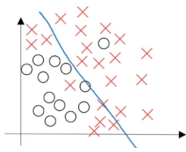


# Deep Neural Networks Fine Tuning

## Step1 - Diagnose

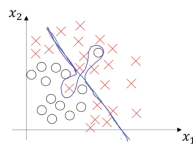
🎯 Check what are the weaknesses and how to proceed



High Bias/Underfitting

High train error (\*Ex: 20%)

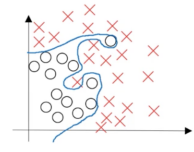
High test error (Ex: 19%)



High Variance & High Bias

High train error (Ex: 15%)

Very high test error (Ex: 30%)



High Variance/Overfitting

Low train error (Ex: 1%)

High test error (Ex: 10%)

(\*) The high and low values are provided as examples. You need to adapt them to your problem and your optimal error.  
In this case we are assuming that the optimal error is  $\approx 0\%$  (Ex: human image classification)

## Step2 - Basic actions

🎯 Reduce Underfitting and then reduce Overfitting

### Reduce Underfitting

Try a bigger Network  
Train the model longer  
Change the Network architecture

Then

### Reduce Overfitting

Get more training data  
Apply Regularization (Step3)  
Change Network architecture

## Step3 – Regularization

🎯 Reduce Overfitting more

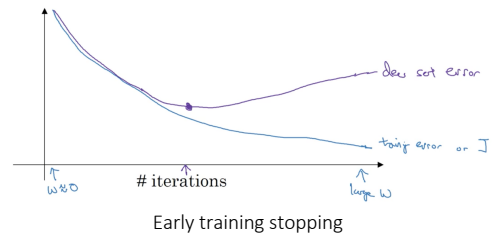
L2 Regularization - The most common

L1 Regularization - Less memory usage

Dropout - Uses random nodes removal

Data augmentation - Ex: *flipping images*

Early training stopping



Early training stopping

## Step4 – Optimization

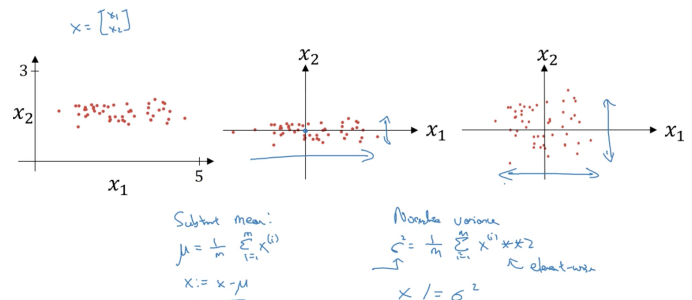
🎯 Reduce training time

### Input normalization

Step1: Subtracting the mean

Step2: Normalizing the variance

### Random weights initialization



Input normalization