Intro to

# Deep Learning

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KMCE | DL 2024-25

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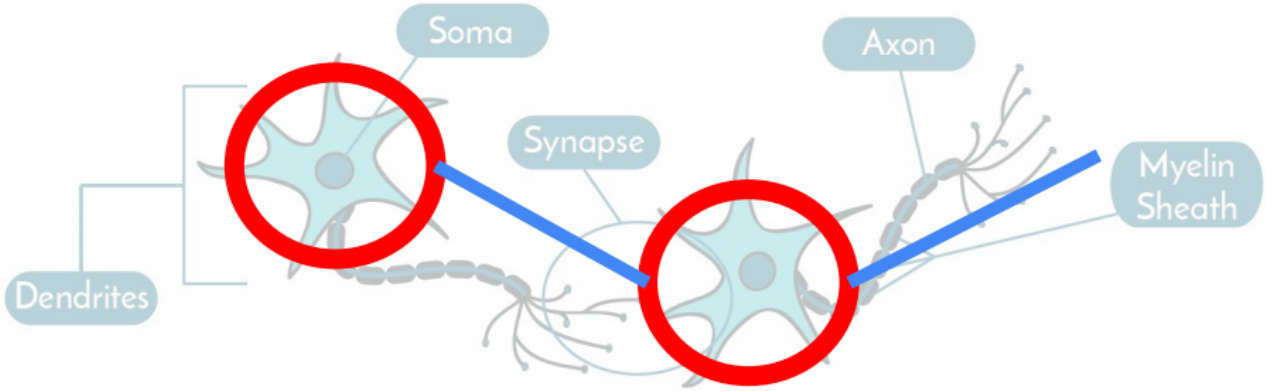
2. Required **mathematics**
3. Basics of **Deep Learning**

Chapter #1

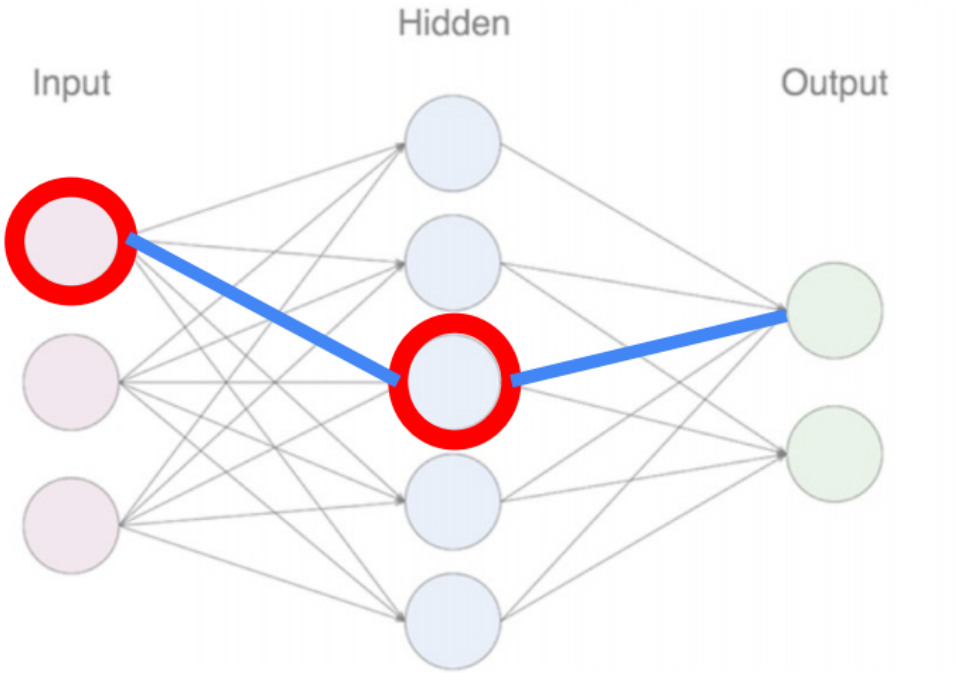
# Inspiration from **neurons**

# Inspiration from neurons




Inspiration for ANNs came from here

# Inspiration from neurons



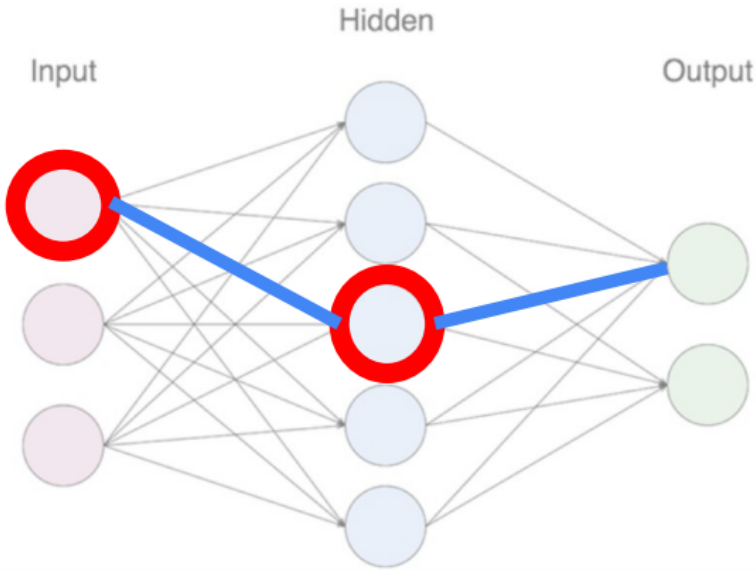
Chapter #2

# Required **mathematics**

# Required mathematics

- Why knowledge of math is needed in DL?
  - To get a deeper understanding of DL
- You don’t have to be math experts
- We’ll explore only the required math concepts

# Required mathematics

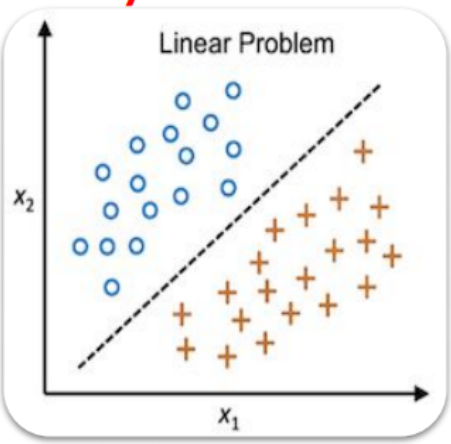



Idea is:

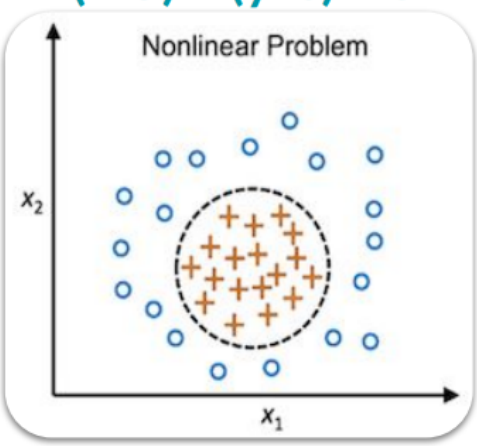
Mimic neurons on a machine using math

# Required mathematics

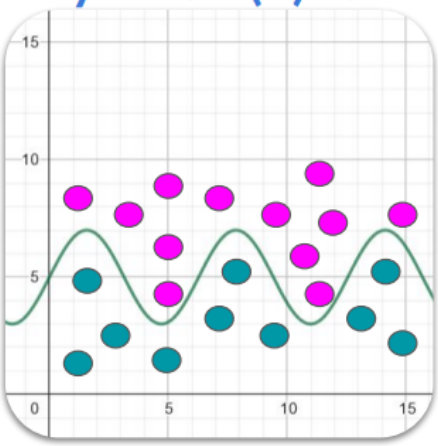
$y = wx+b$




$(x-a)^2+(y-b)^2=c$




$y = 2\sin(x)+5$




2D representation

# Required mathematics

- In real time:
  - **Many features** have to be considered $(x_1, x_2, x_3...)$
  - It is an **N-dimensional problem**
  - **Non-linearity** is required!!

Chapter #3

# Basics of **Deep Learning**

# Basics of Deep Learning

- How will my machine automatically learn a math function based on the data I feed it?
- Ans: There should be
  - Automated **learning process**
  - Automated **math function creation**
  - Automated **feedback process** to fit correct function
  - **Non-linearity** involved

# Basics of Deep Learning

Steps in ANNs learning/training:

1. Dataset preparation with predictors, truth labels
2. ANN initialization with randomness
3. Involve non-linearity to fit a good prediction function
4. Calculate the prediction with help of predictors
5. Check how close the ANN prediction is to the truth label
6. Use #5 for feedback and go back correct the params

# Basics of Deep Learning

Steps in ANNs learning/training:

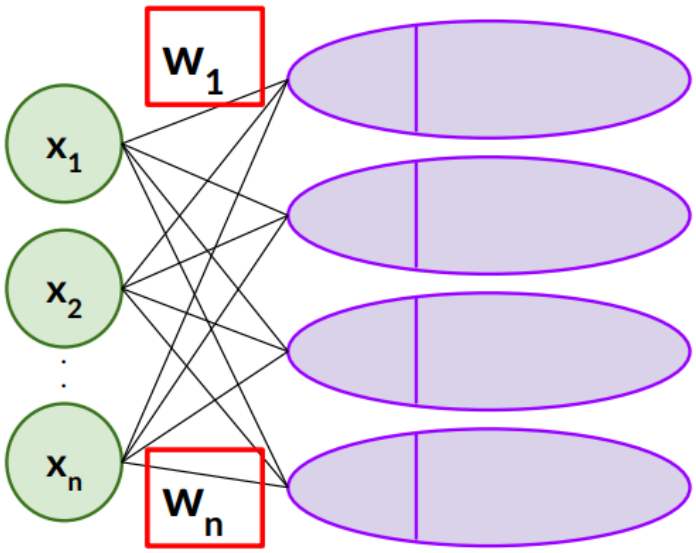
1. Dataset preparation with predictors, truth labels

| $x_1$ | $x_2$ | $x_3$ | ... $x_n$ | y (truth label) |
|---|---|---|---|---|
| | | | | |

# Basics of Deep Learning

Steps in ANNs learning/training:

2. ANN initialization with **randomness**

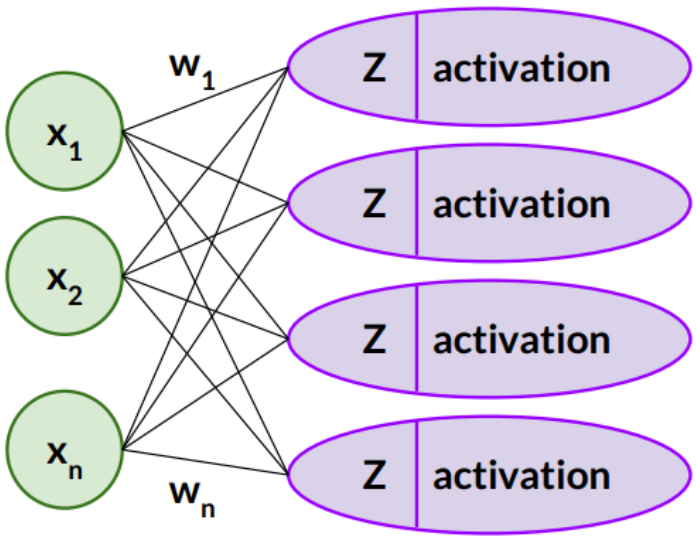



In this step the **weights and biases** are initialized randomly

# Basics of Deep Learning

Steps in ANNs learning/training:

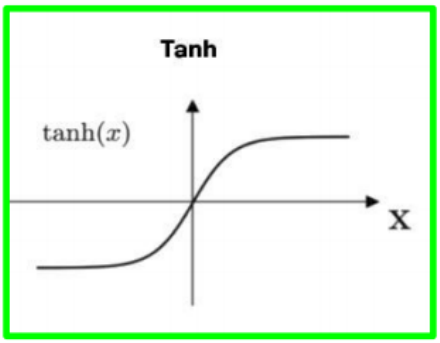
3. Involve **non-linearity** to fit a good prediction function

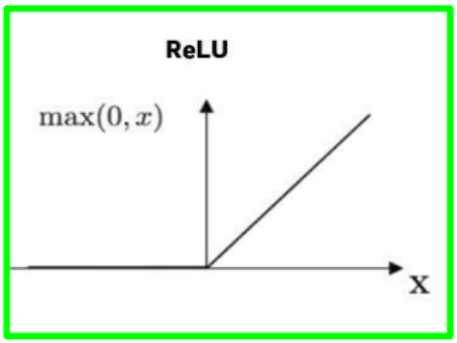


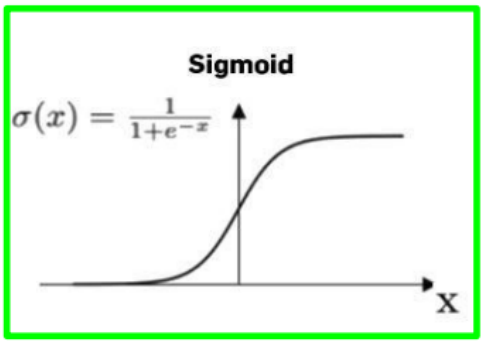

- $z = \Sigma (w_i x_i + b)$

# Basics of Deep Learning

A few commonly used activation functions:




- $z = \Sigma (w_i x_i + b)$ is LINEAR
- Activation(z) i.e., tanh(z) or ReLU(z) or Sigmoid(z) is NON-LINEAR