Introduction to Deep Learning

Video 4: Let’s get “Networking”

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In air

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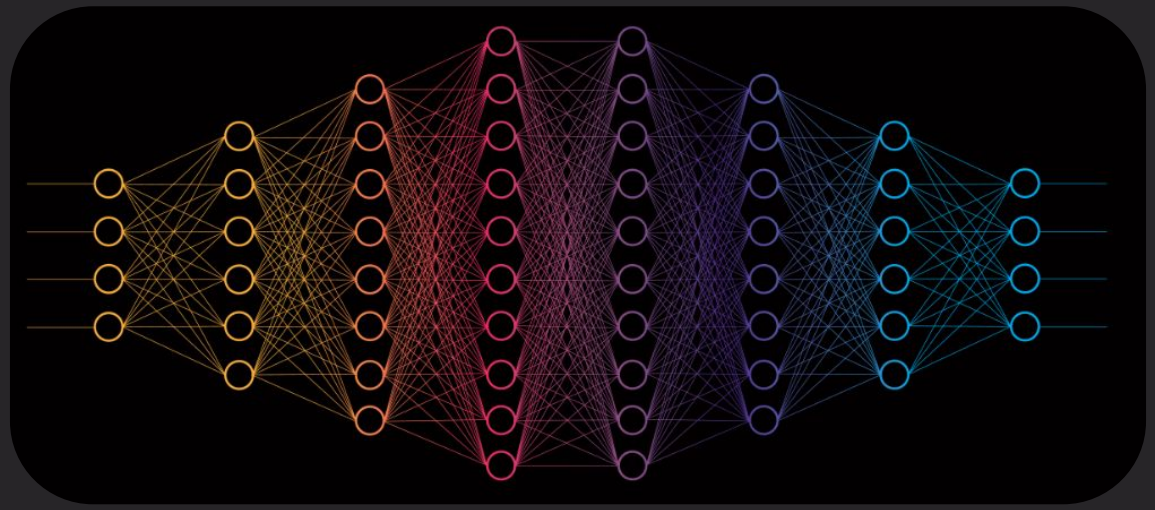
Neural Network

- A structured combination of nodes in different layers that work in cohesion is called a **neural network**.



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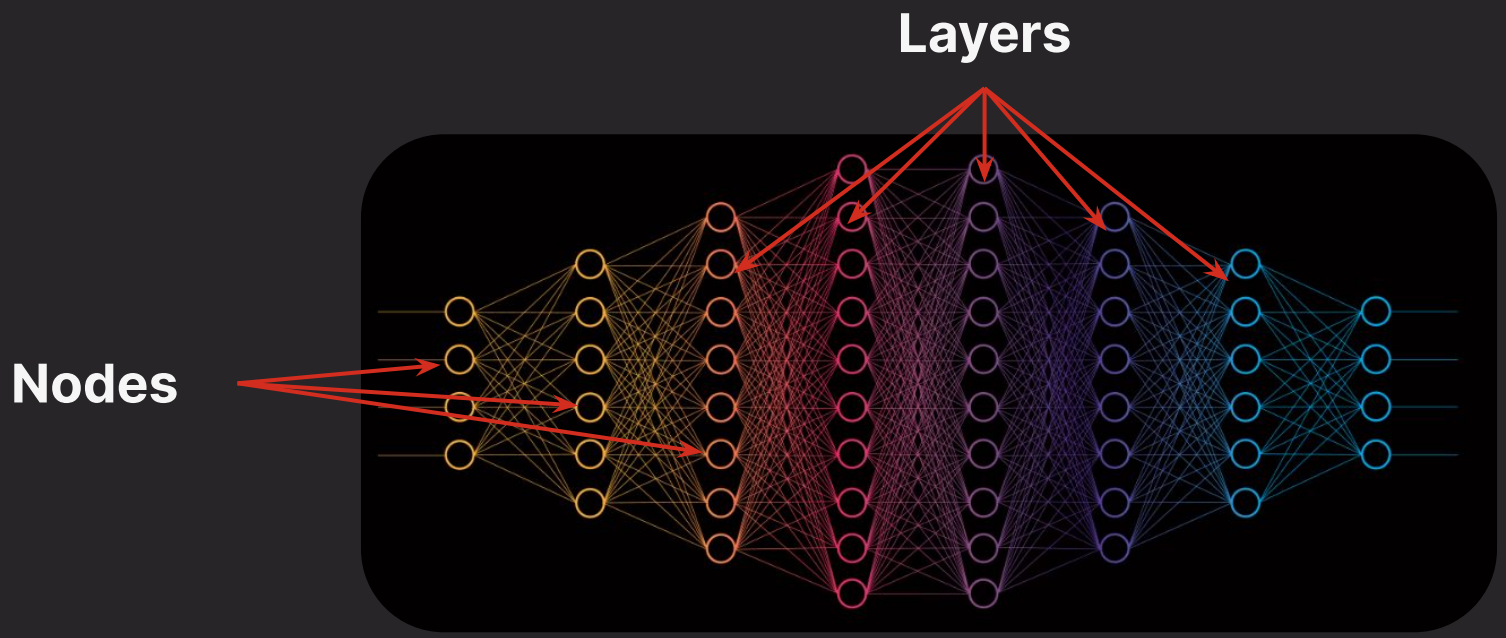
Neural Network

- **Nodes** form the most basic processing unit of any neural network.



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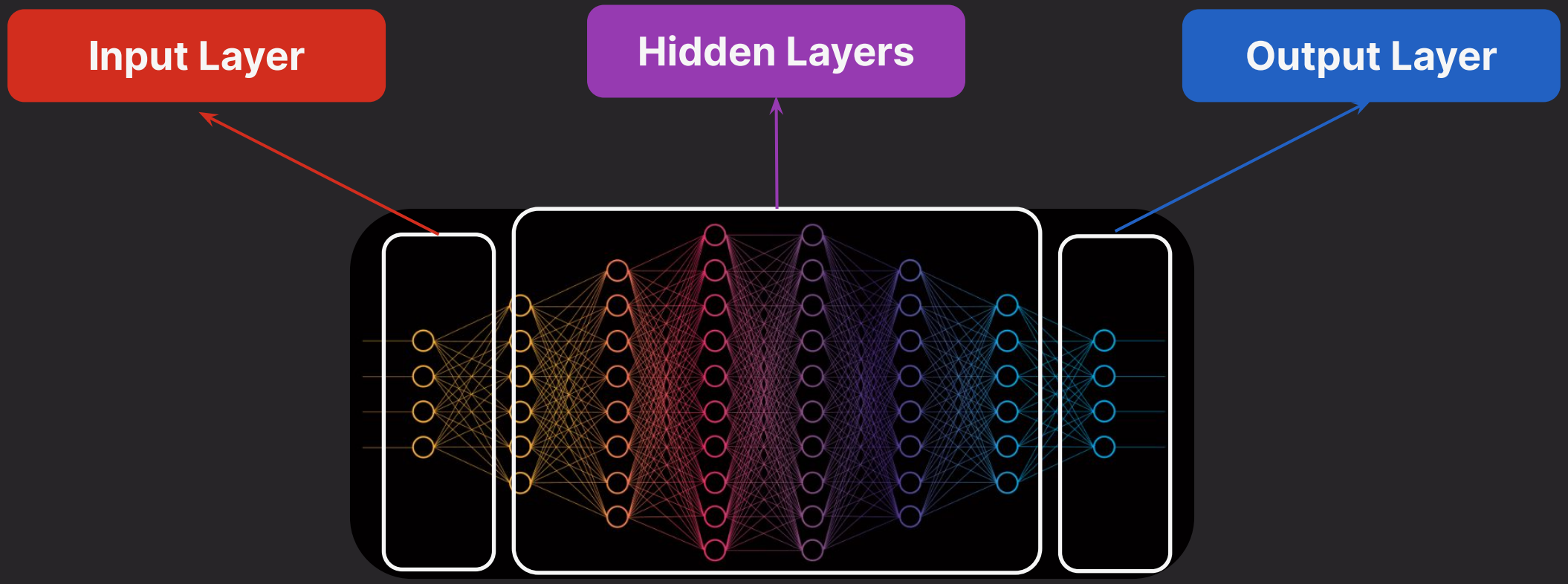
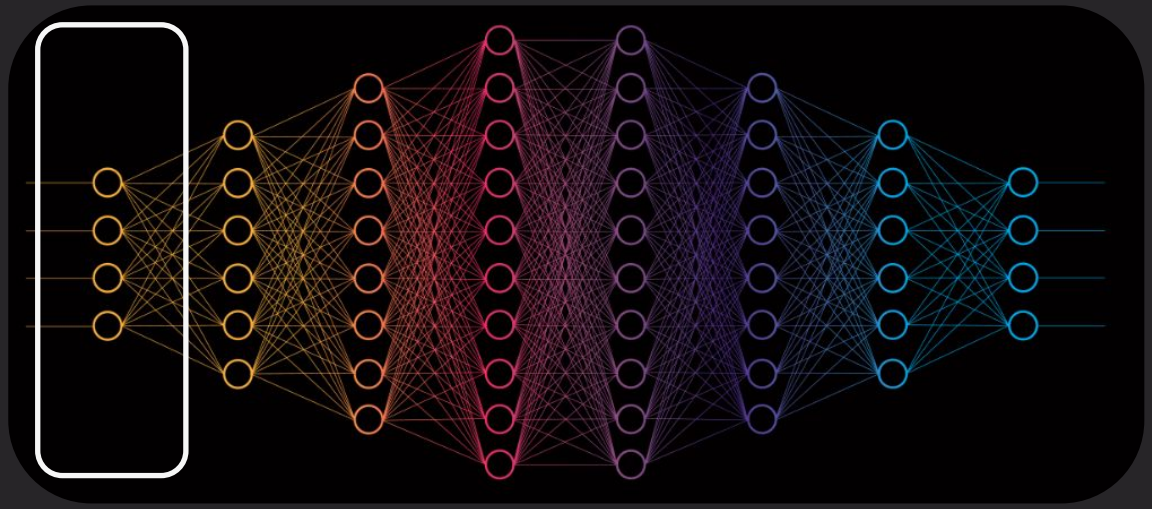
Neural Network



Neural Network

Input Layer

- Number of nodes represents number of features.



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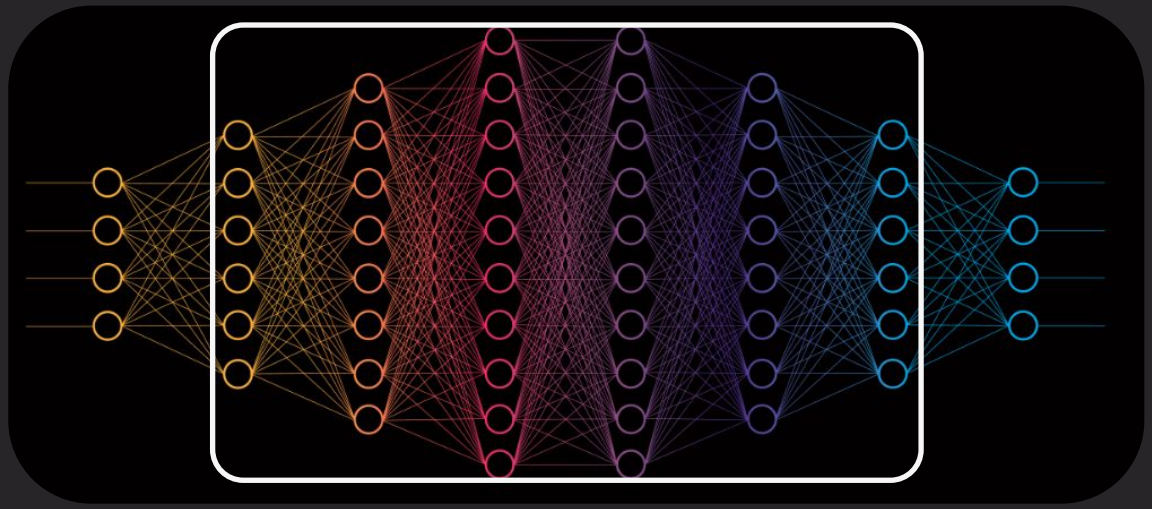
Neural Network

Hidden Layers

- Several hidden layers with varying size.
- Not exposed to input or output.
- Perform complex computations using weights & activation functions.



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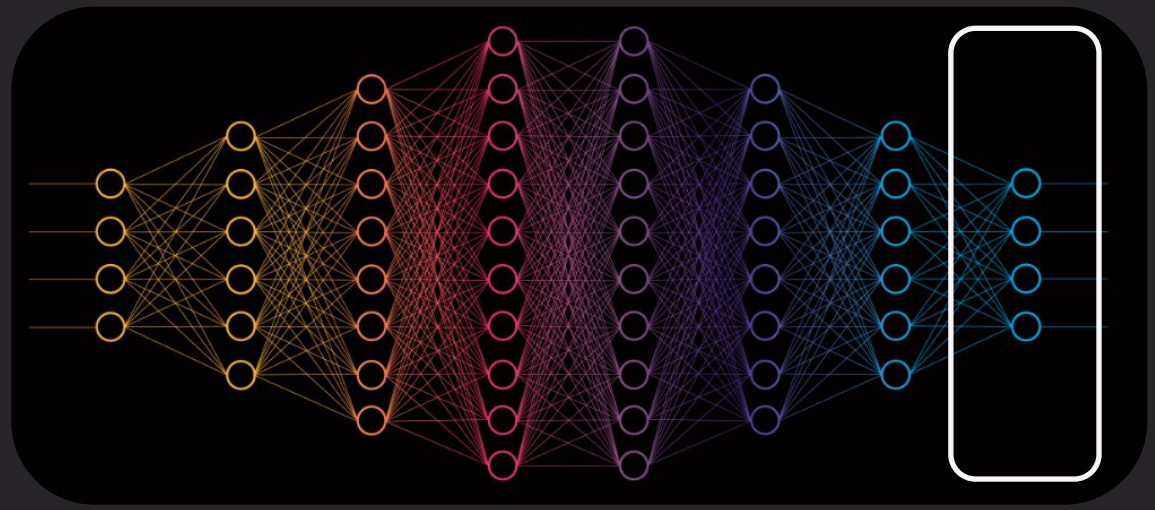
Neural Network

Output Layer

- Provides final output of the network.
- Regression / Binary Classification - 1 neuron
- Multi Classification - As many as the class



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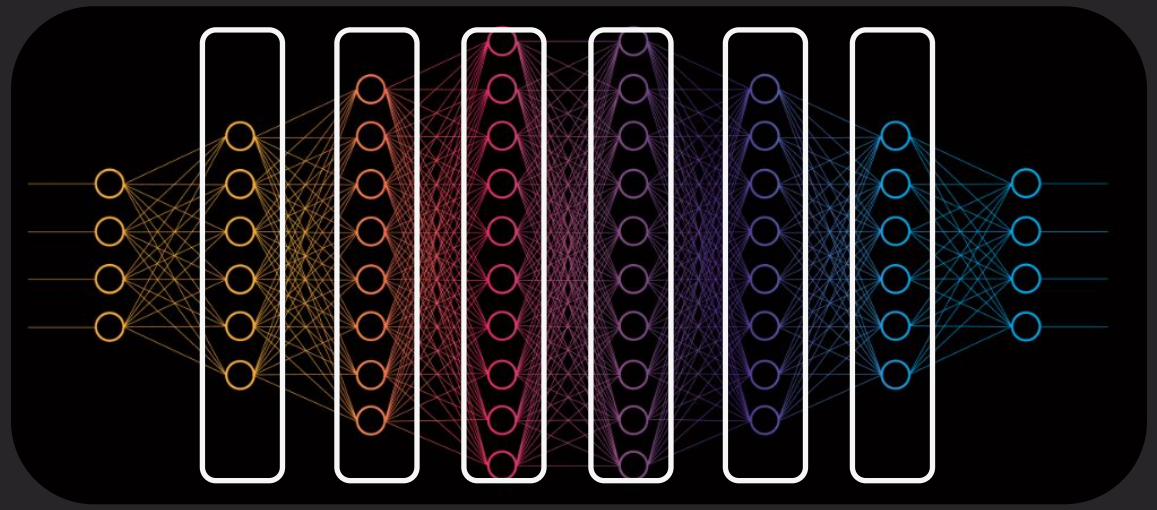
Neural Network

Number of hidden layers determines the depth of the neural network.



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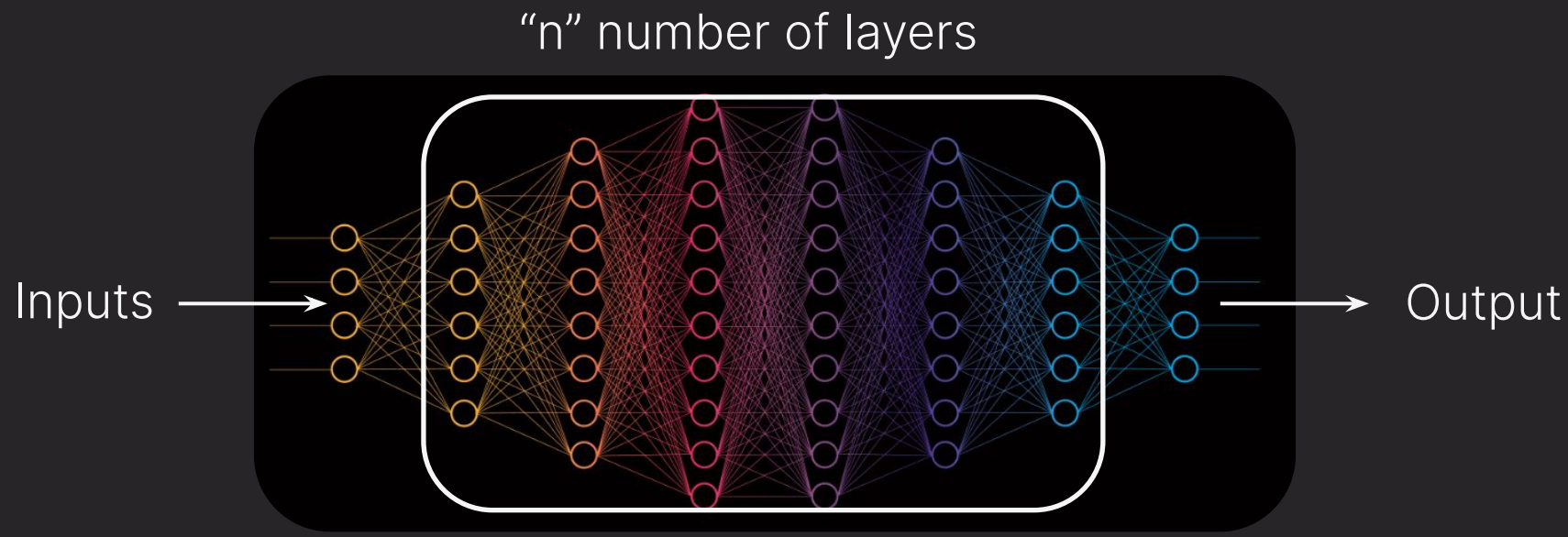
Deep Learning

The term Deep Learning is derived from the depth of the neural network.



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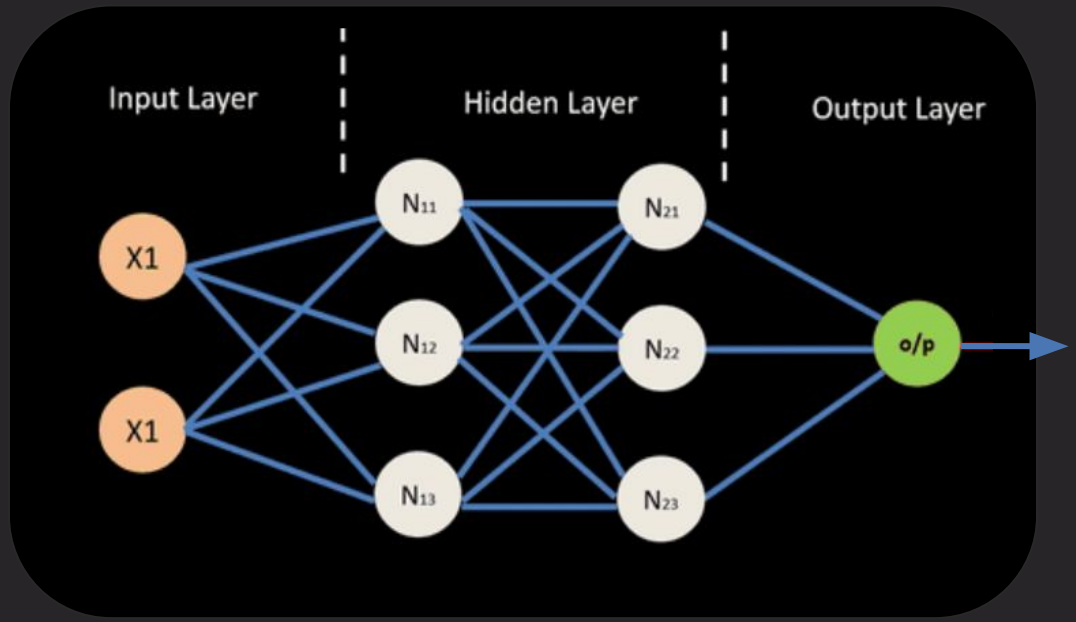
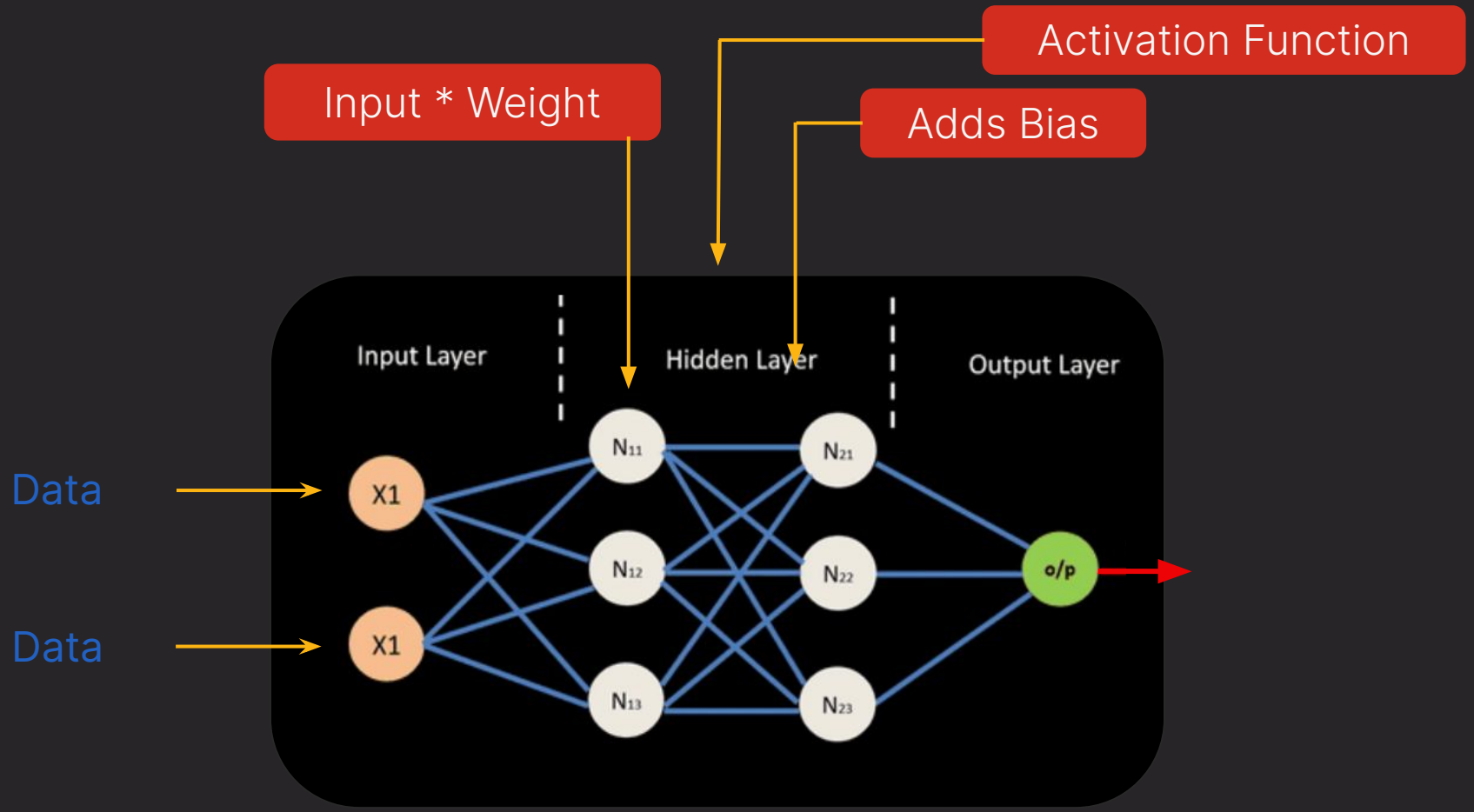
Fully Connected Network



Fully Connected Network



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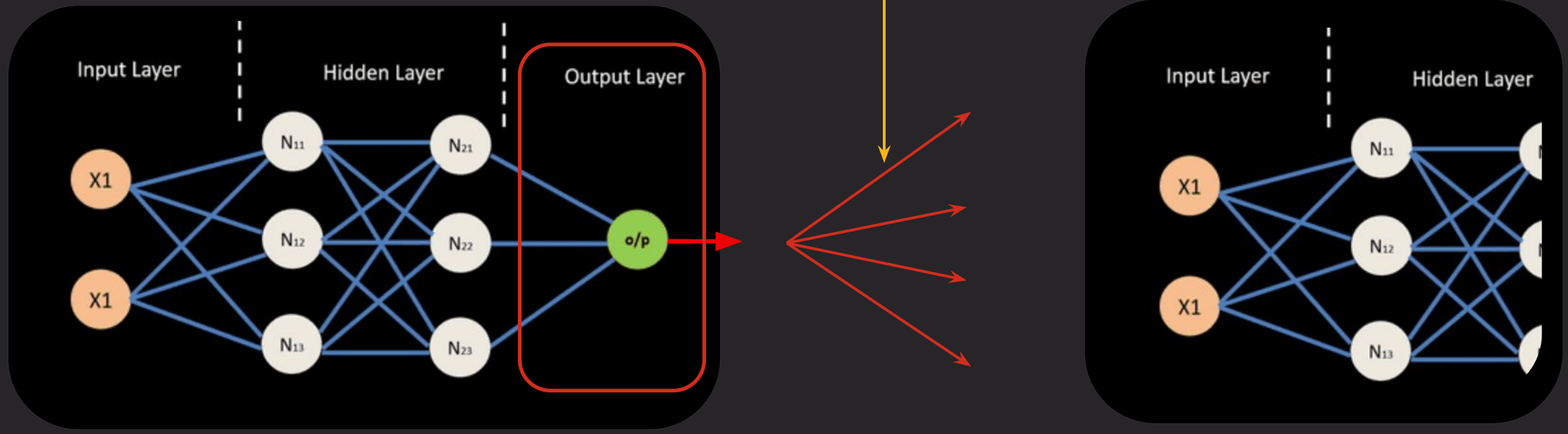
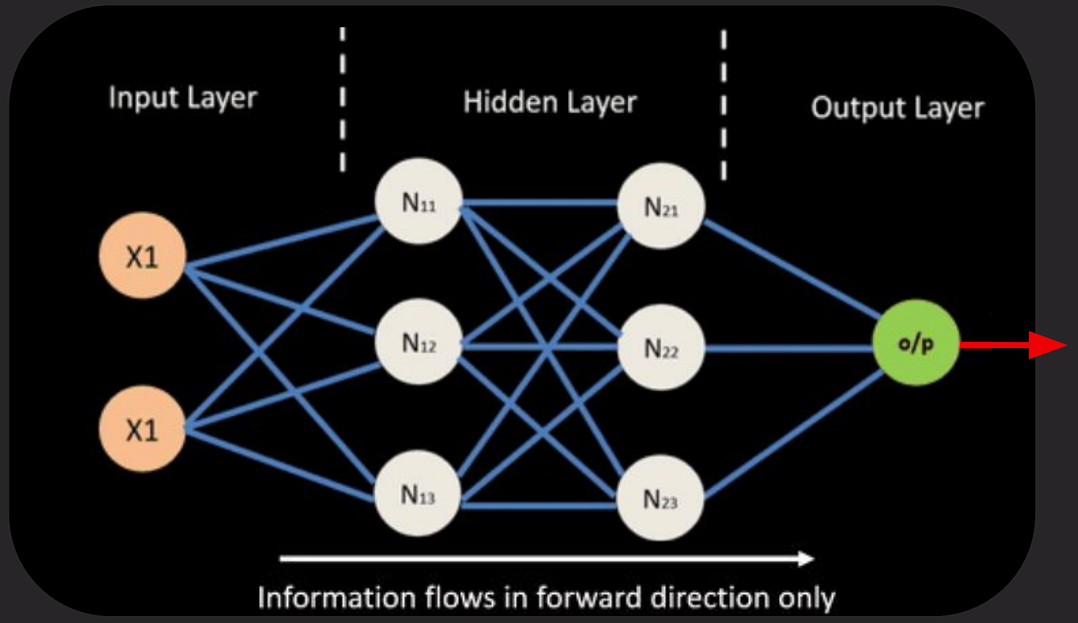
Fully Connected Network

Output of each layer becomes input for the next layer



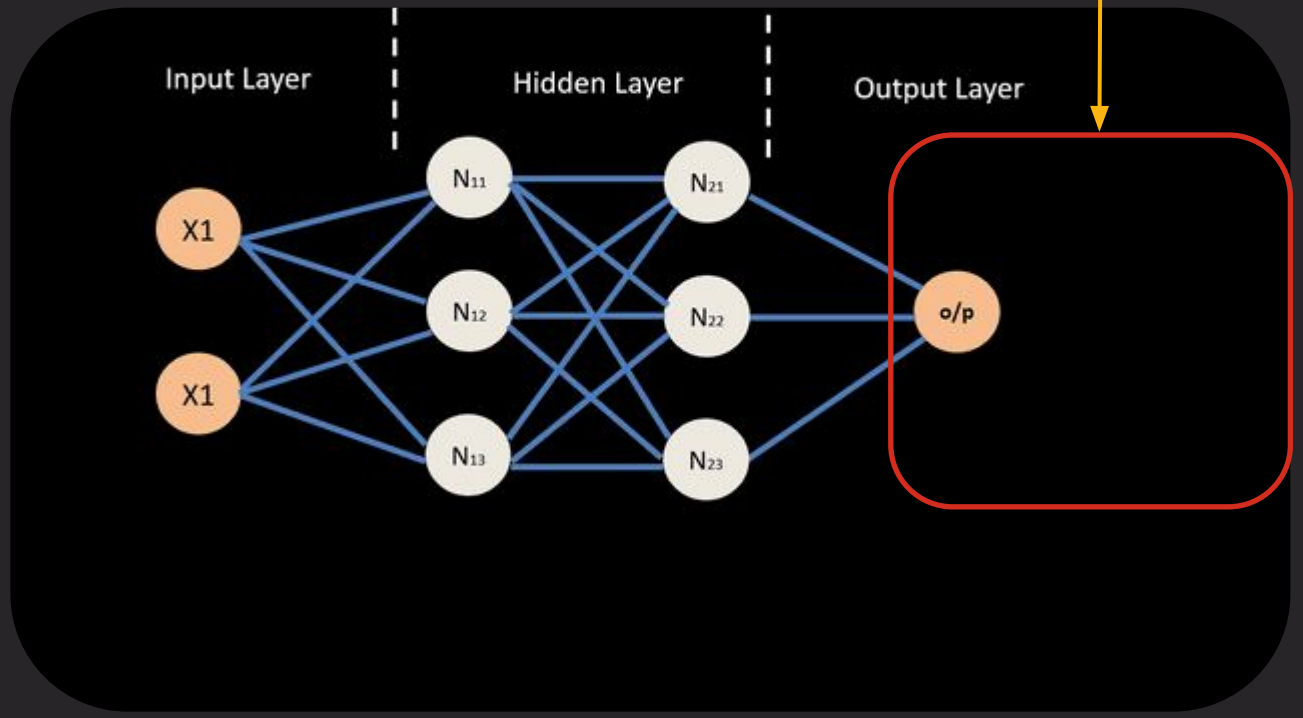
Activation function: Introduces non-linearity and allows network to handle complex patterns

Forward Propagation



The forward movement of data from the input to the output layer is called **forward propagation**.

Backpropagation



Output validation

By comparing predicted output values with actual target values

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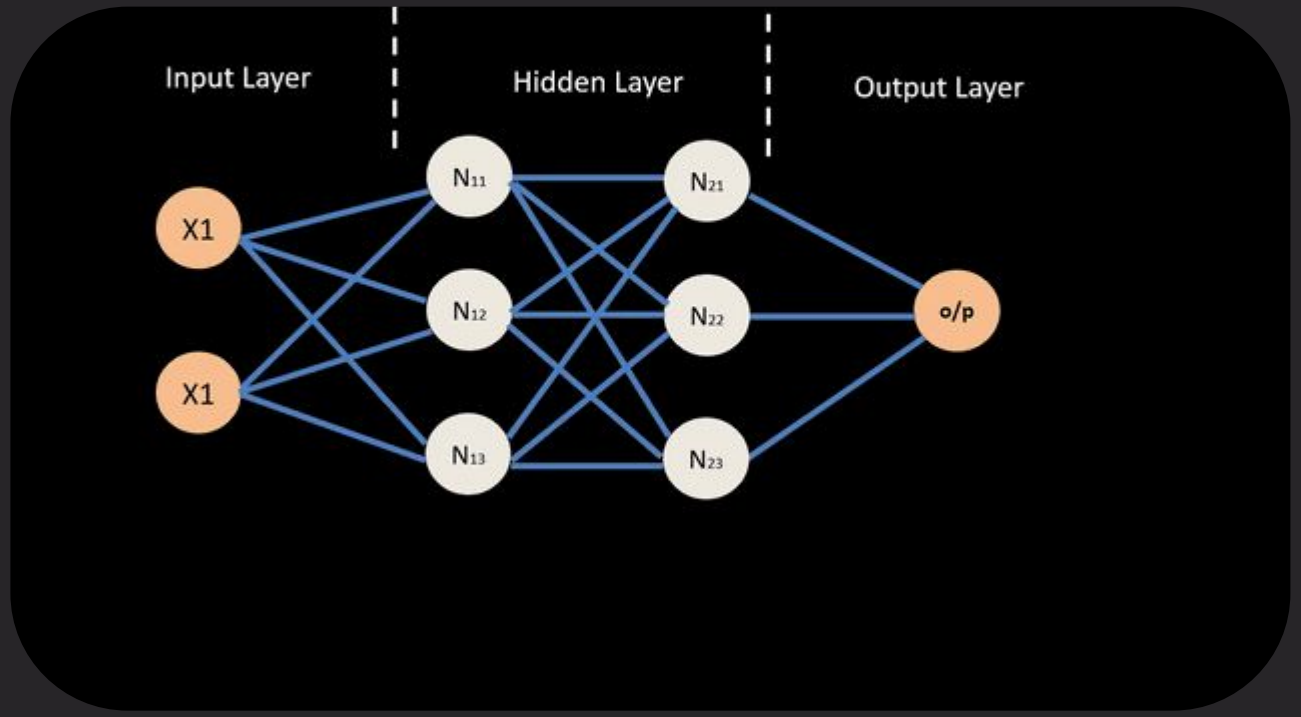
Backpropagation



Calculates error in prediction

Using Evaluation Metrics such as
Mean Squared Error

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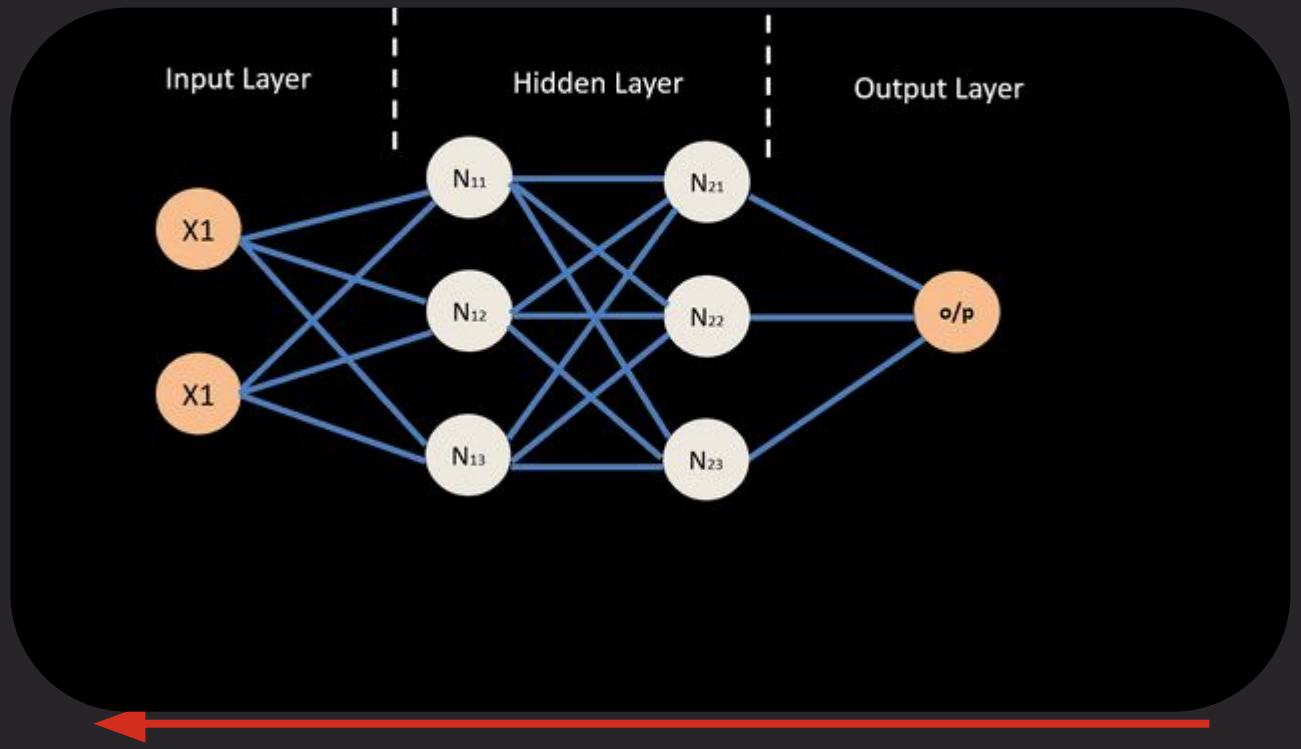
Backpropagation



Error is fed back in reverse to update the weights and biases.

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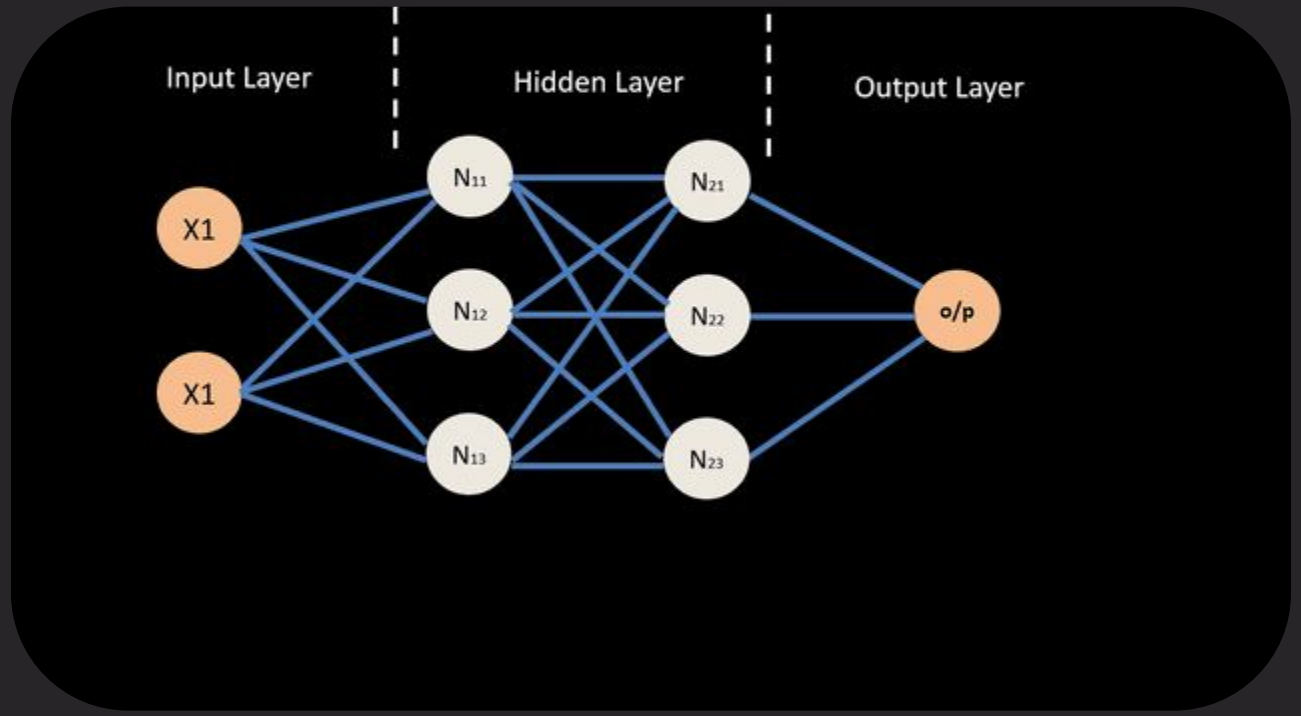
Backpropagation



The backward movement of data from the output towards the input layer is called **Backpropagation**.

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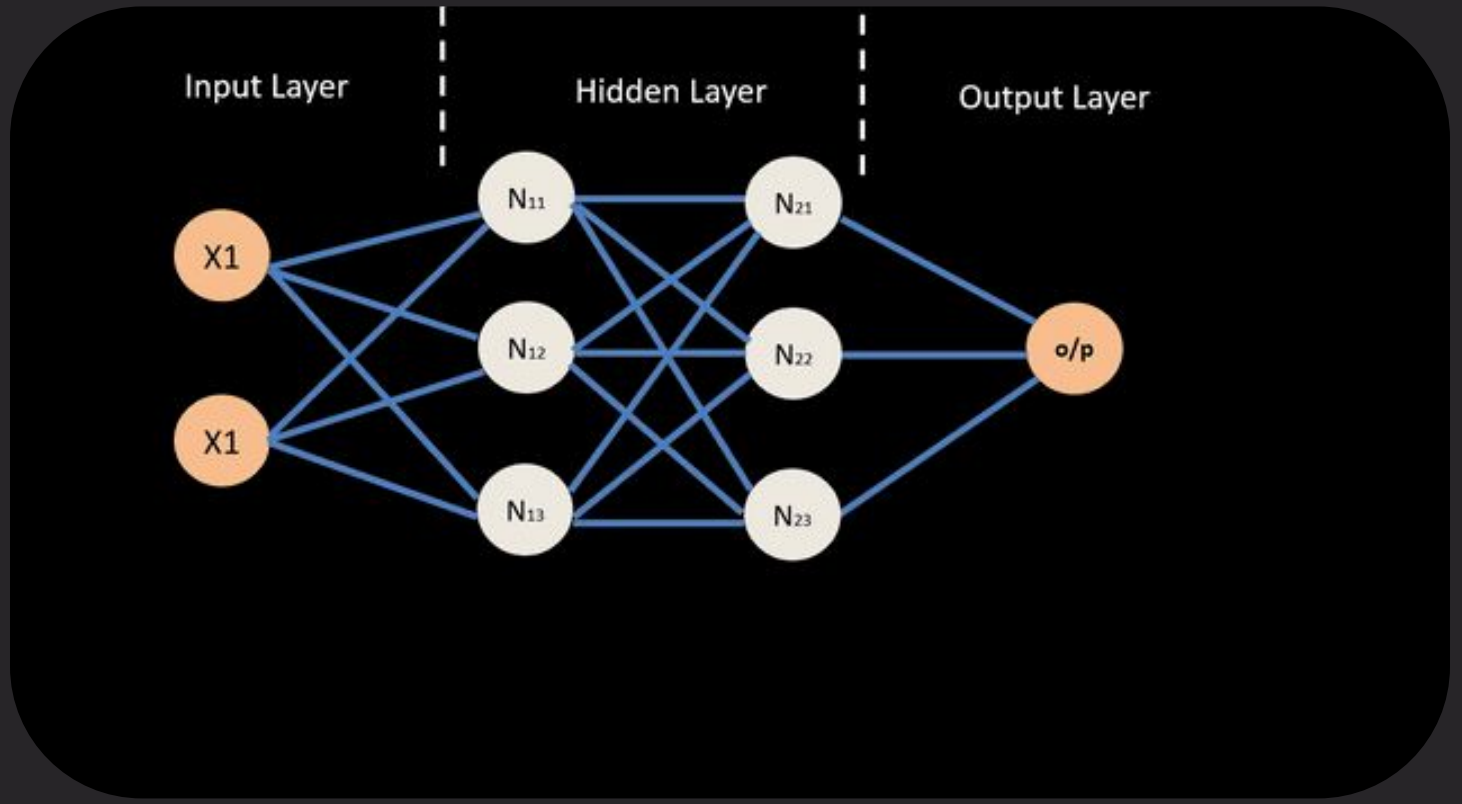
Backpropagation



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Up Next: Introduction to the framework

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Types of neural network

Selection of the type of neural network depends on:

1. Nature of Data
2. Architecture
3. Sequence Processing
4. Training Dynamics
5. Problem Complexity

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Types of neural network

Some of the Popular Neural Networks:

MLP | CNN | RNN | Autoencoder | GANs | Transformer

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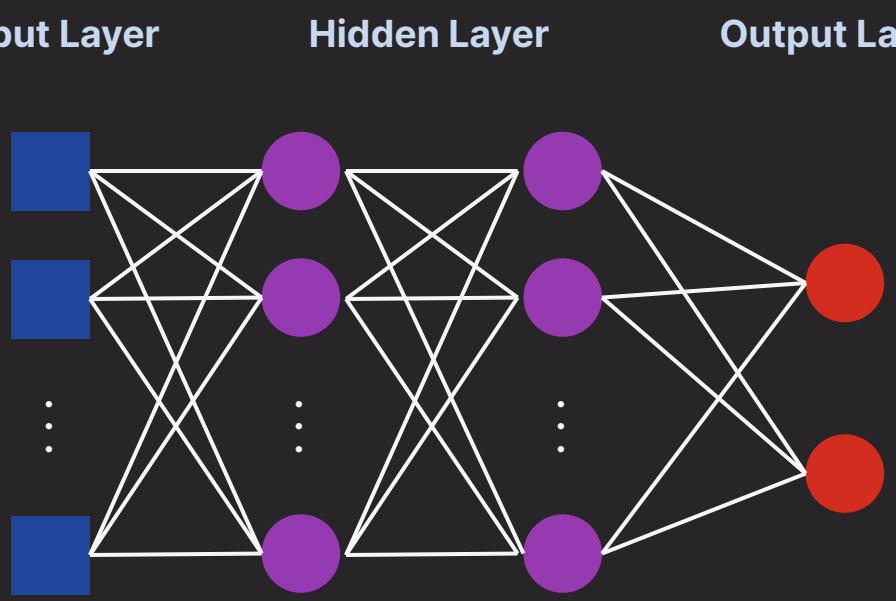
MLP (Multilayer Perceptron)

- A basic form of neural network that consists of multiple layers of nodes.
- Each node is connected to every node in the previous and the next layers.



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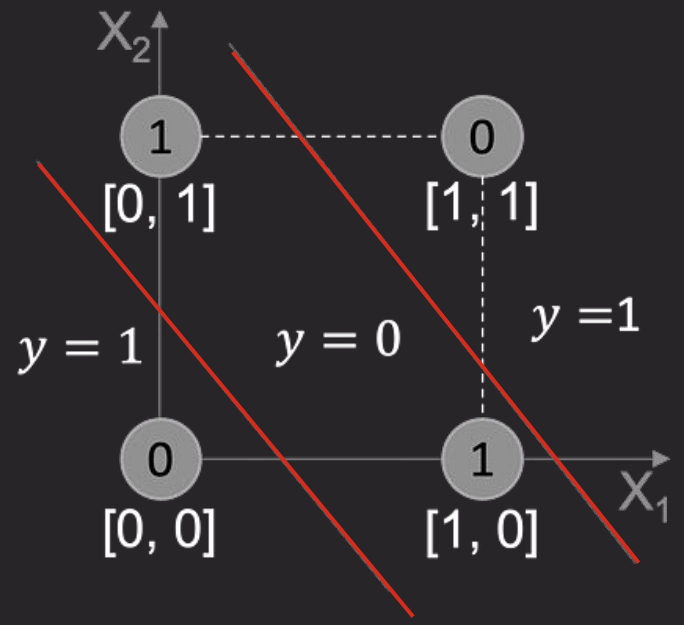
MLP (Multilayer Perceptron)

XOR Gate Problem



- The outputs of XOR are linearly inseparable
- A perceptron can only separate data points using a single line
- MLP with two hidden layers effectively combines the results of two linear equations.
- Allows for easy separation of linearly inseparable outputs of an XOR gate.

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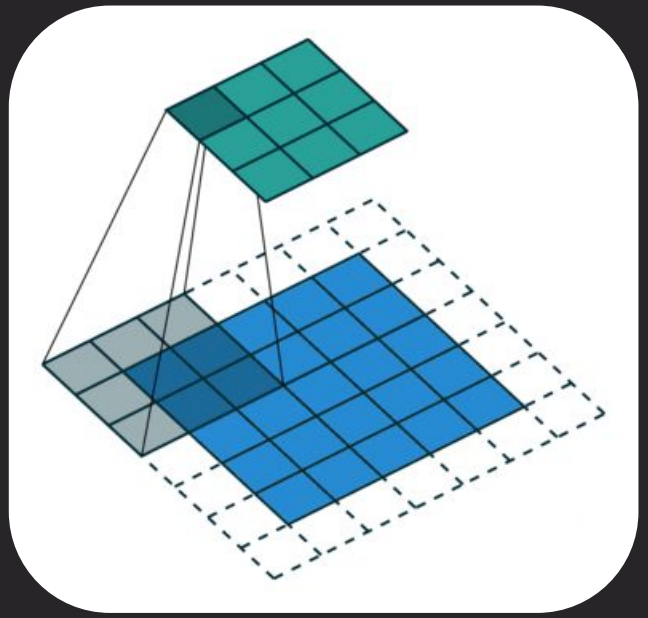
CNN (Convolutional Neural Network)

- Designed for processing data with grid-like structure, such as images and video recognition.
- **CNN Convolution Technique**: Utilizes filters to capture spatial relationships in data.
- Widely used for **Computer Vision** tasks such as object detection, face recognition, and semantic segmentation.



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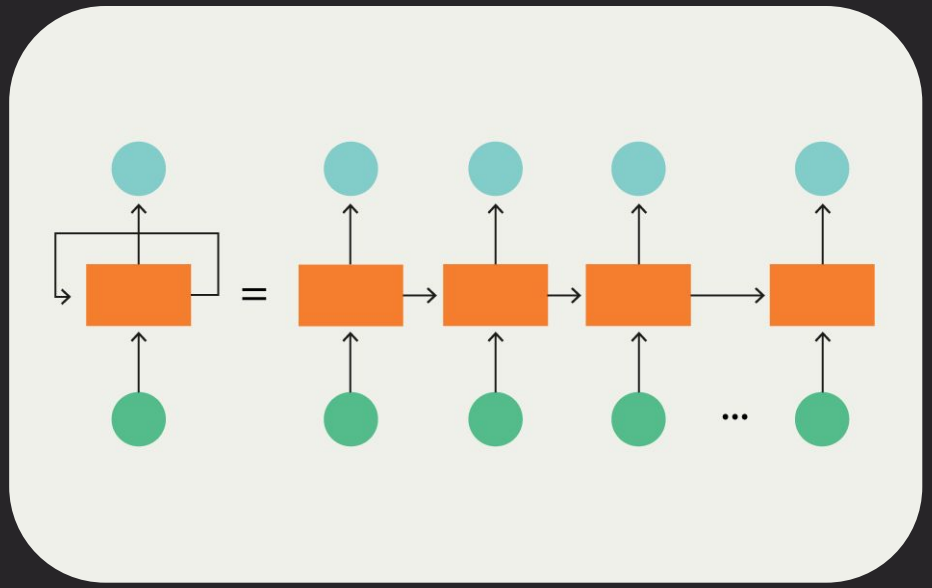
RNN (Recurrent Neural Network)

- They uniquely retain a 'memory' of previous inputs to inform the processing of current input.
- Ideal for **Natural Language Processing (NLP)**.
- RNNs excel in handling sequential data like time series or natural language.



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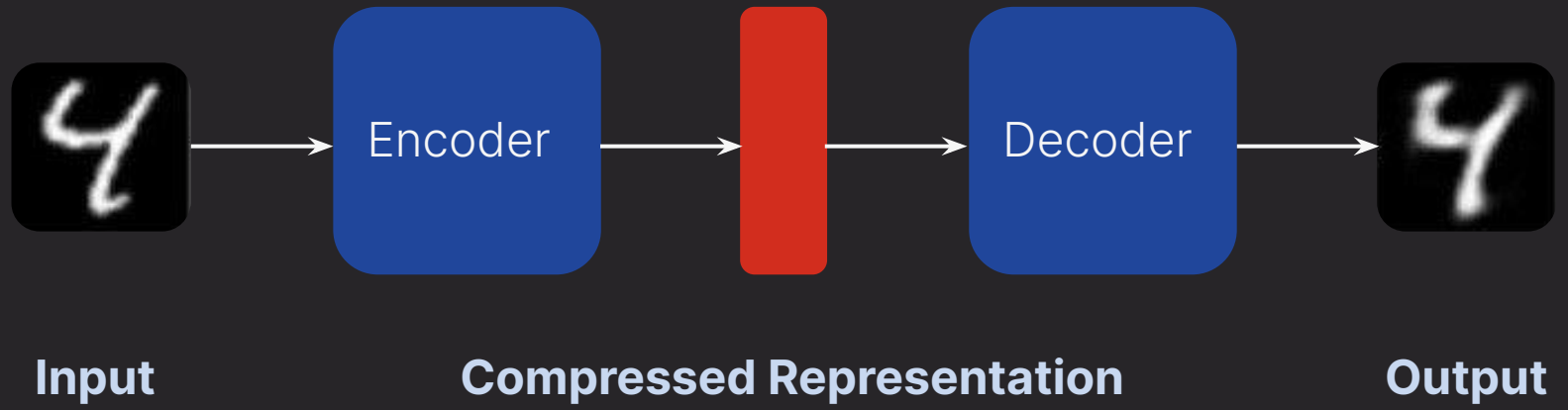
Autoencoders

- **Encoder Role**: Compresses input data into a smaller form through encoding.
- **Decoder Function**: Decodes the compressed data to closely match the original input.
- Ideal for reducing size of data, cleaning noisy data and feature extraction



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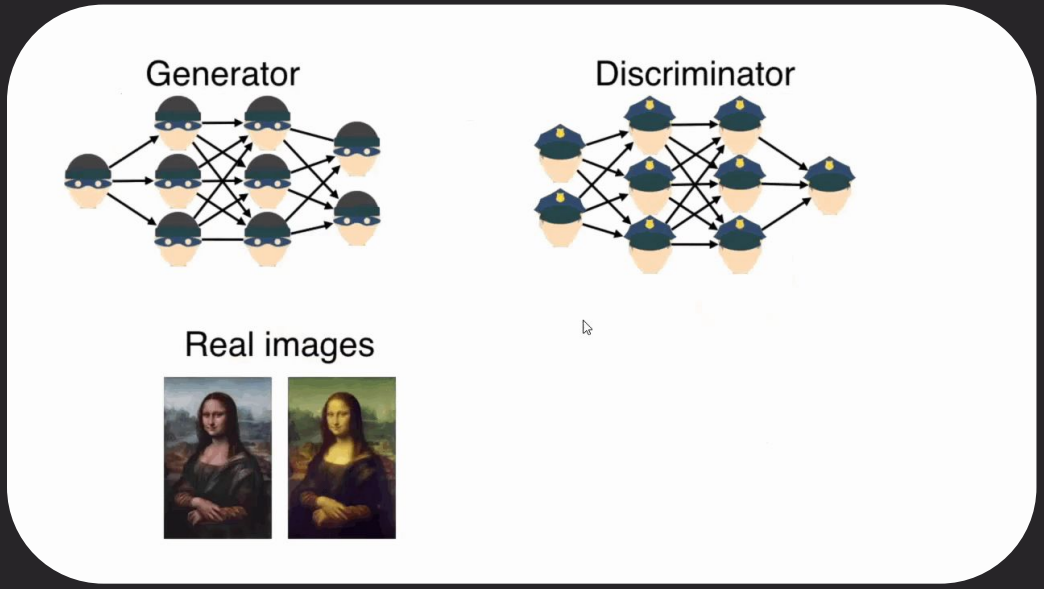
GANs (Generative Adversarial Networks)

- **Generator:** Creates data similar to input data.
- **Discriminator:** Differentiates between real and generated data.
- This interplay enhances the quality of generated data
- Ideal for creating realistic images or videos



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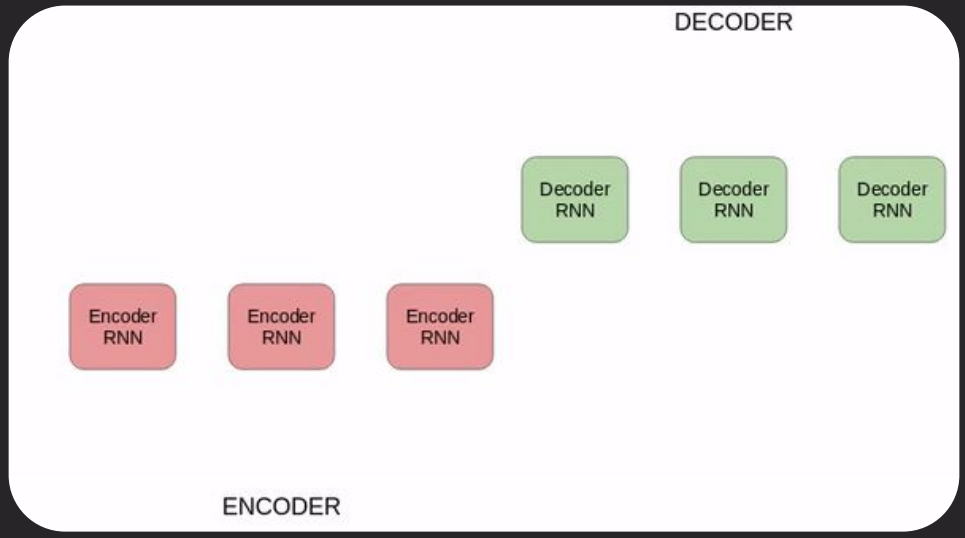
Transformers

- Transformers have revolutionized the field of NLP.
- They have the ability to capture long-range dependencies and handle sequential data effectively.
- Ideal for **machine translation**, **text summarization** and **language modeling**.



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