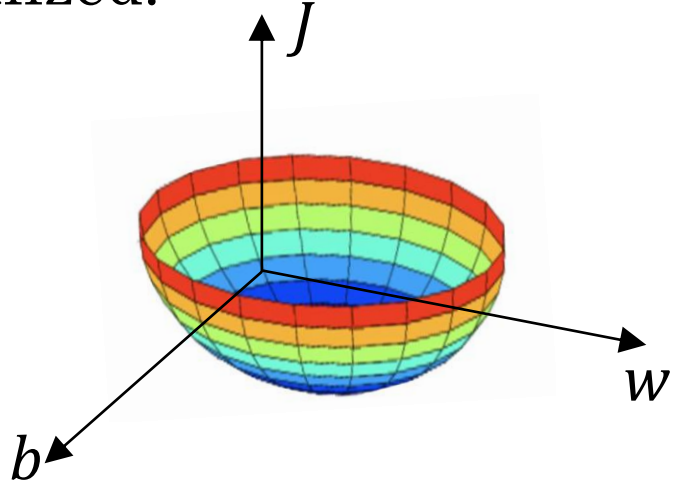
$$J(w,b) = \frac{1}{m}\sum_{i=1}^{m} \mathcal{L}\left(\hat{y}^{(i)}, y^{(i)}\right)$$

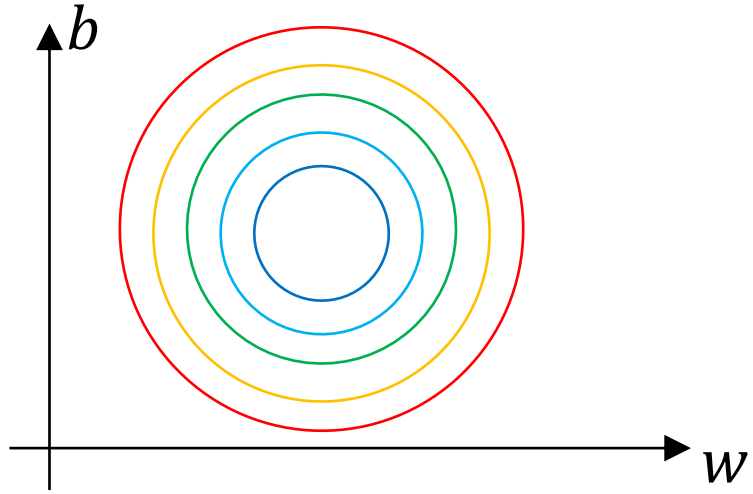
Unnormalized:





Normalized:





Andrew Ng

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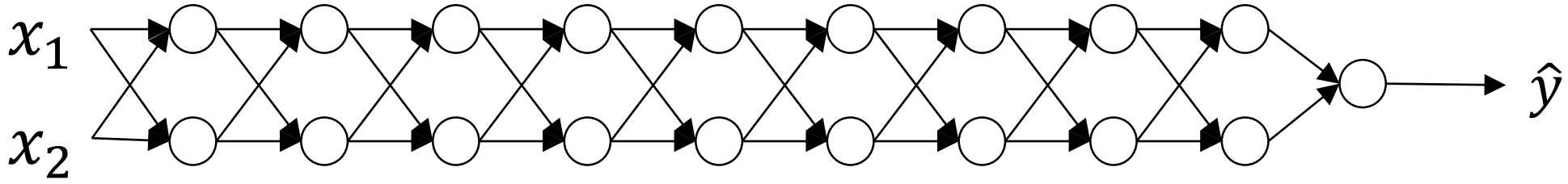
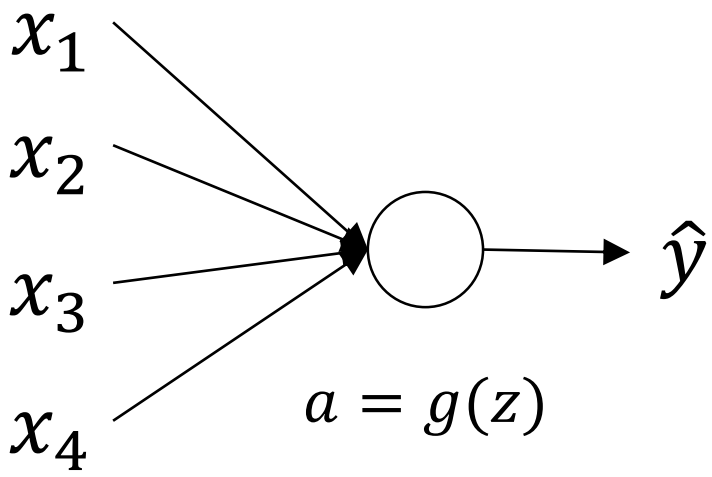
Setting up your optimization problem

Vanishing/exploding gradients

Vanishing/exploding gradients



Single neuron example



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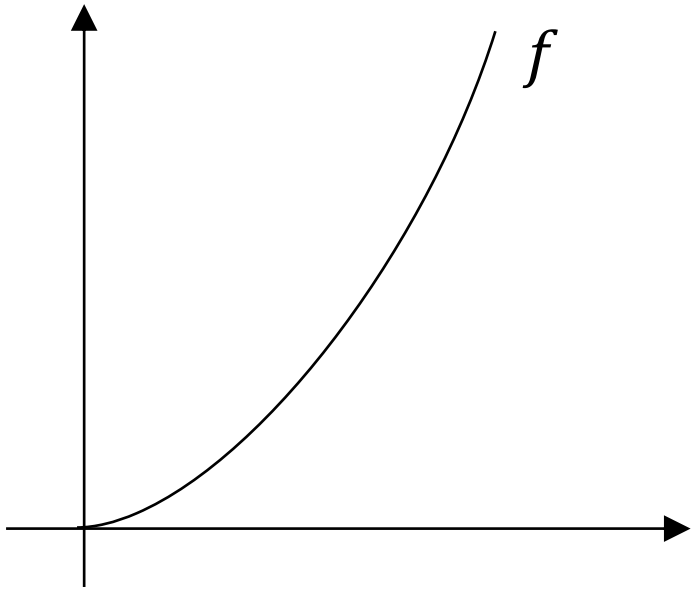
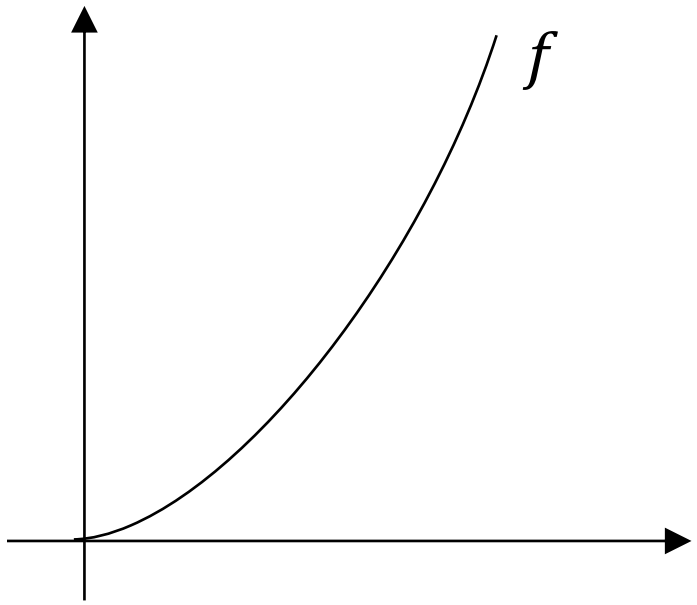
Setting up your optimization problem

Numerical approximation of gradients

Checking your derivative computation



Checking your derivative computation



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Setting up your optimization problem

Gradient Checking

Gradient check for a neural network

Take $W^{[1]}, b^{[1]}, \ldots, W^{[L]}, b^{[L]}$ and reshape into a big vector θ.

Take $dW^{[1]}, db^{[1]}, \ldots, dW^{[L]}, db^{[L]}$ and reshape into a big vector $d\theta$.

Gradient checking (Grad check)

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Setting up your optimization problem

Gradient Checking implementation notes

Gradient checking implementation notes

- Don’t use in training – only to debug

- If algorithm fails grad check, look at components to try to identify bug.

- Remember regularization.

- Doesn’t work with dropout.

- Run at random initialization; perhaps again after some training.