

DEEP LEARNING

Trainer : **Dr. Darshan Ingle**

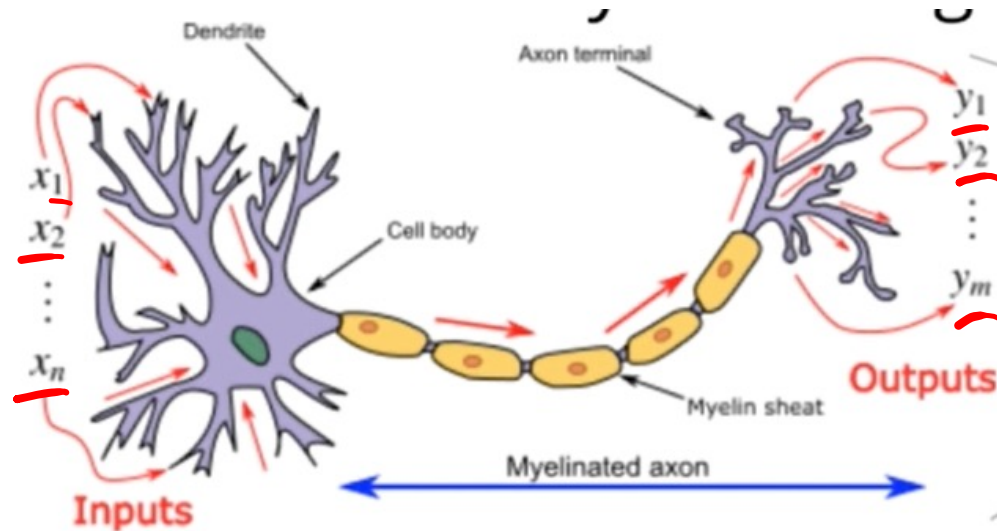


Darshan

Artificial Neural Network (ANN)

Where do ANN come from?

are artificial, then what is non-artificial NN?



Neuron: cells in
our brain



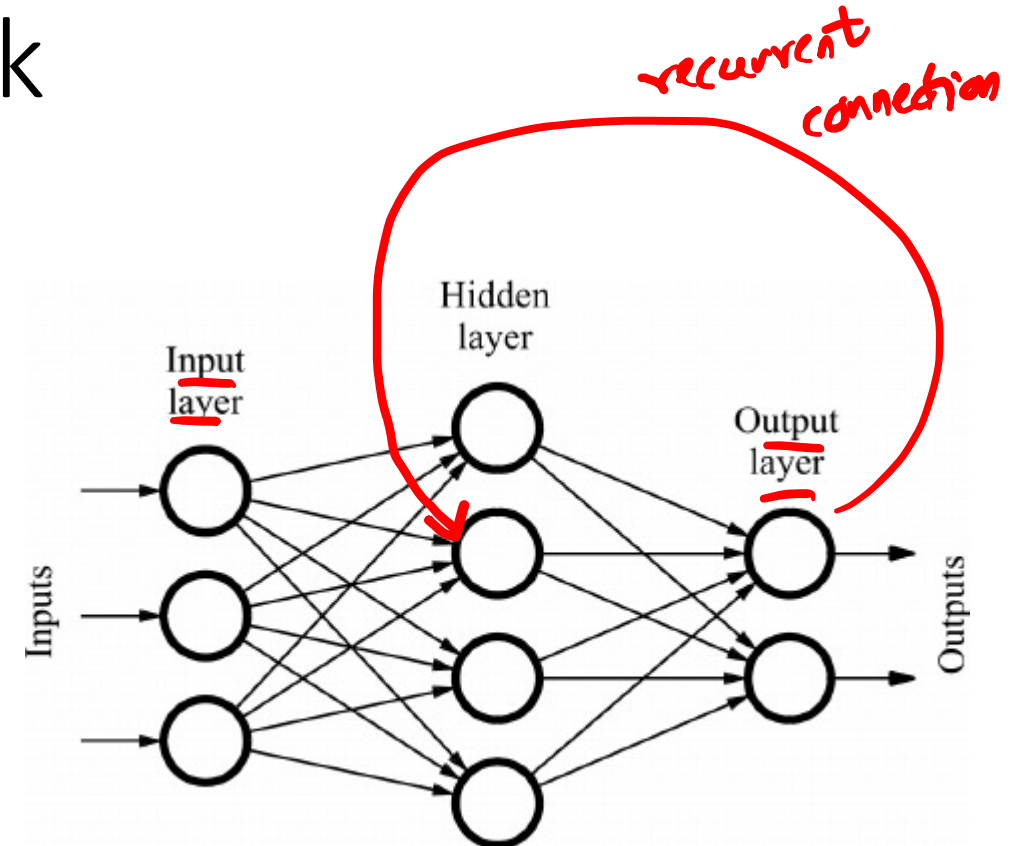
The obvious question

- We know that brain is made up of neurons, and we also know how neurons work (and thus can simulate them)
- It thus makes sense to ask: “Can we build brain?”
- If we connect a bunch of neurons together, will intelligence suddenly emerge?
- If so, it would be an Artificial Intelligence.

Feed Forward Neural Network

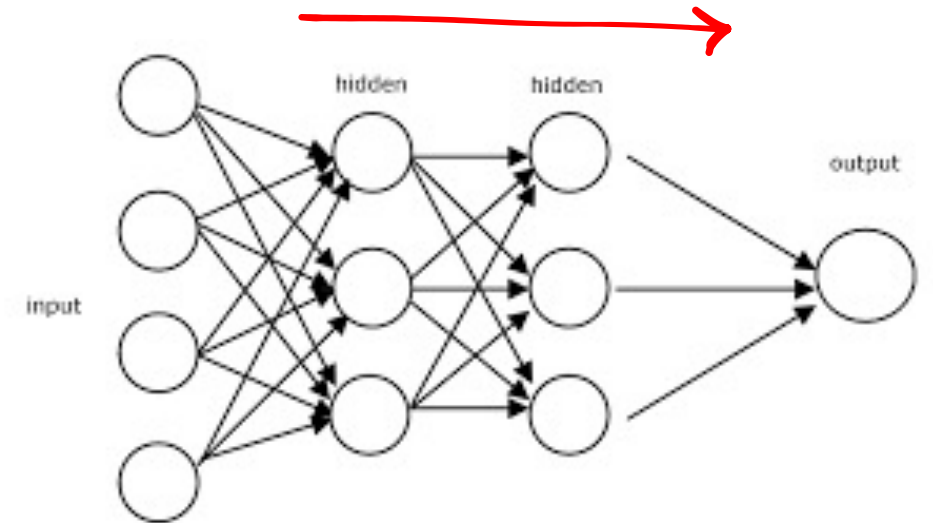
Simplistic

Real brain: Wires can be "Crisscross."



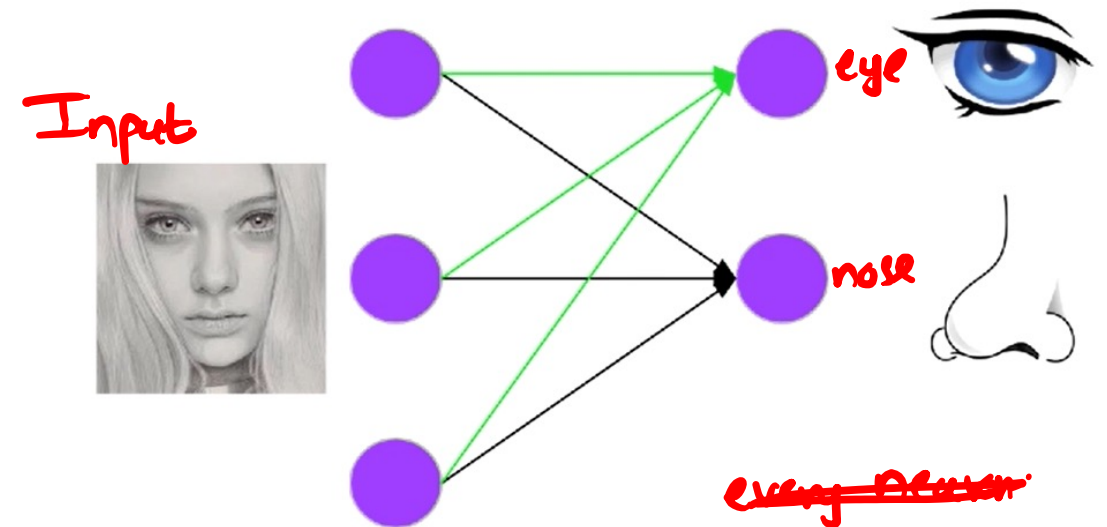
Forward Propagation

Model → is created to make predictions.



Repeating the single neuron

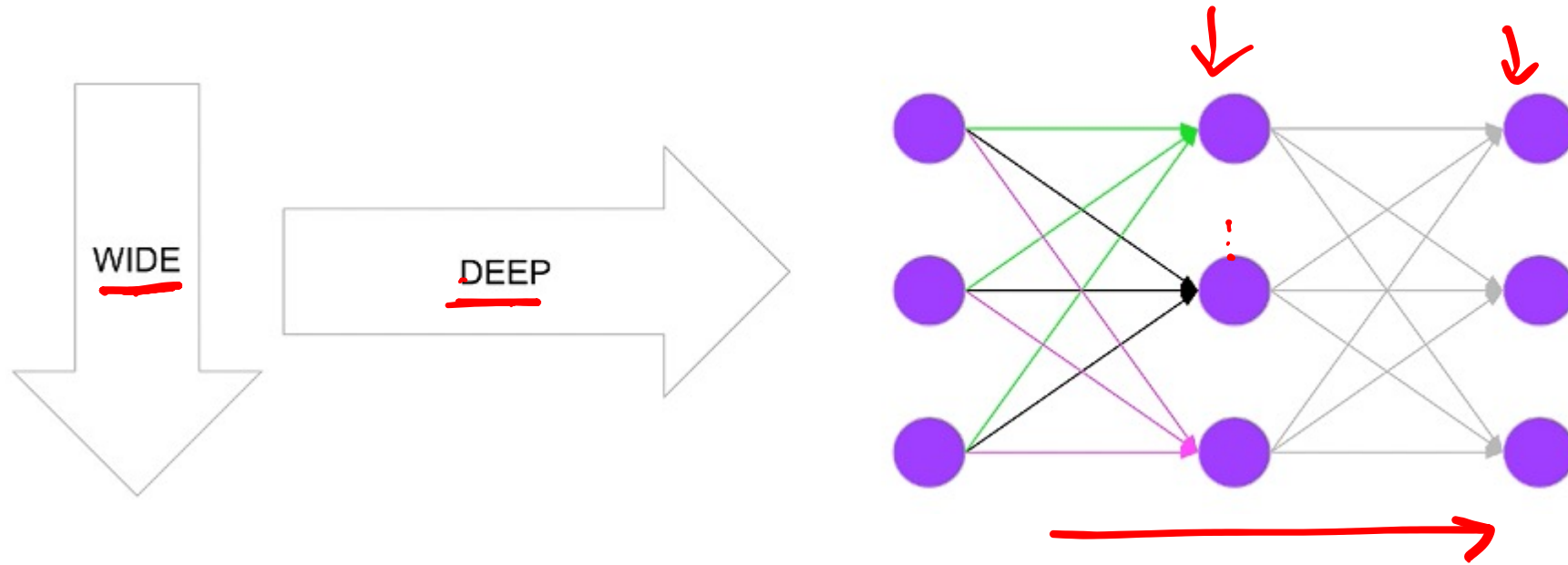
- Each of these neurons may be calculating something different, via different weights



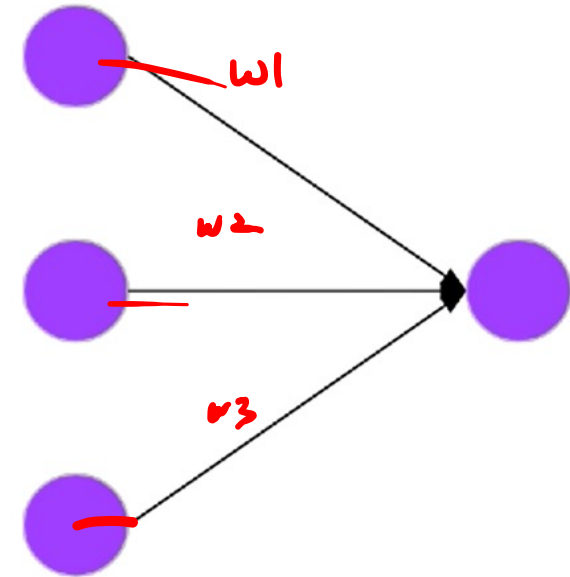
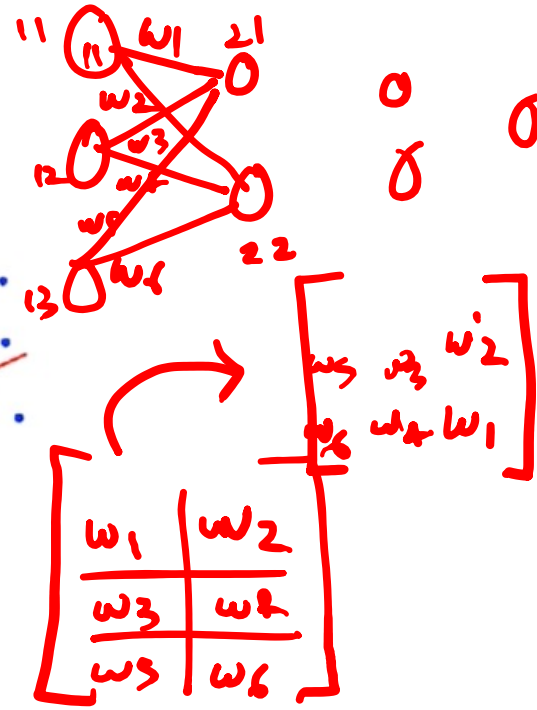
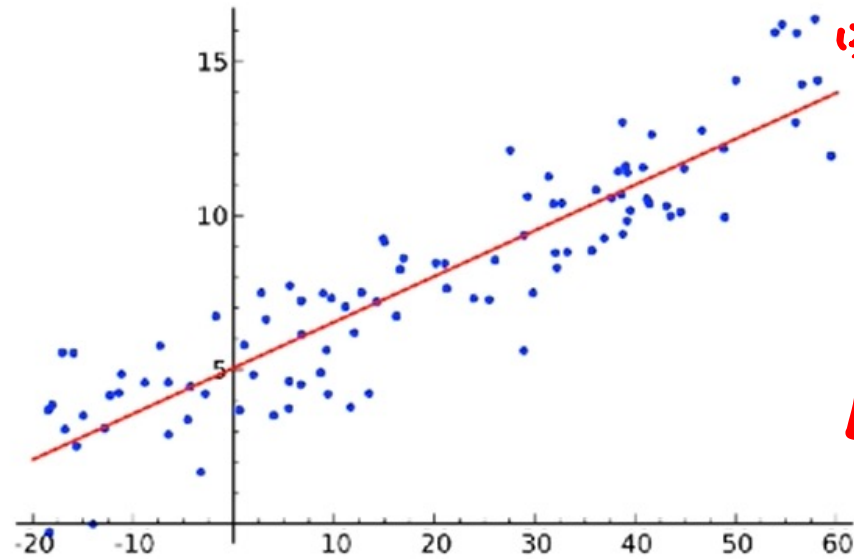
~~every neuron~~
each neuron is
looking for
different
features

Two important ways to extend a single neuron

1. The same inputs can be fed to multiple different neurons, each calculating something different (more neurons per layer)
2. Neurons in one layer can act as inputs to another layer



Lines to Neurons



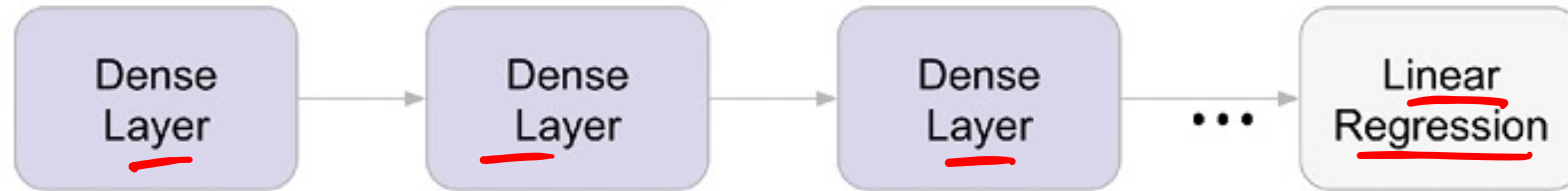
A line : $ax + b$

A neuron : $\sigma(w^T x + b)$

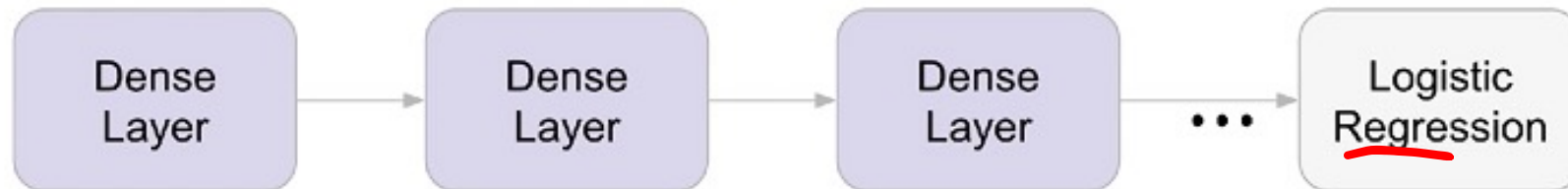
Another perspective

- Each neural network is a feature transformation

Regression:

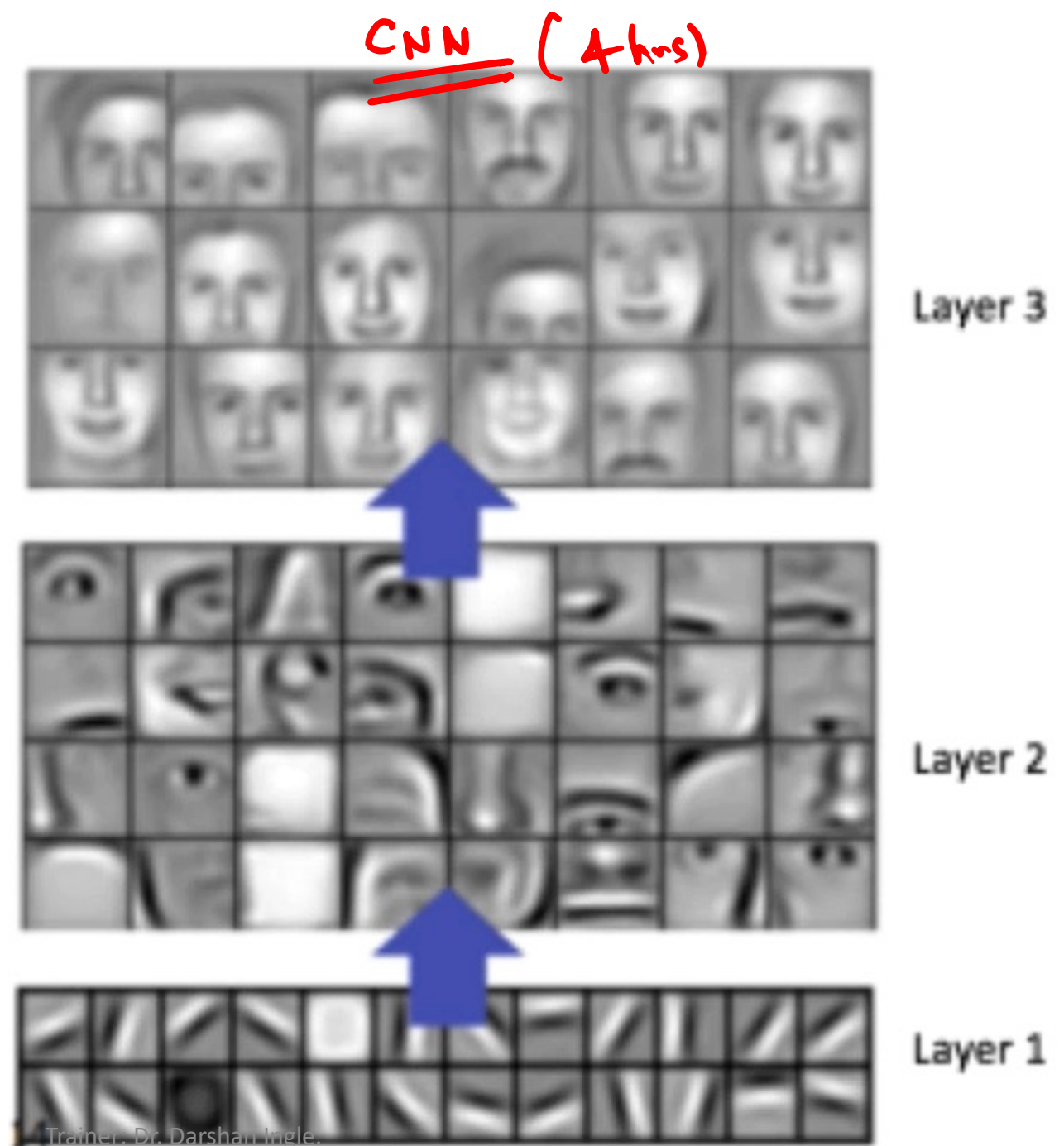


Classification:



Feature hierarchies

- Researchers noticed that each layer learns increasingly complex features

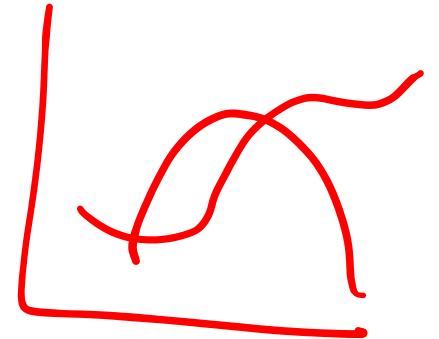
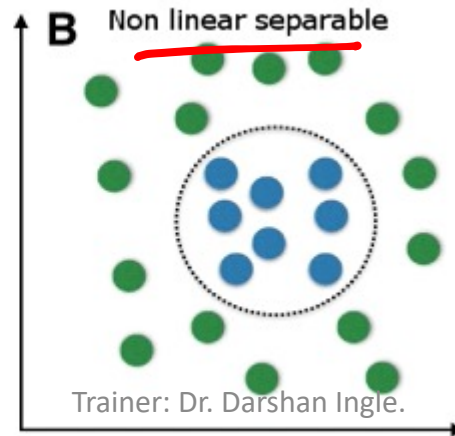
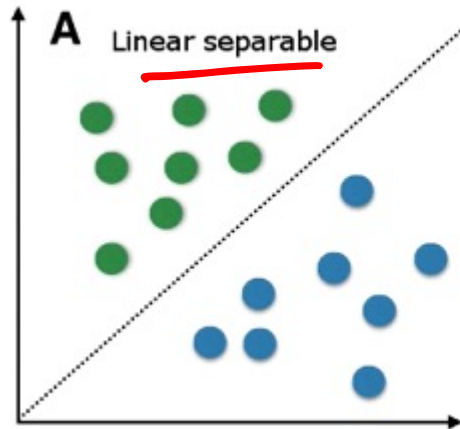


The Geometric Picture

- ML is nothing but a geometry problem
- Why are Neural Network so important?
- Why cant we just use a single neuron?
- The neuron is nice and interpretable
- Large weights = important feature
- Small weights = not important feature
- Unfortunately, the neuron (linear model) is not very expensive
- But true learning doesn't happen with a single neuron

Making the line more complicated

- 2 ways to make our problem more complicated than “finding a line”
 1. Adding more input dimensions $D=14$
 2. “Make the pattern non linear” (This is what we are concerned with now)
*adding more layers &
adding more neurons in each layer*



TensorFlow Playground

- <https://playground.tensorflow.org/#activation=tanh&batchSize=10&dataset=circle®Dataset=reg-plane&learningRate=0.03®ularizationRate=0&noise=0&networkShape=4,2&seed=0.33964&showTestData=false&discretize=false&percTrainData=50&x=true&y=true&xTimesY=false&xSquared=false&ySquared=false&cosX=false&sinX=false&cosY=false&sinY=false&collectStats=false&problem=classification&initZero=false&hideText=false>