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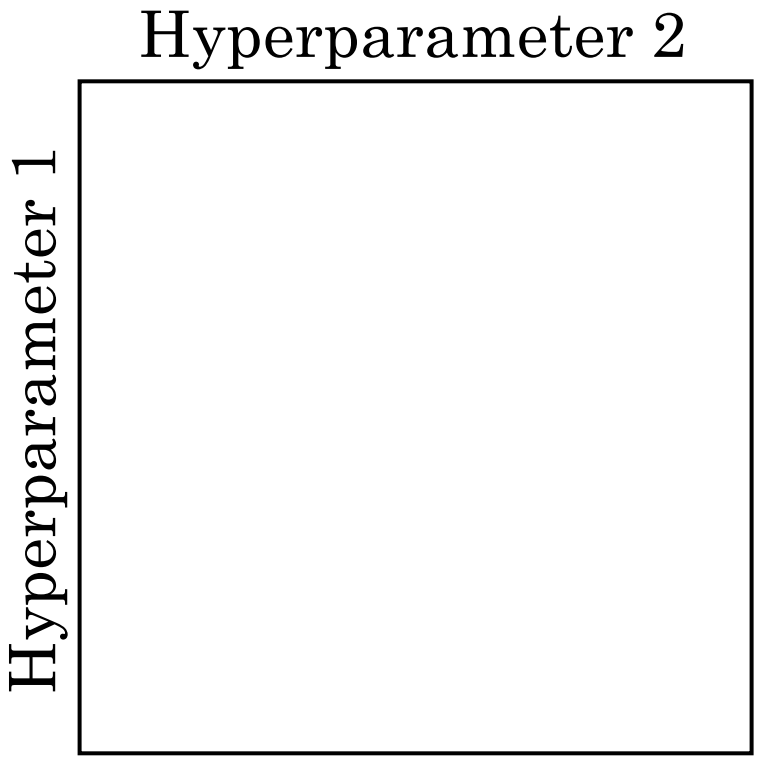
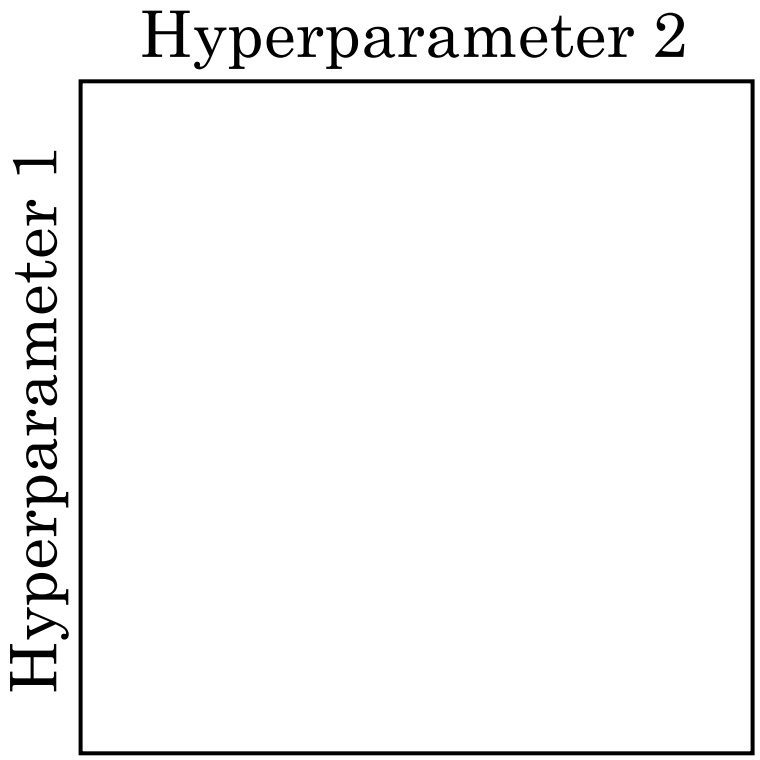
Hyperparameter tuning

Tuning process

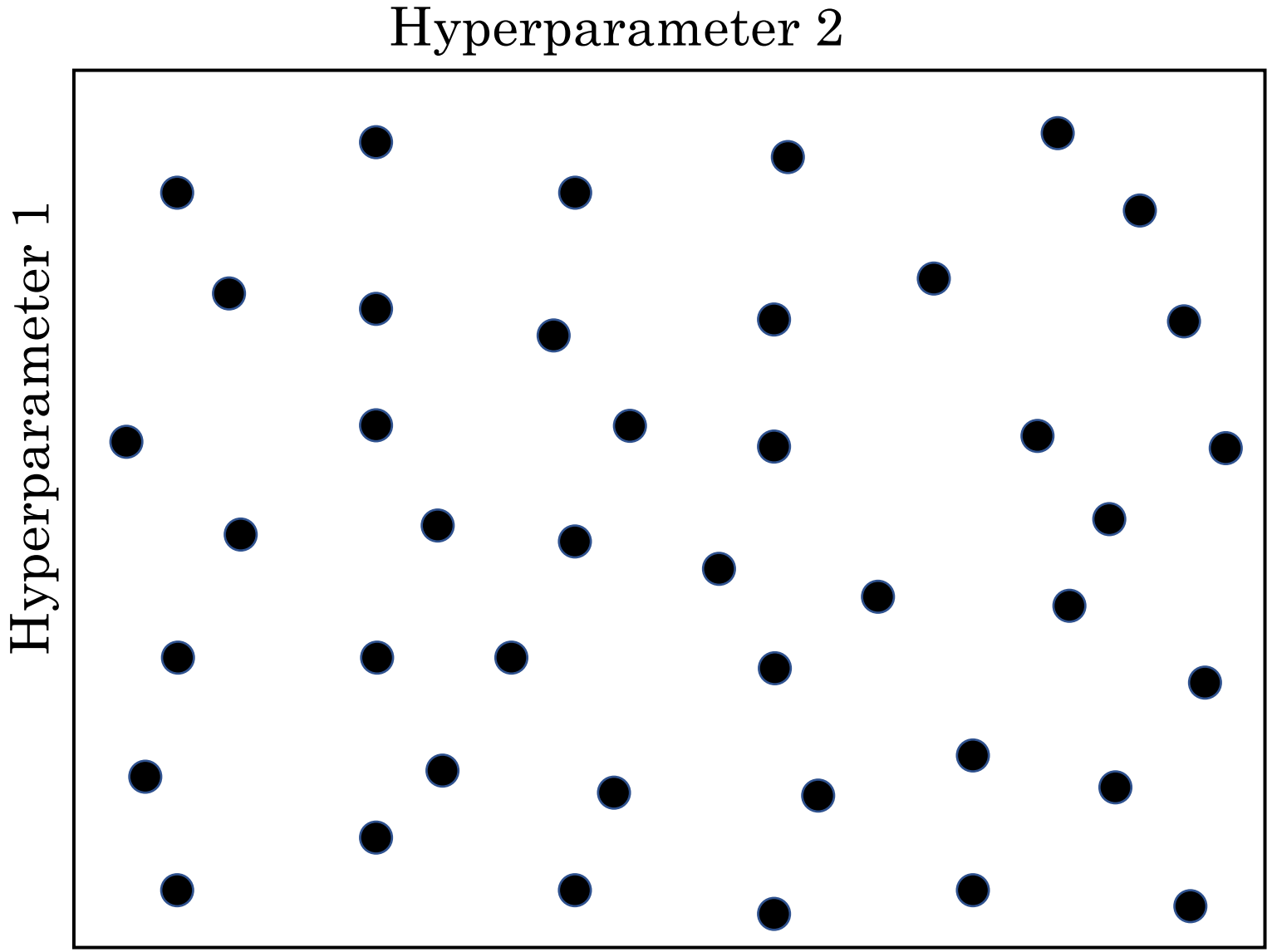
Hyperparameters

Try random values: Don’t use a grid





Coarse to fine



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Hyperparameter tuning

Using an appropriate scale to pick hyperparameters

Picking hyperparameters at random

Appropriate scale for hyperparameters

Hyperparameters for exponentially weighted averages

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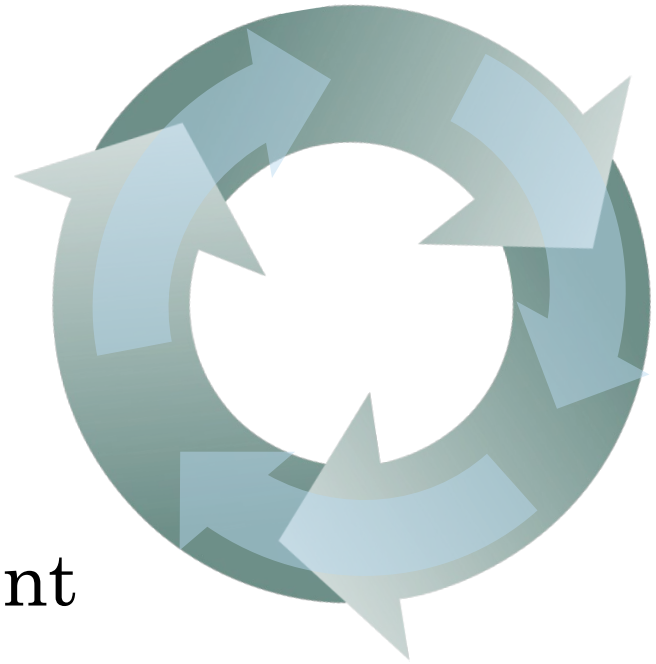
Hyperparameters tuning in practice: Pandas vs. Caviar

Re-test hyperparameters occasionally

Idea



Experiment

Code

- NLP, Vision, Speech, Ads, logistics, ….

- Intuitions do get stale. Re-evaluate occasionally.

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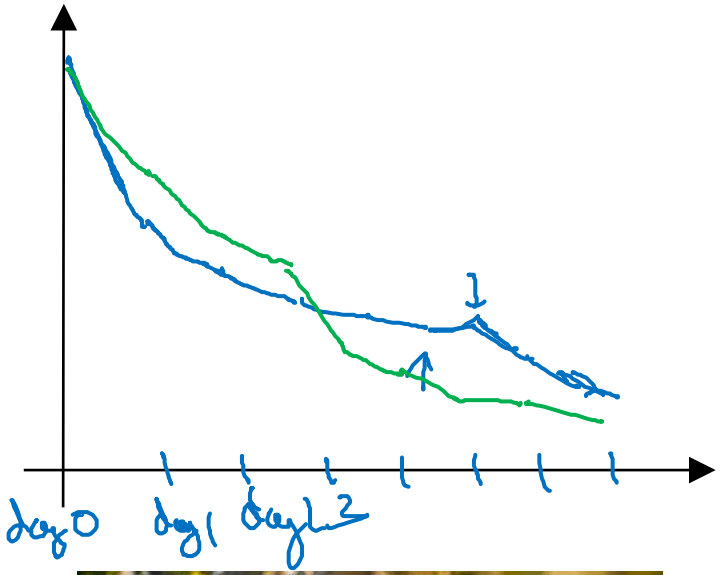
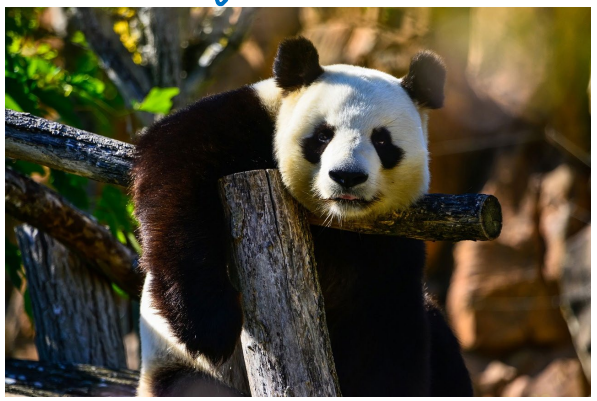
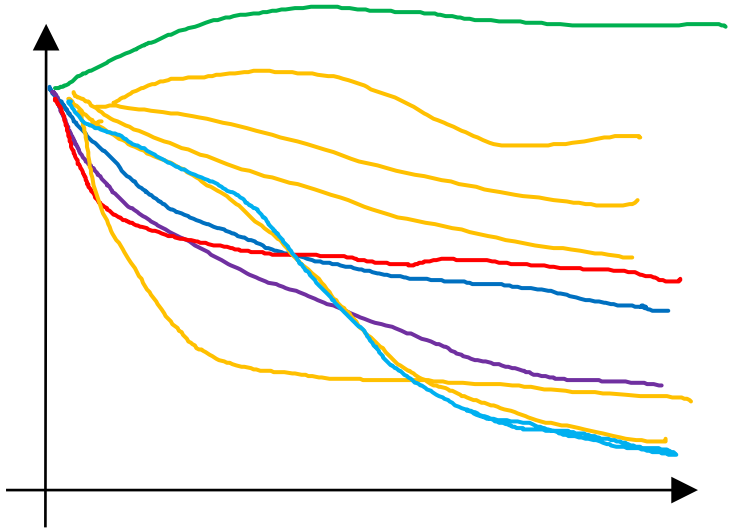
Babysitting one model





Panda

Training many models in parallel



Caviar

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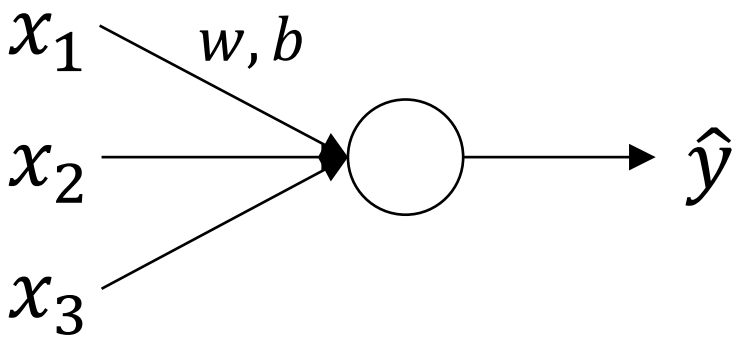
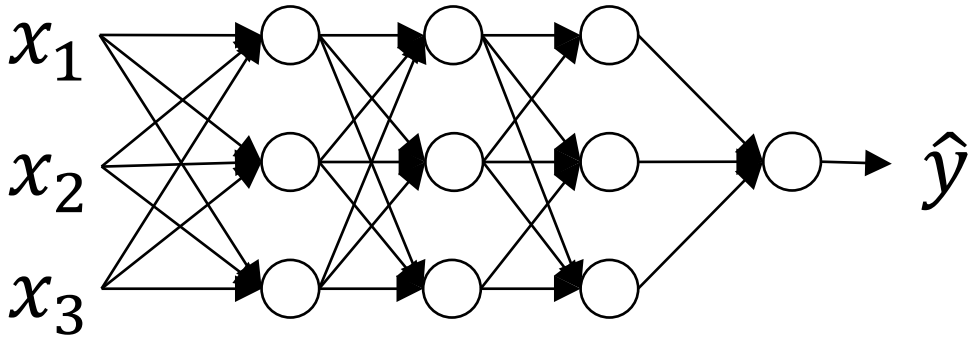
Batch Normalization

Normalizing activations in a network

Normalizing inputs to speed up learning





Implementing Batch Norm

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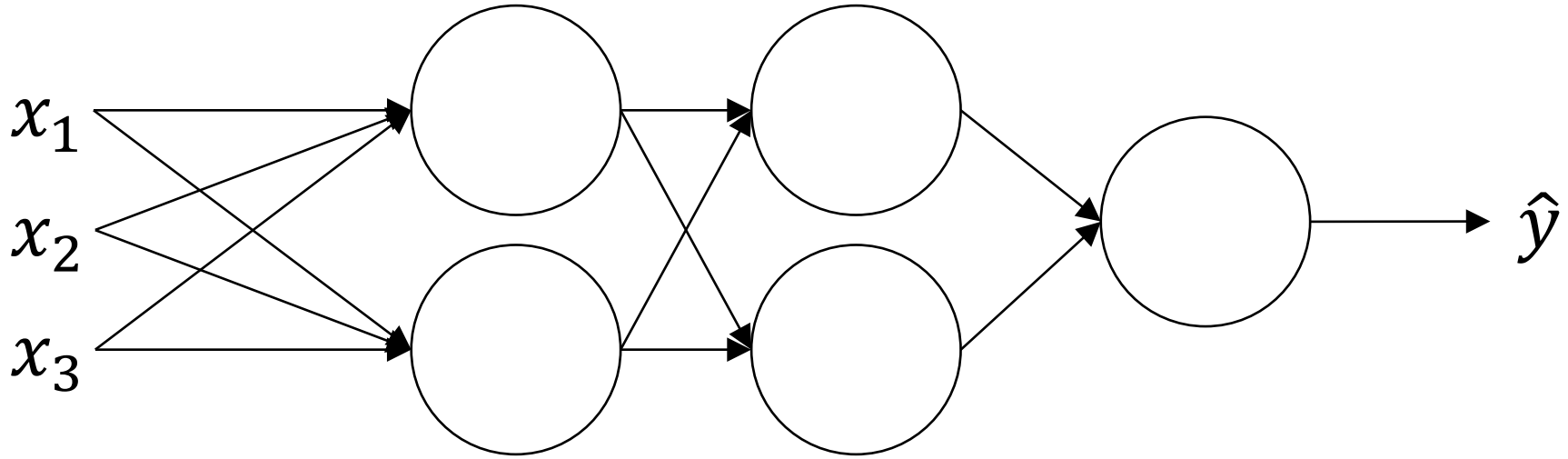
Batch Normalization

Fitting Batch Norm into a neural network

Adding Batch Norm to a network



Working with mini-batches

Implementing gradient descent

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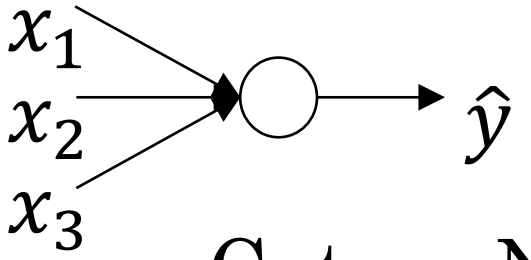
Batch Normalization

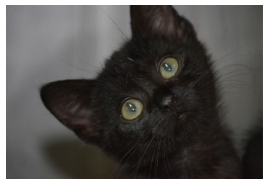
Why does Batch Norm work?

Learning on shifting input distribution



Cat
$y = 1$

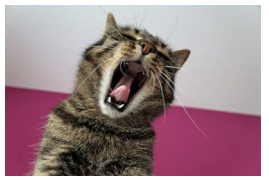


Non-Cat
$y = 0$

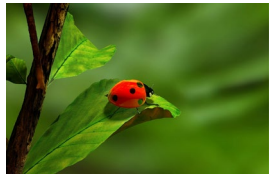



$y = 1$

$y = 0$



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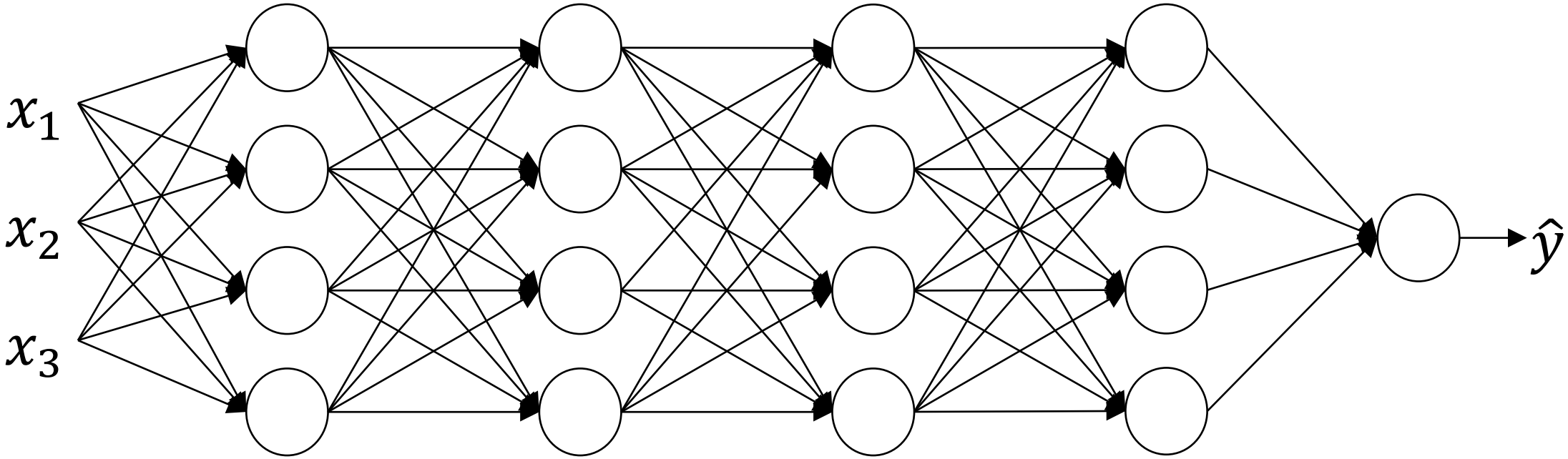
Why this is a problem with neural networks?



Batch Norm as regularization

- Each mini-batch is scaled by the mean/variance computed on just that mini-batch.
- This adds some noise to the values $z^{[l]}$ within that minibatch. So similar to dropout, it adds some noise to each hidden layer's activations.
- This has a slight regularization effect.

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Batch Normalization

Batch Norm at test time

Batch Norm at test time

$$\mu = \frac{1}{m}\sum_i z^{(i)}$$

$$\sigma^2 = \frac{1}{m}\sum_i (z^{(i)} - \mu)^2$$

$$z^{(i)}_{\text{norm}} = \frac{z^{(i)} - \mu}{\sqrt{\sigma^2 + \varepsilon}}$$

$$\tilde{z}^{(i)} = \gamma z^{(i)}_{\text{norm}} + \beta$$

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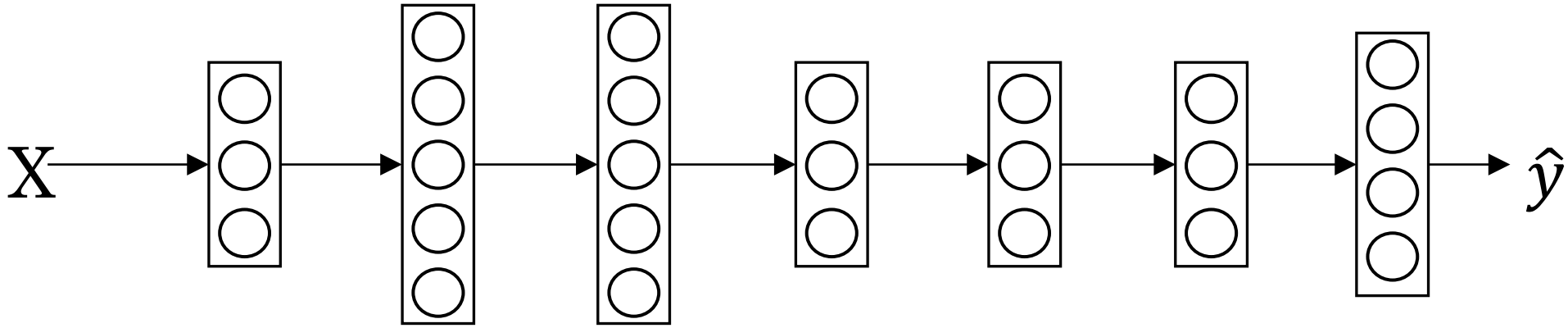
Multi-class classification

Trying a softmax classifier

Understanding softmax

Loss function

Summary of softmax classifier



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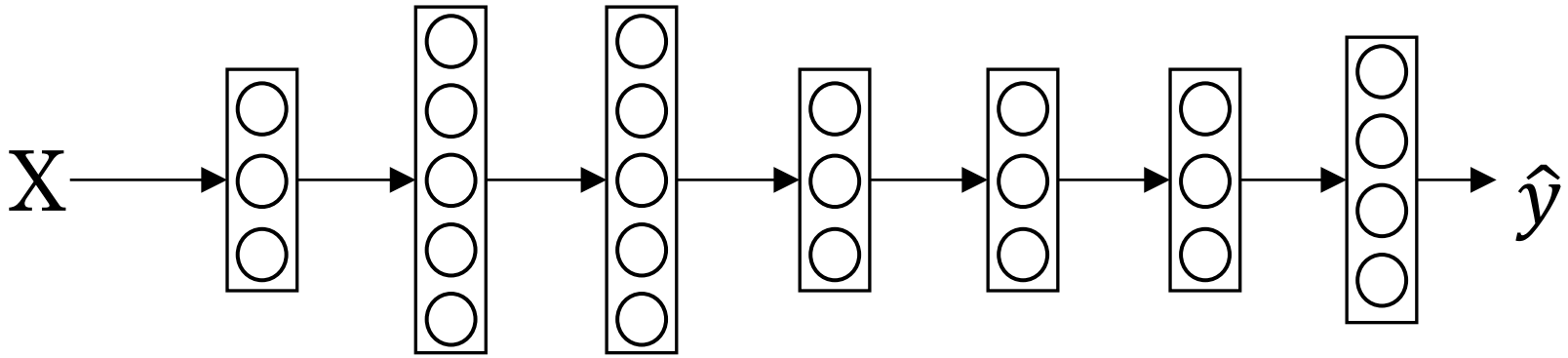
Multi-class classification

Softmax regression

Recognizing cats, dogs, and baby chicks

3 1 2 0 3 2 0 1



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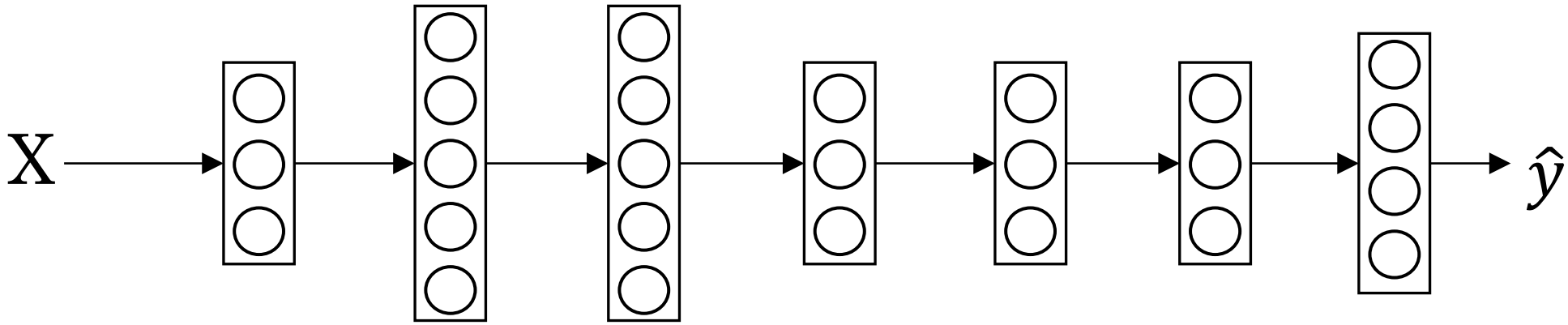
Softmax layer



Softmax examples