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DEEP
LEARNING
WWW

Image Recognition

How does image recognition work?

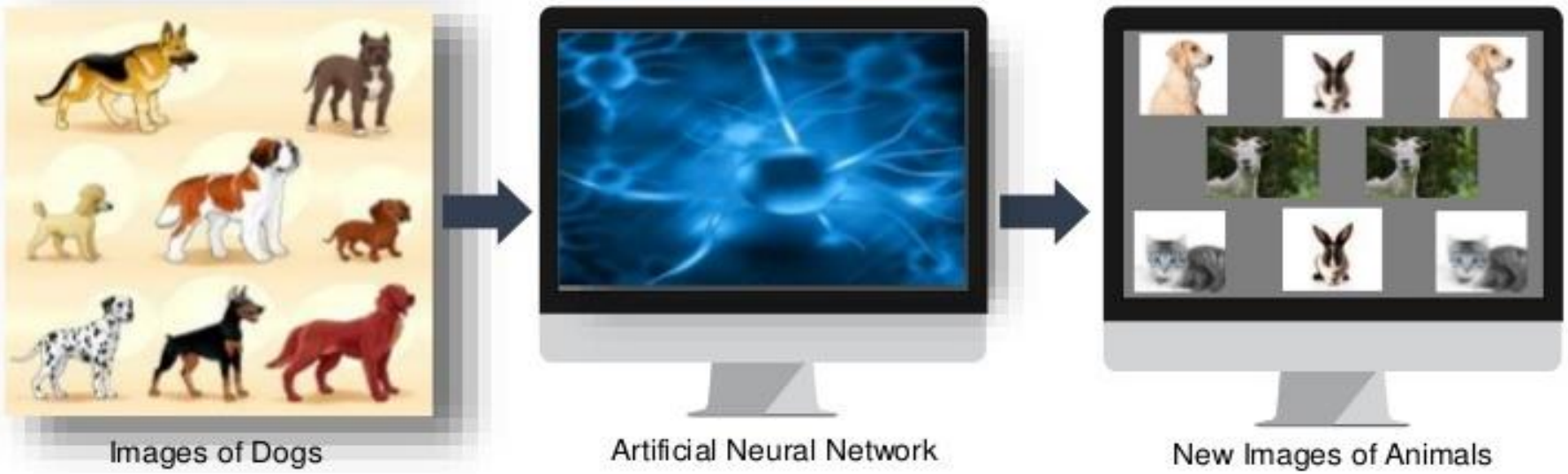

Image Recognition

How does image recognition work?

Images of Dogs

Image Recognition

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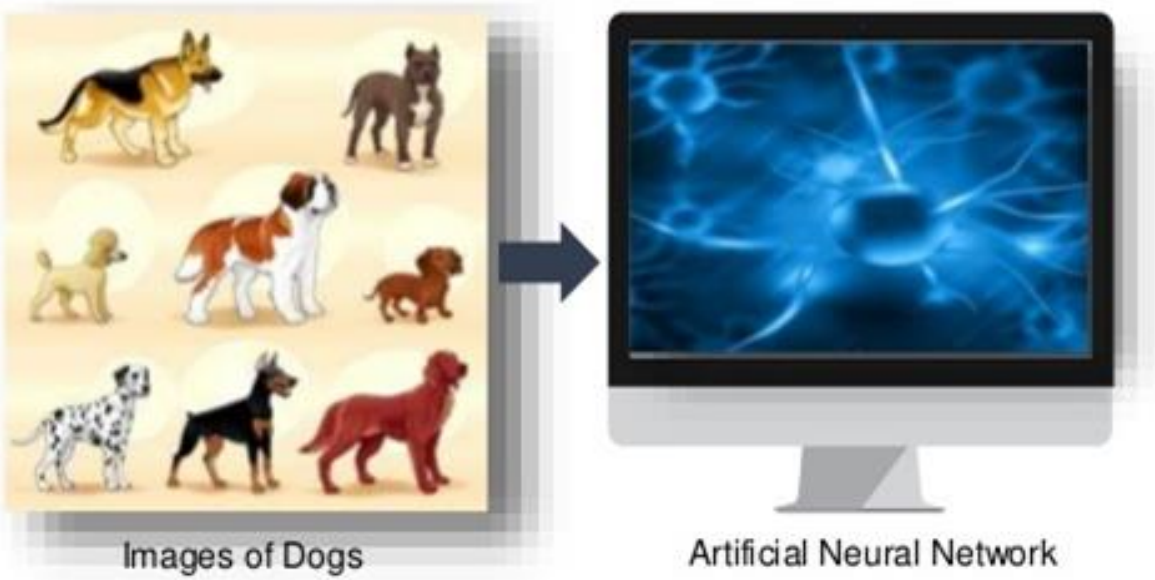

Images of Dogs

Artificial Neural Network

Image Recognition

How does image recognition work?

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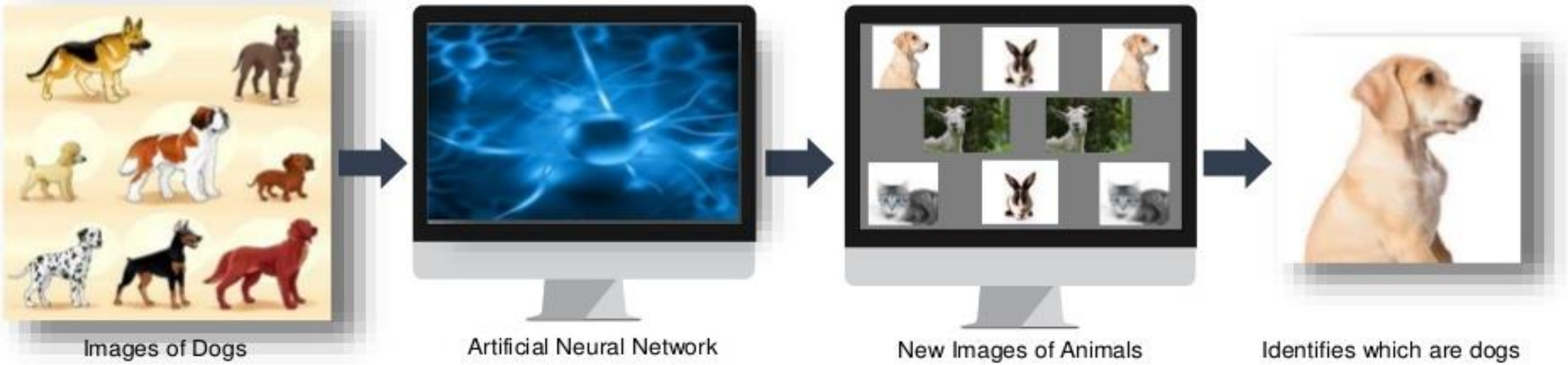


Image Recognition

Lets understand how Artificial Neural Network identifies the images

Image Recognition

Lets understand how Artificial Neural Network identifies the images

Training Data

Image Recognition

Lets understand how Artificial Neural Network identifies the images

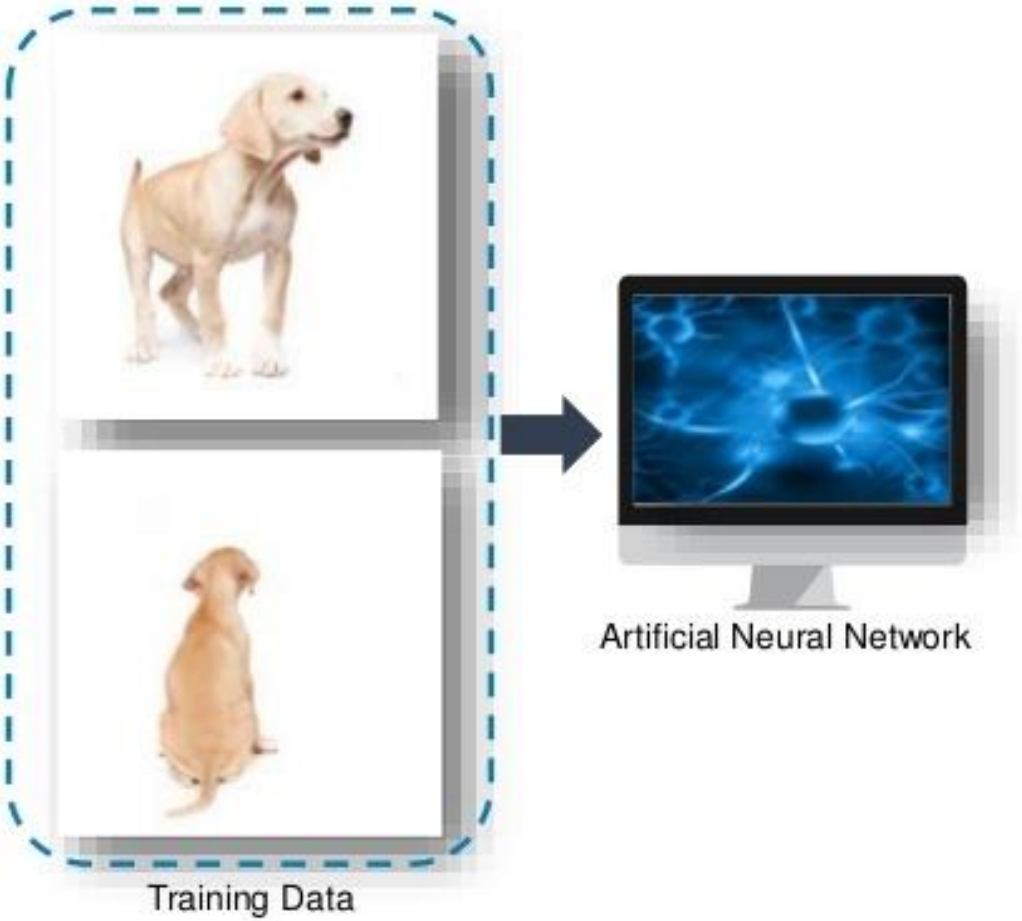
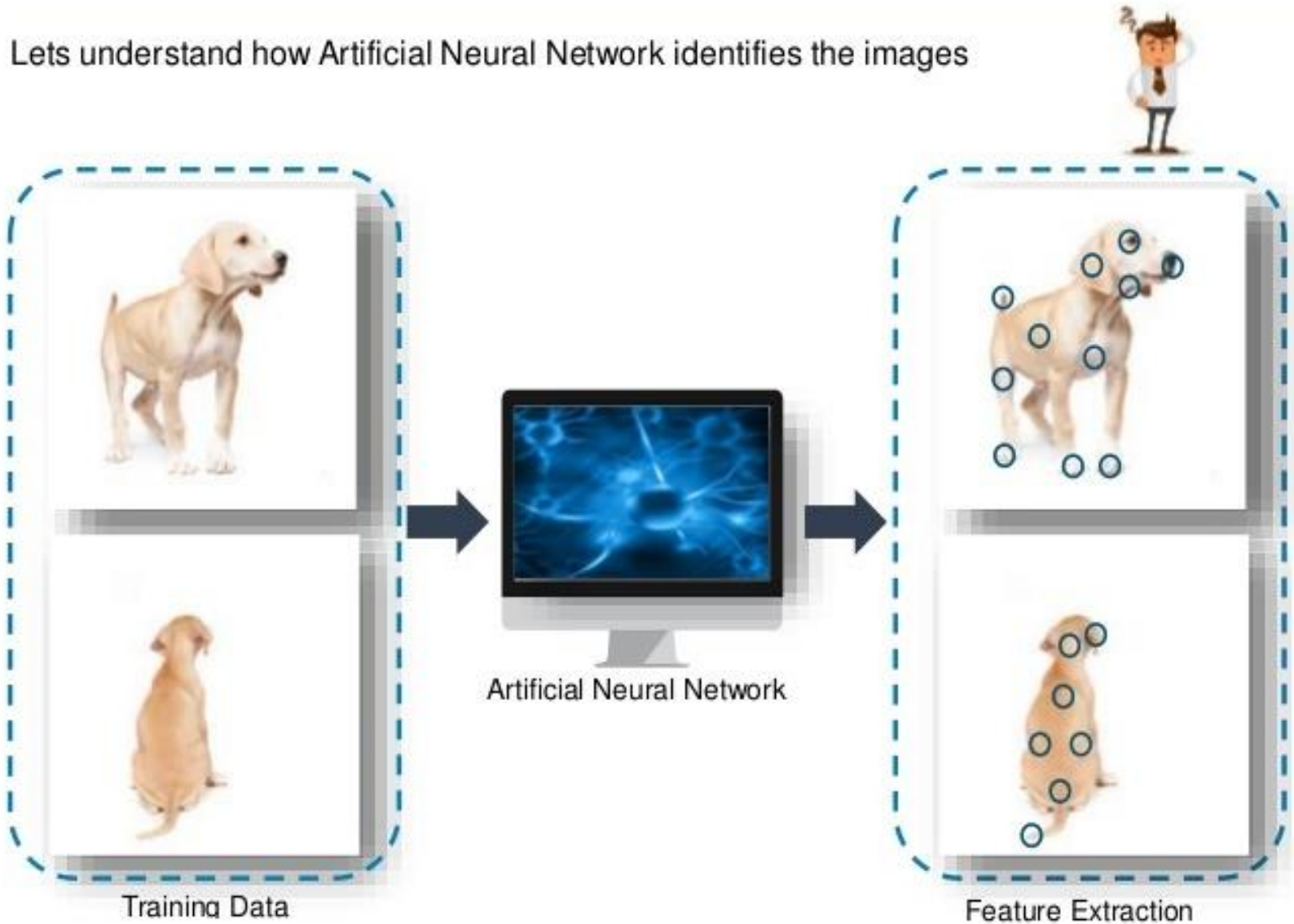


Image Recognition

Lets understand how Artificial Neural Network identifies the images



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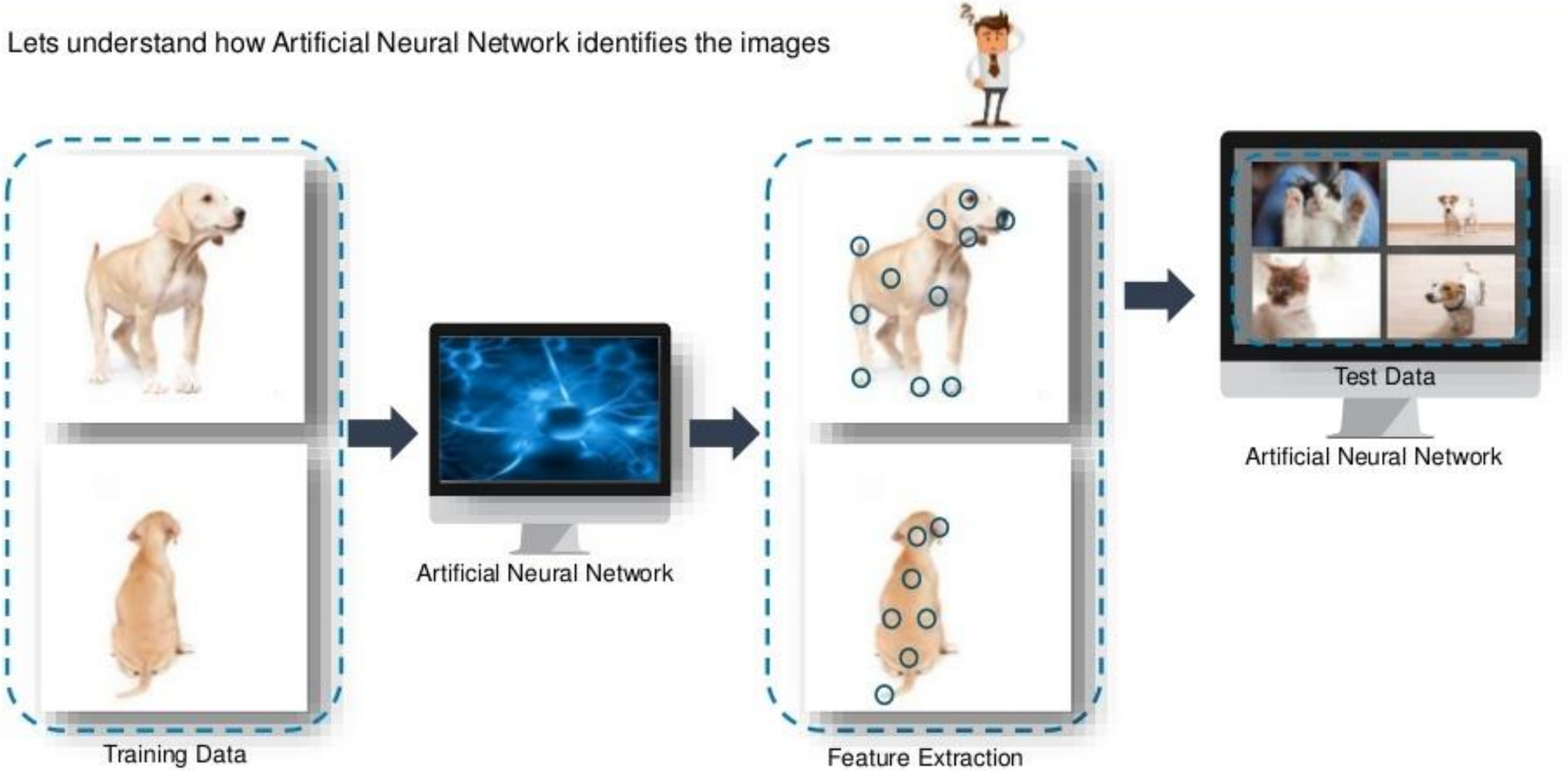

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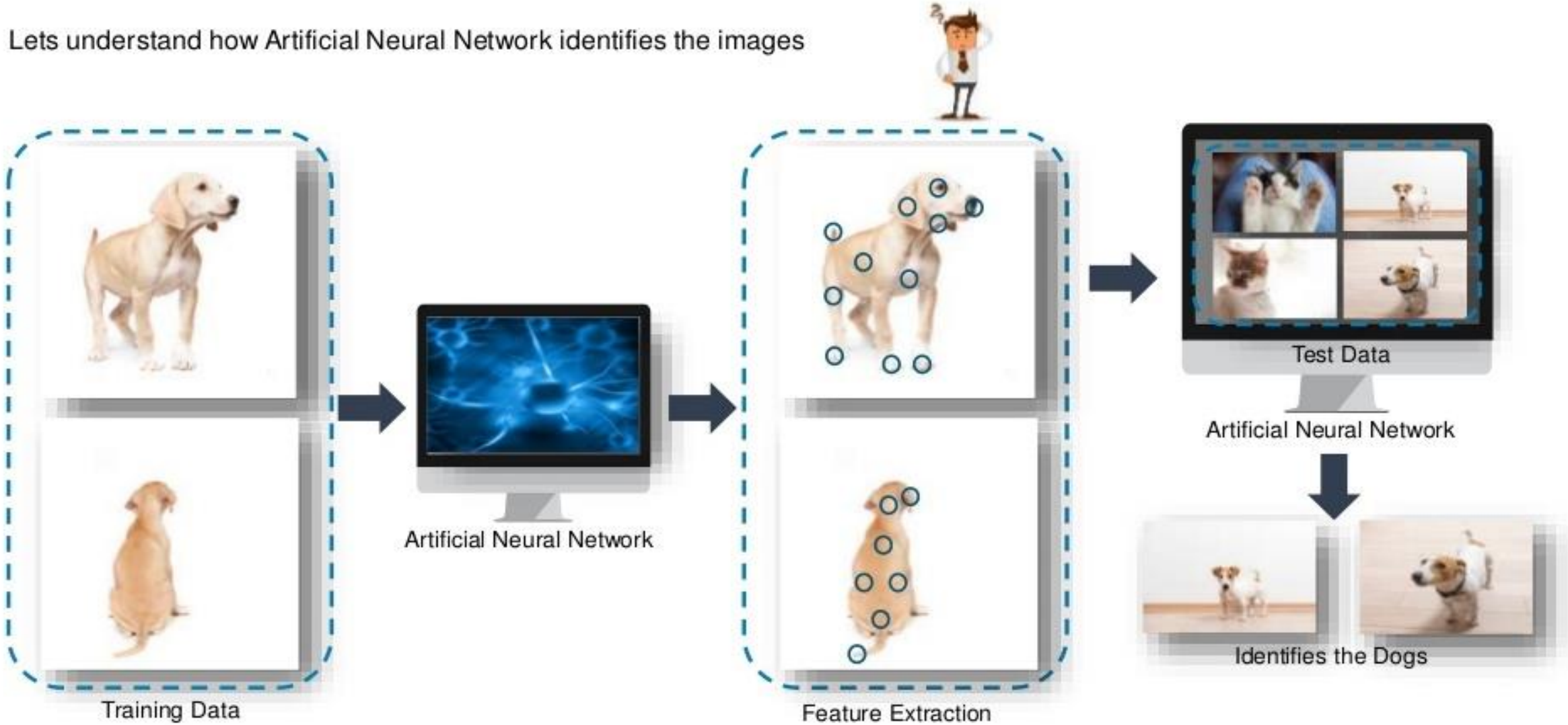


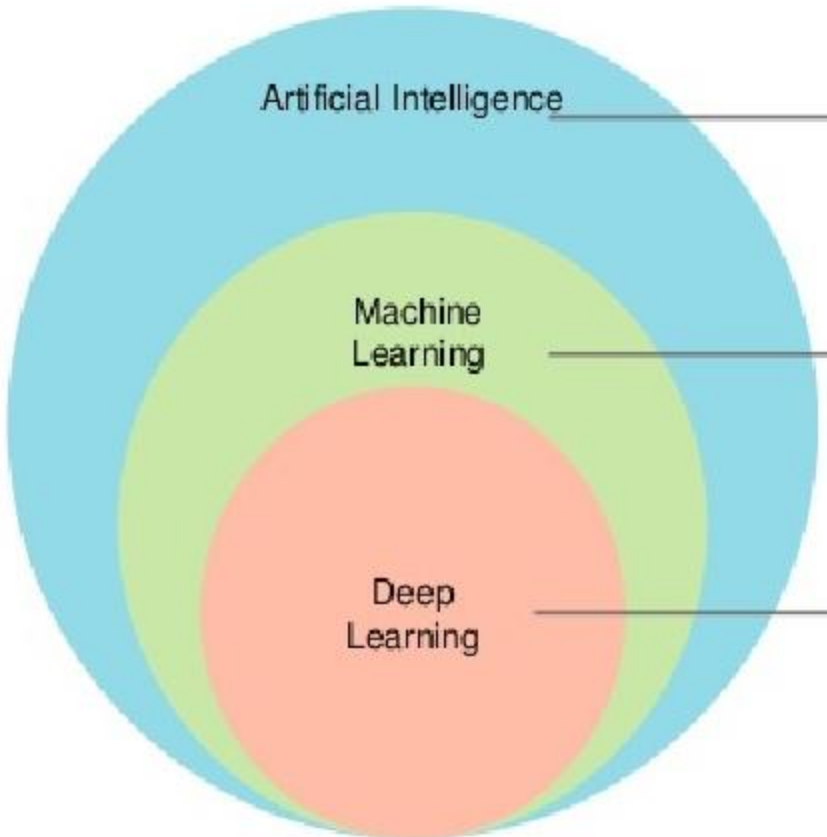
What's in it for you?

- What is Deep Learning?
- Why do we need Deep Learning?
- Applications of Deep Learning
- What is a Neural Network?
- Activation Functions
- Working of a Neural Network

What is Deep Learning?

What is Deep Learning?

Deep Learning is a subfield of Machine Learning that deals with algorithms inspired by the structure and function of the brain



Ability of a machine to imitate intelligent human behavior

Application of AI that allows a system to automatically learn and improve from experience

Application of Machine Learning that uses complex algorithms and deep neural nets to train a model

Why do we need Deep Learning?

Process huge amount of data

Machine Learning algorithms work with huge amount of structured data but Deep Learning algorithms can work with enormous amount of structured and unstructured data

Perform complex algorithms

Machine Learning algorithms cannot perform complex operations, to do that we need Deep Learning algorithms

To achieve the best performance with large amount of data

As the amount of data increases, the performance of Machine Learning algorithms decreases, to make sure the performance of a model is good, we need Deep Learning

Feature Extraction

Machine Learning algorithms extract patterns based on labelled sample data, while Deep Learning algorithms take large volumes of data as input, analyze the input to extract features out of an object and identifies similar objects

Applications of Deep Learning

Applications of Deep Learning

Cancer Detection

Deep Learning helps to detect cancerous tumors in the human body

Applications of Deep Learning

Robot Navigation

Deep Learning is used to train robots to perform human tasks

Applications of Deep Learning

Autonomous Driving Cars

Distinguishes different types of objects, people, road signs and drives without human intervention

Applications of Deep Learning

Machine Translation

Given a word, phrase or a sentence in one language, automatically translates it into another language

Applications of Deep Learning

Music Composition

Deep Neural Nets can be used to produce music by making computers learn the patterns in a composition

Applications of Deep Learning

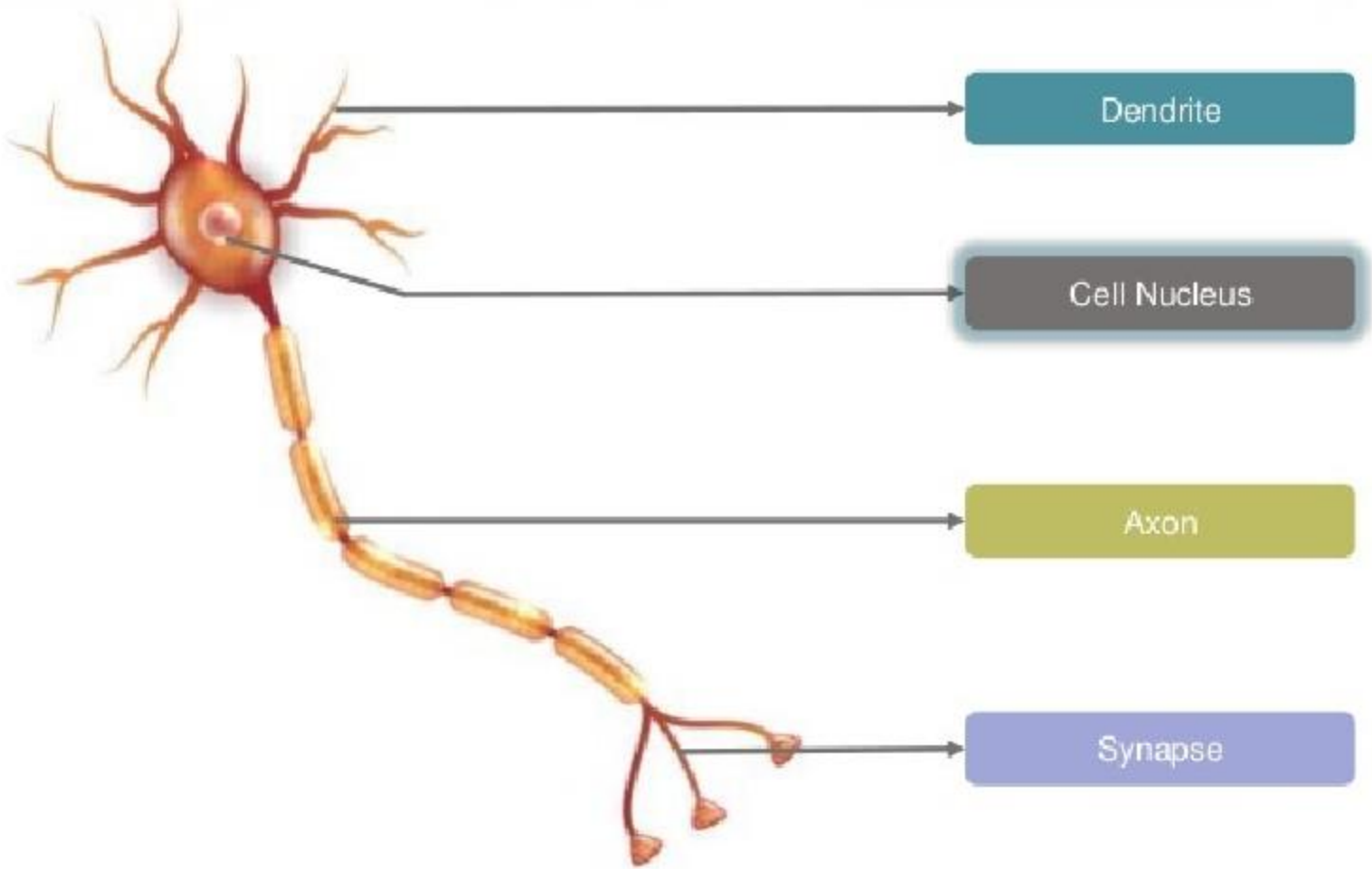
Colorization of images

Uses the object and their context within the photograph to color the image

What is a Neural Network?

What is a Neural Network?

Deep Learning is based on the functioning of a human brain, lets understand how does a Biological Neural Network look like



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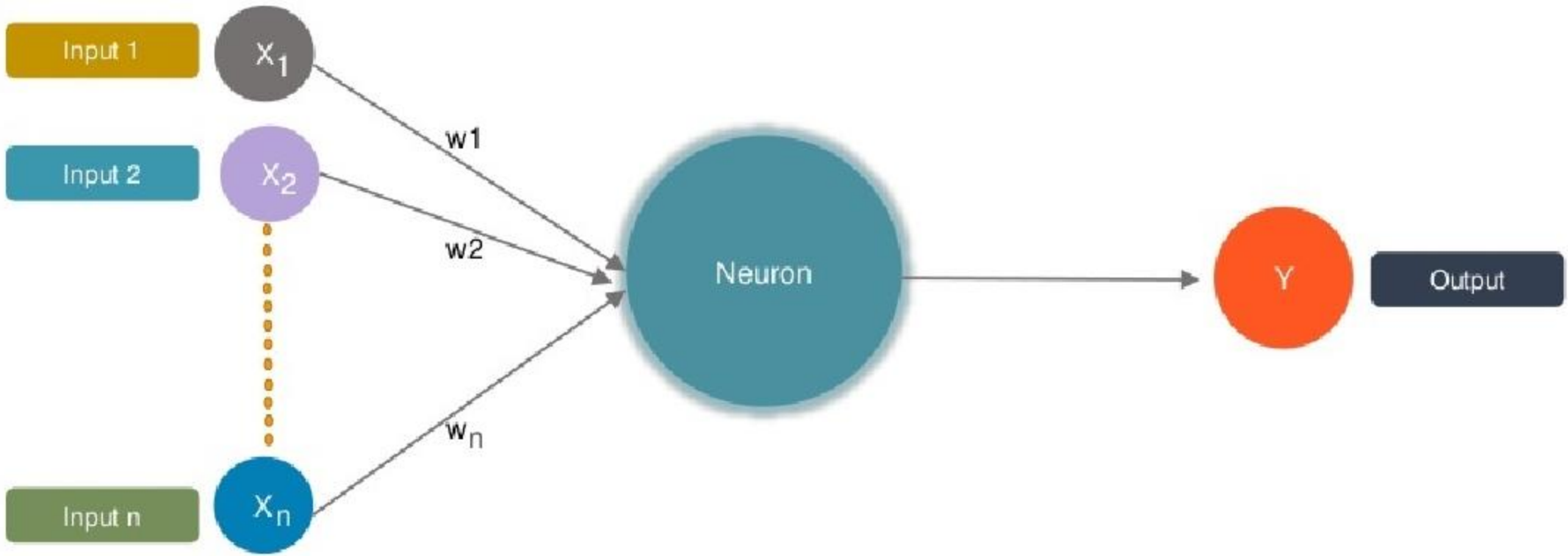
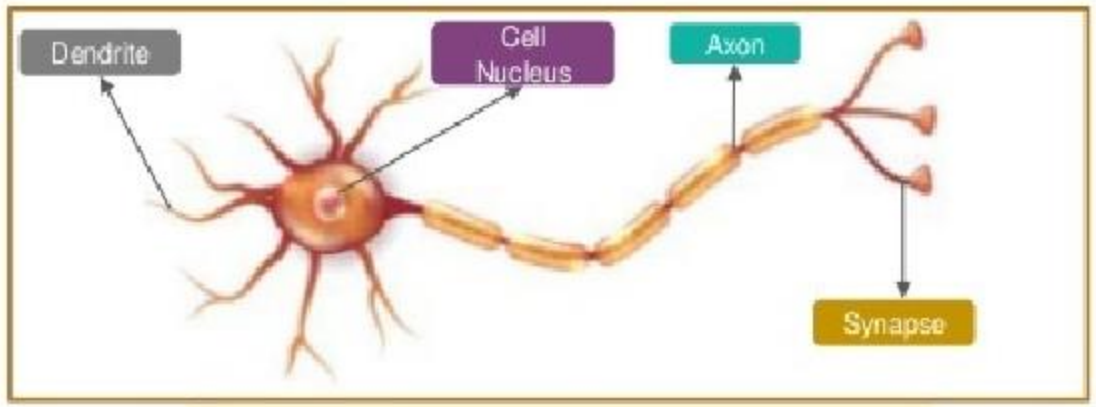
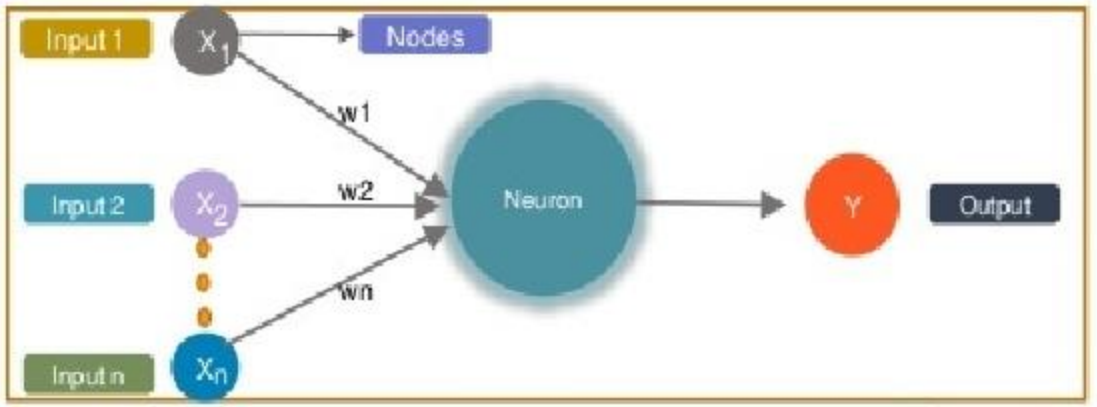


Biological Neuron vs Artificial Neuron

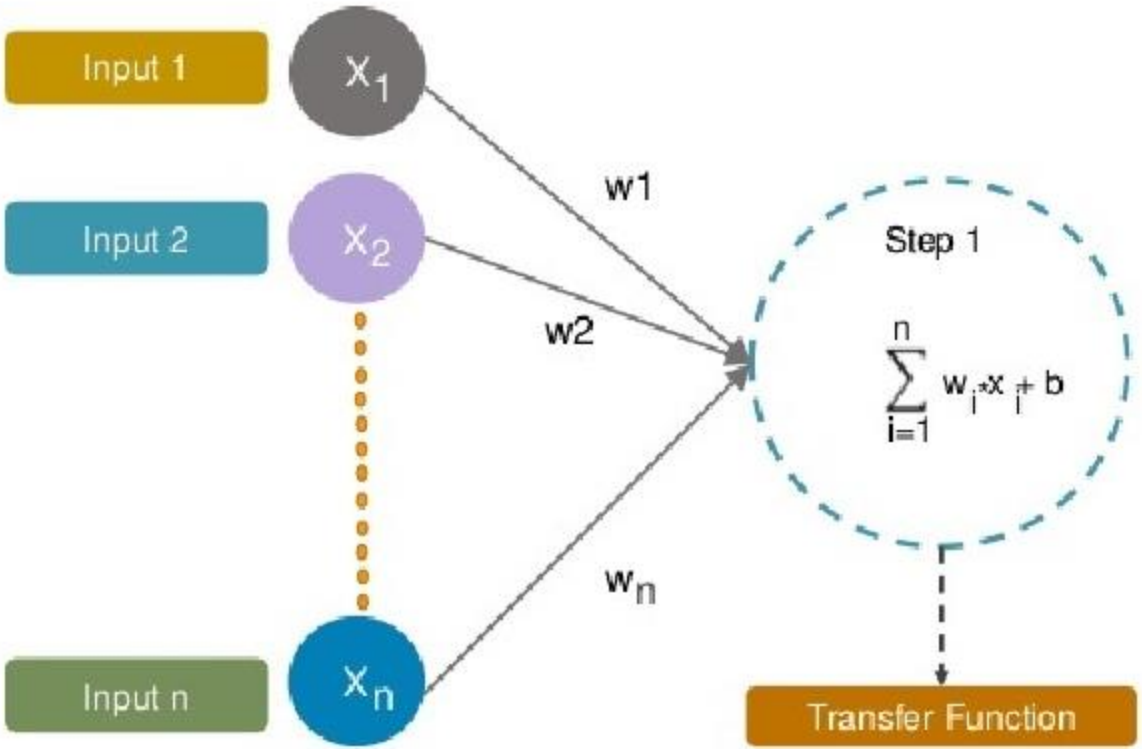




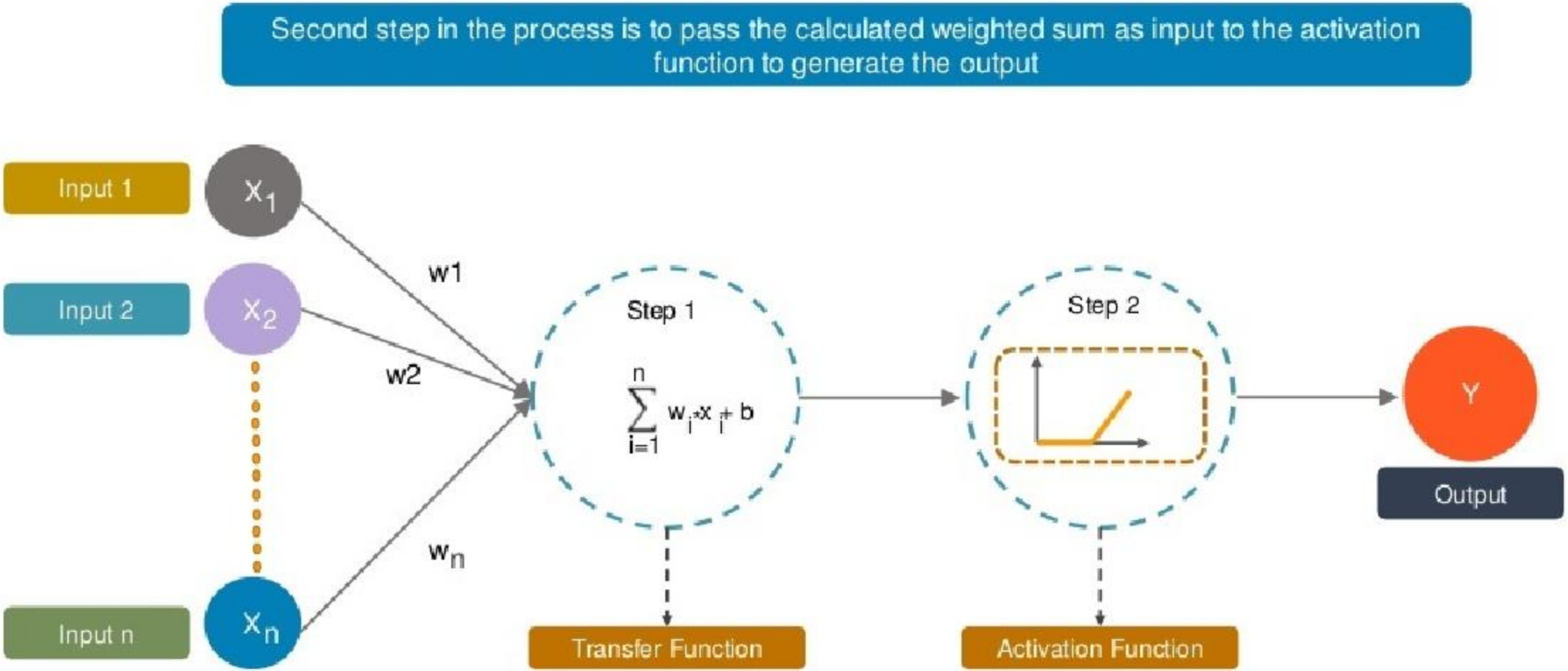
Biological Neuron	Artificial Neuron
Dendrites	Inputs
Cell Nucleus	Nodes
Synapse	Weights
Axon	Output

What is a Neural Network?

First step in the process is to calculate the weighted sum of the inputs and add a bias

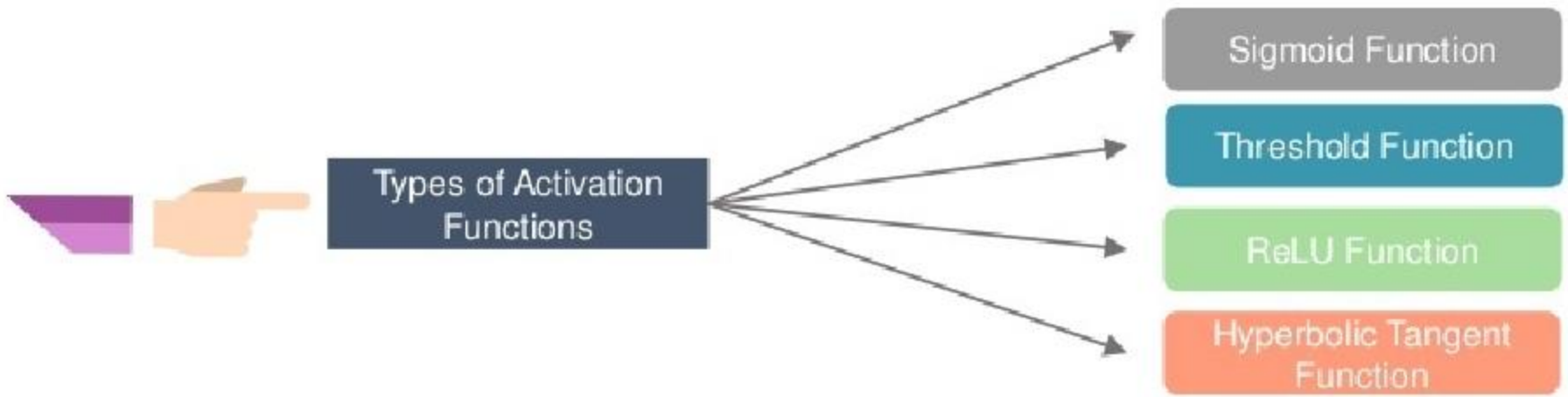


What is a Neural Network?



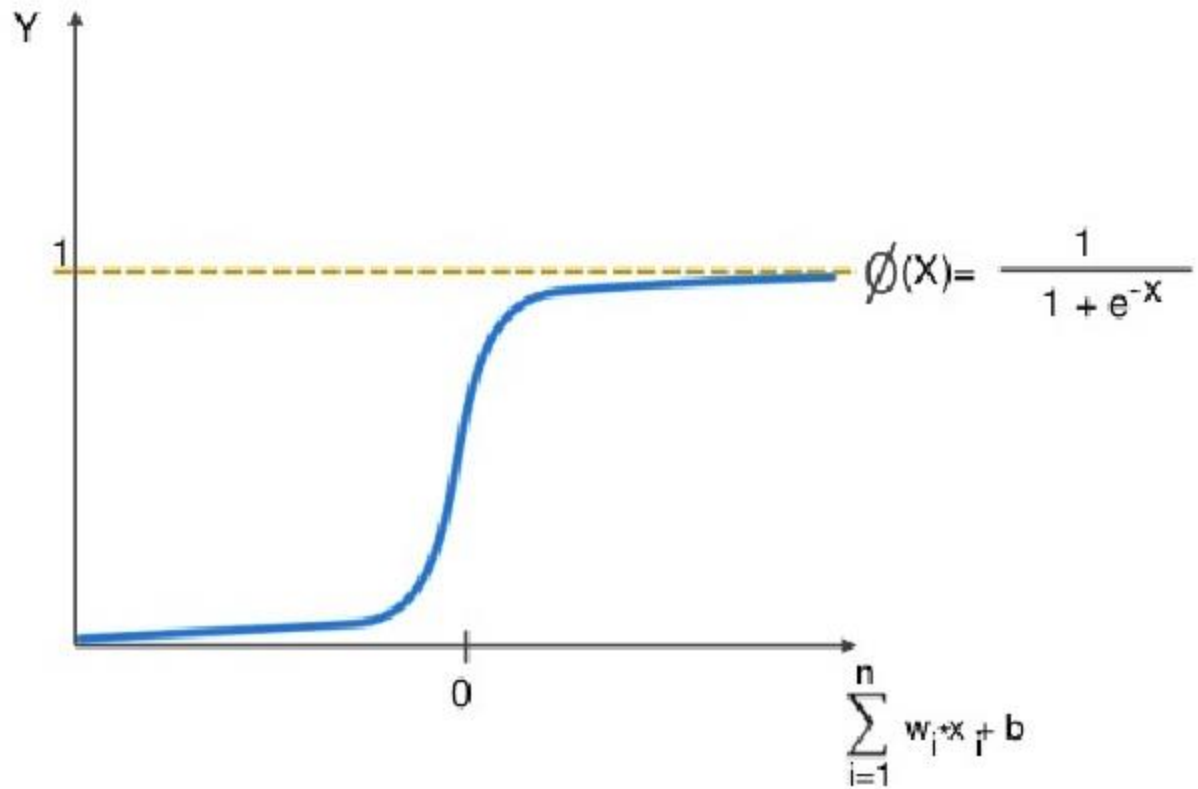
Activation Functions

An Activation function takes the "weighted sum of input plus the bias" as the input to the function and decides whether it should be fired or not



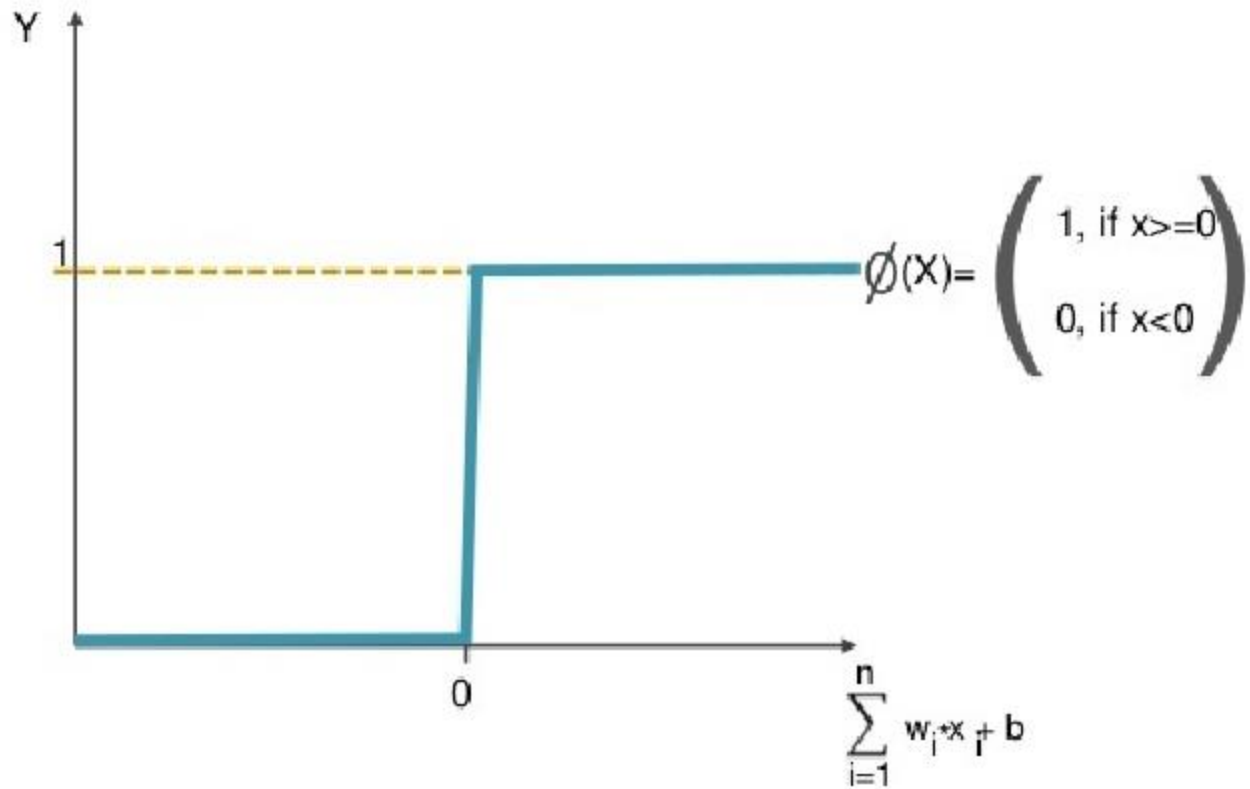
Activation Functions

Sigmoid Function → Used for models where we have to predict the probability as an output. It exists between 0 and 1.



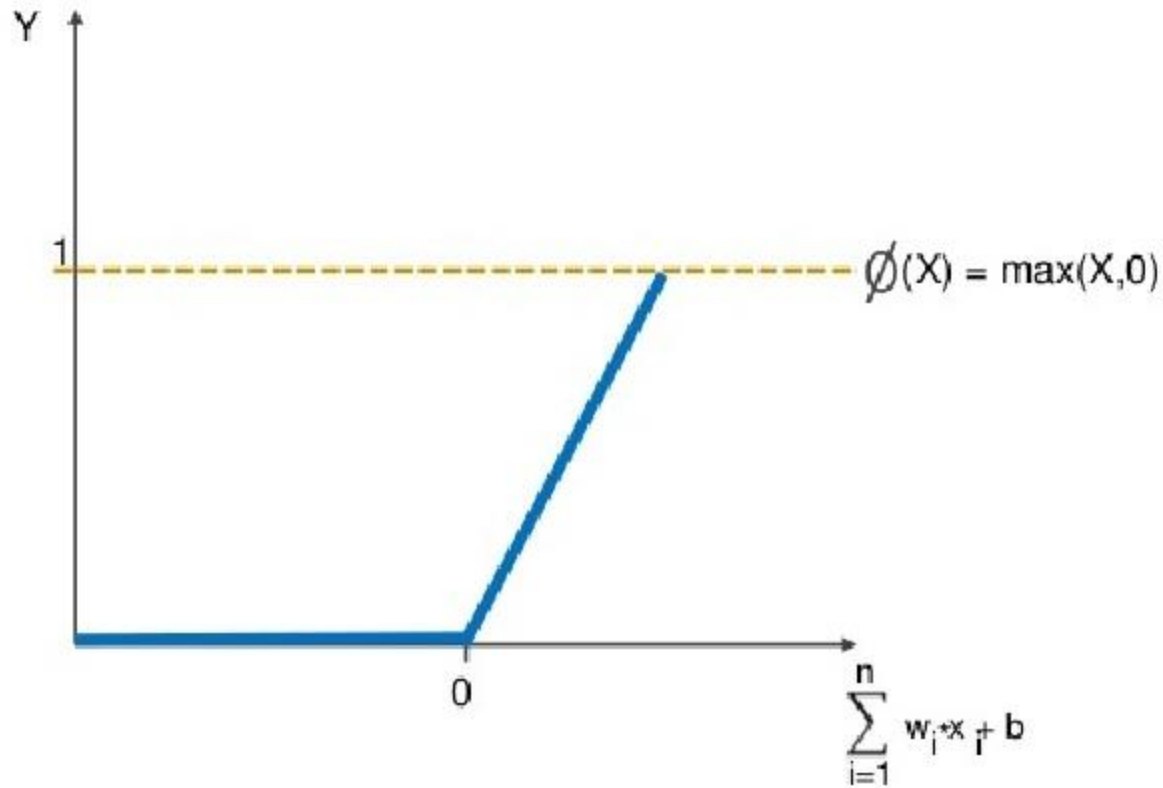
Activation Functions

Threshold Function → It is a threshold based activation function. If Y value is greater than a certain value, the function is activated and fired else not.



Activation Functions

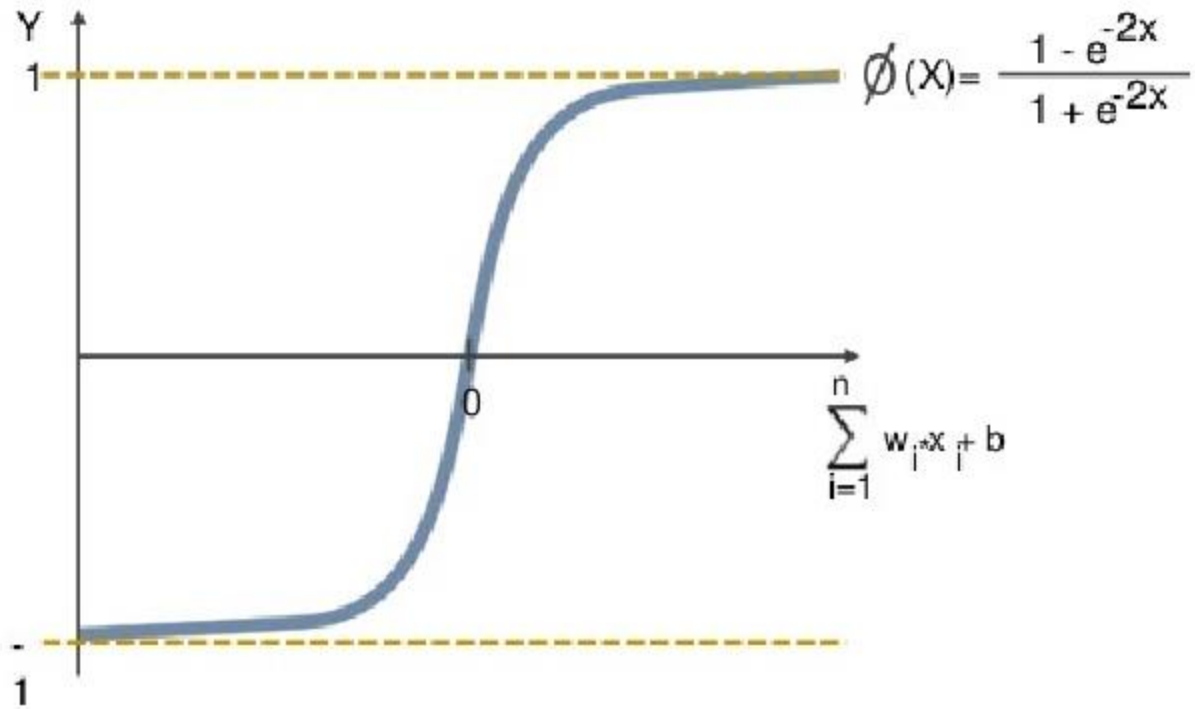
ReLU Function → It is the most widely used Activation function and gives an output of X if X is positive and 0 otherwise



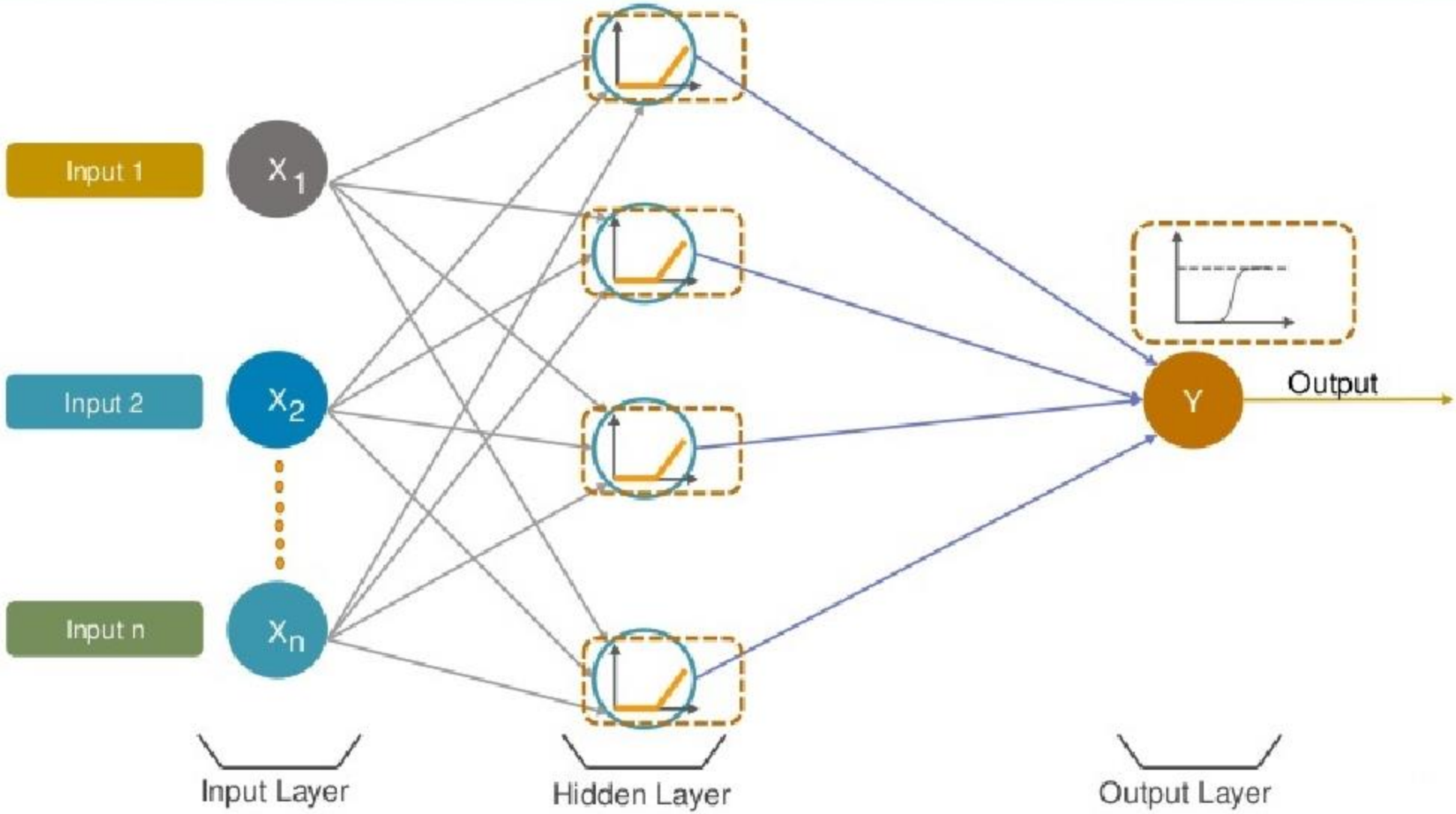
Activation Functions

Hyperbolic Tangent Function →

This function is similar to Sigmoid function and is bound to range (-1, 1)



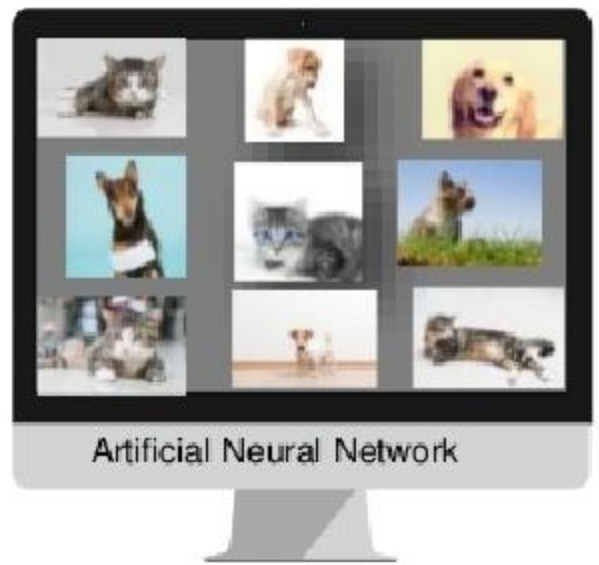
Activation Functions



Working of a Neural Network

Working of a Neural Network

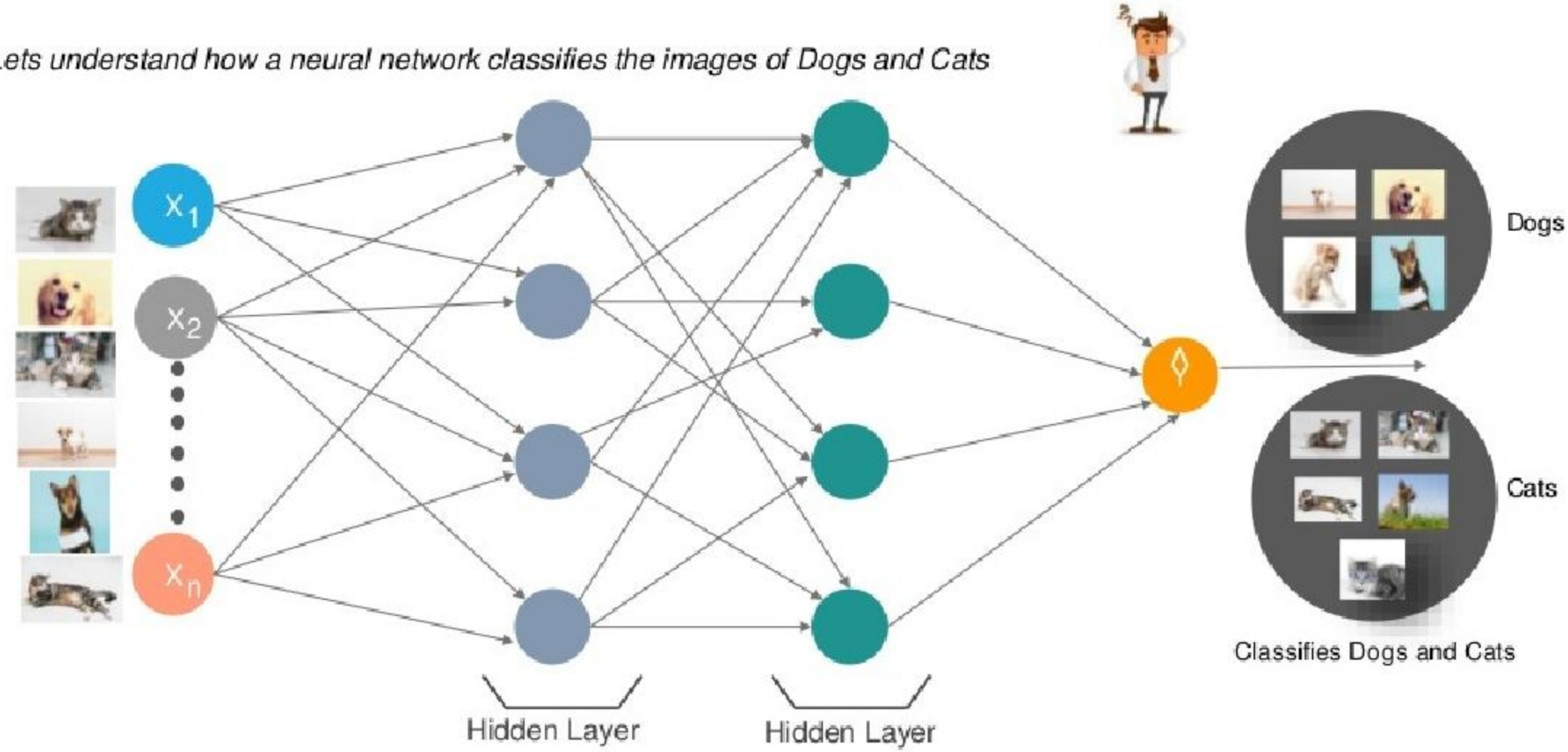
Lets understand how a neural network classifies the images of Dogs and Cats



Feed the images of Dogs and Cats to the neural network as input

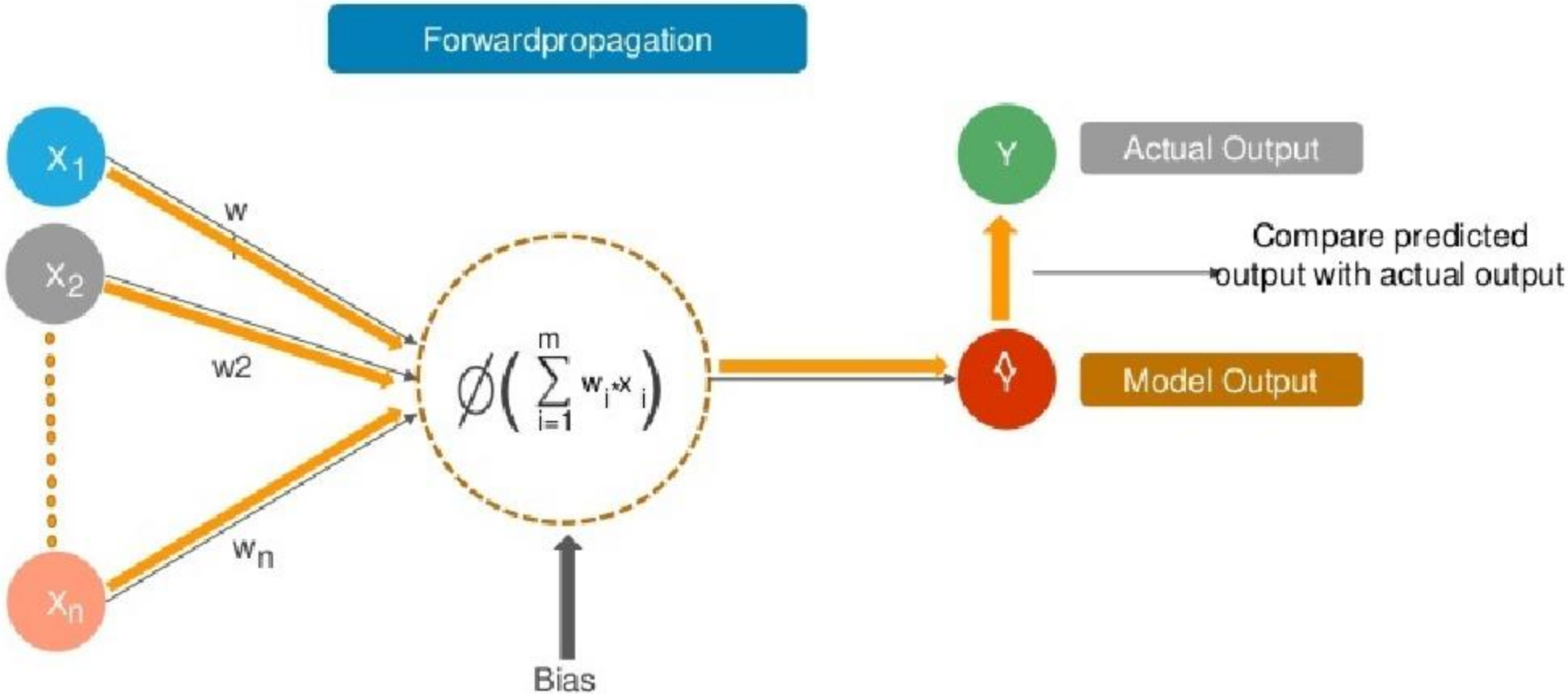
Working of a Neural Network

Lets understand how a neural network classifies the images of Dogs and Cats



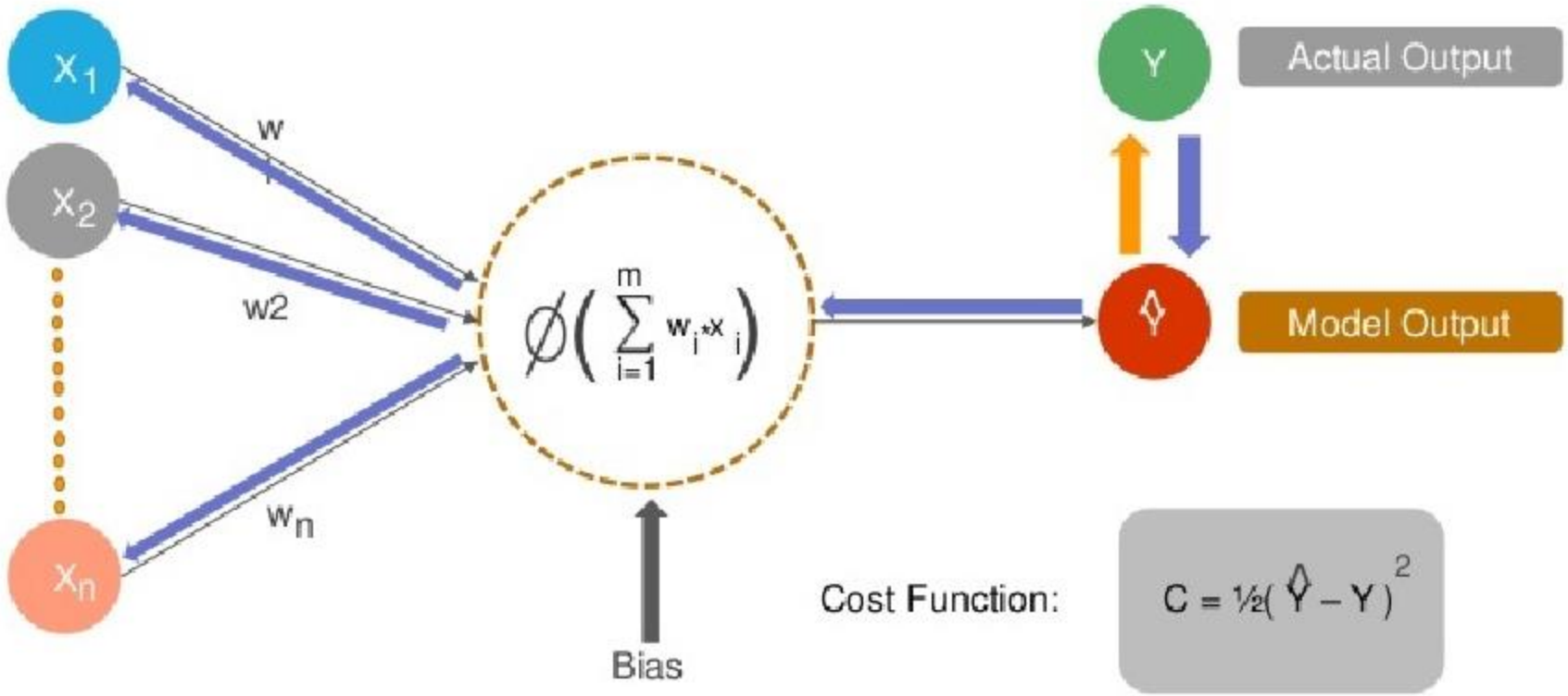
Working of a Neural Network

Lets consider a simple neural network



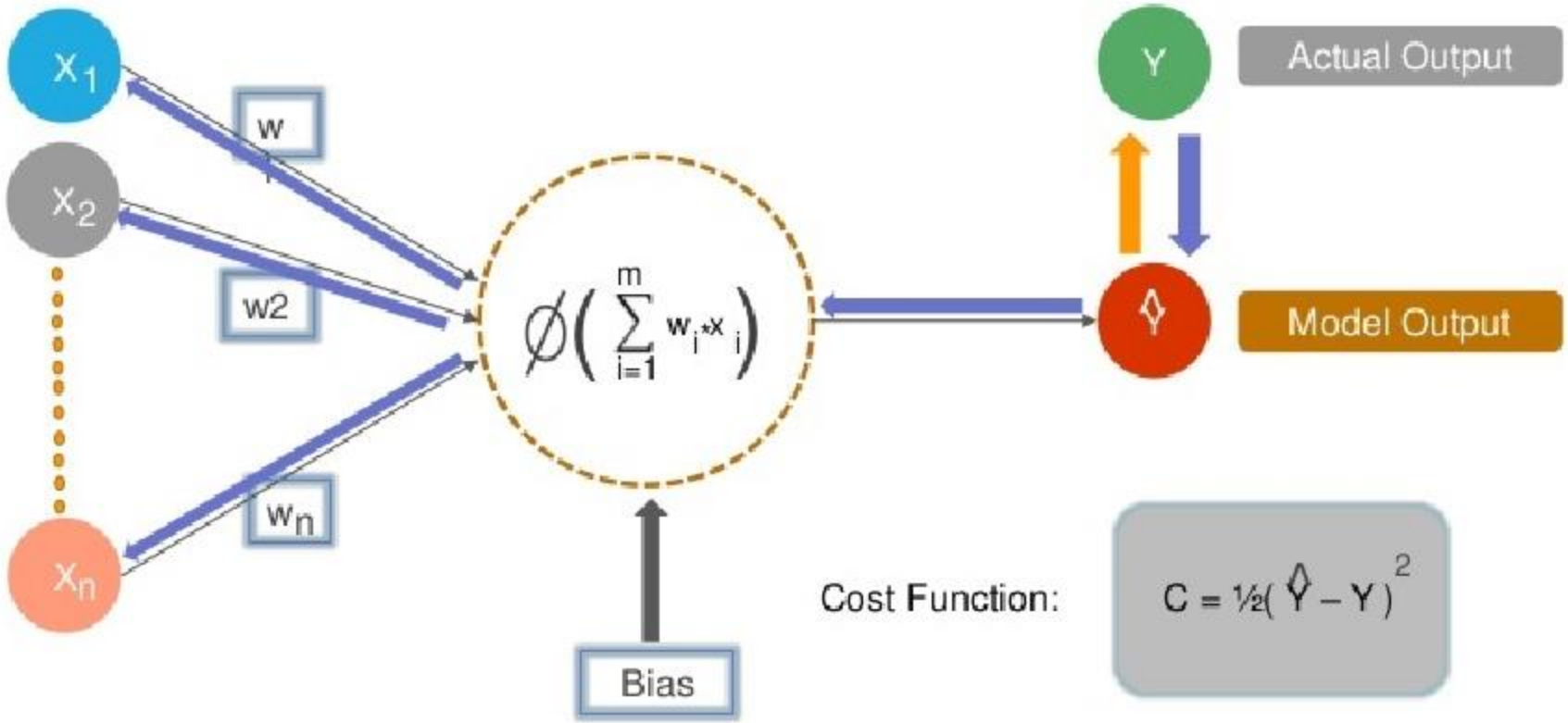
Working of a Neural Network

After training the Neural Network, it uses ***Backpropagation*** method to improve the performance of the network. Cost Function helps to reduce the error rate.

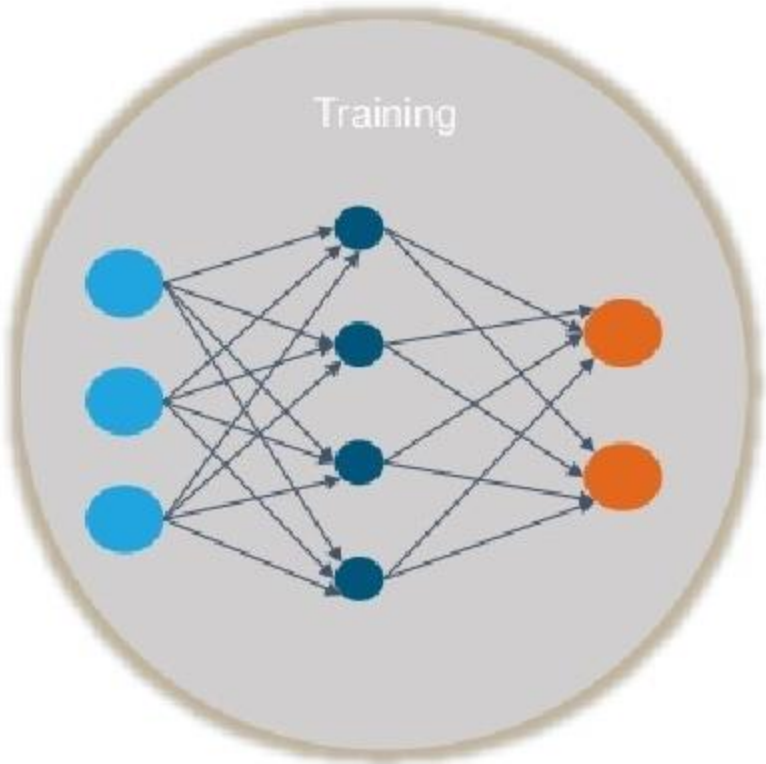


Cost Function

The ***Cost*** value is actually the difference between the neural nets predicted output and the actual output from a set of labelled training data. The least cost value is obtained by making adjustments to the weights and biases iteratively throughout the training process.



Why are Deep Neural Nets hard to train?



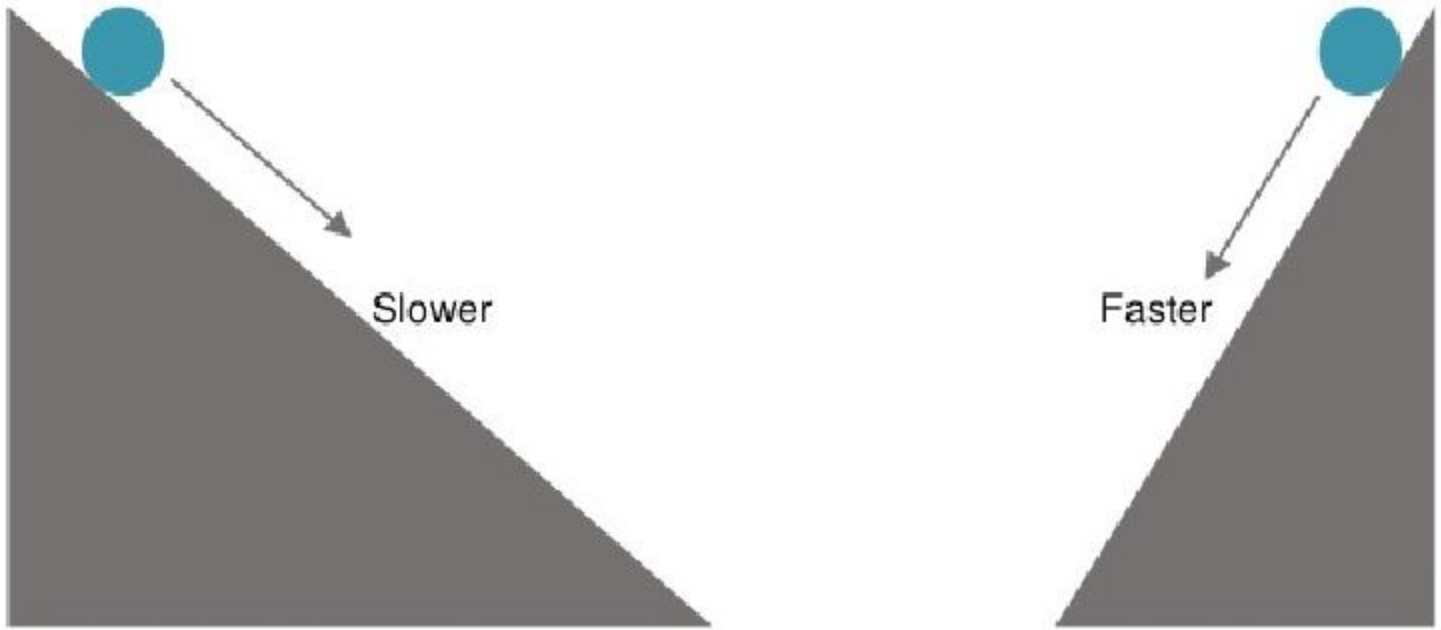
Gradient is the rate at which cost changes with respect to weight and bias

Until 2006, there was no proper method to accurately train deep neural networks due to a basic problem with the training process:

The Vanishing Gradient

Why are Deep Neural Nets hard to train?

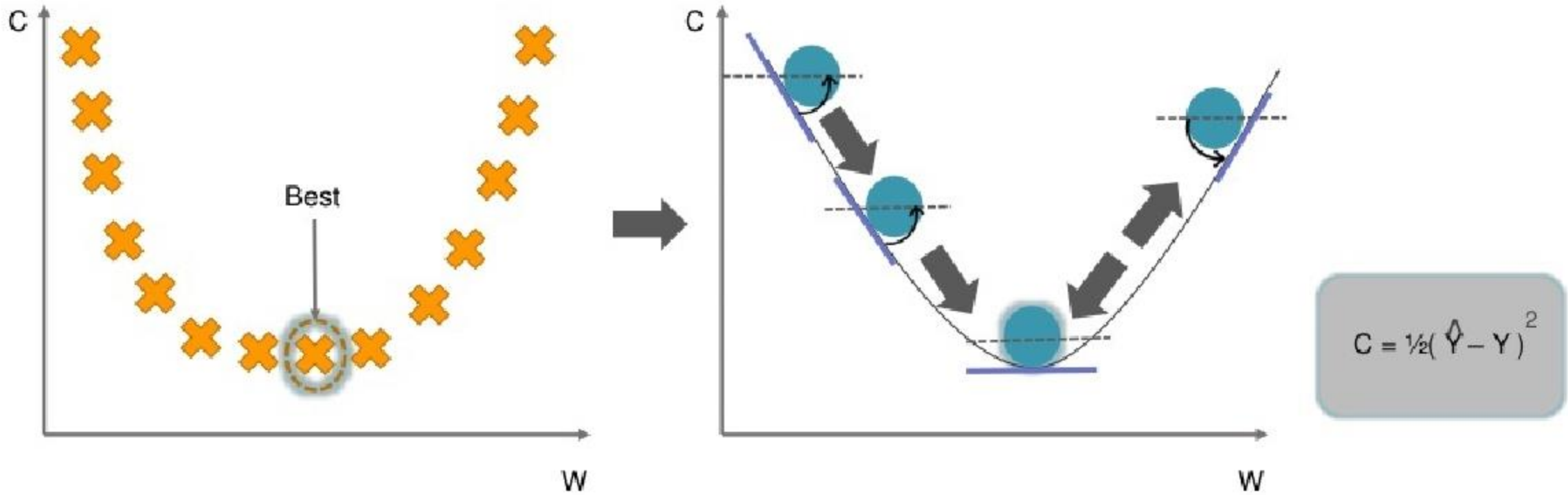
Let's understand Gradient like a slope and the training process like Rolling a ball



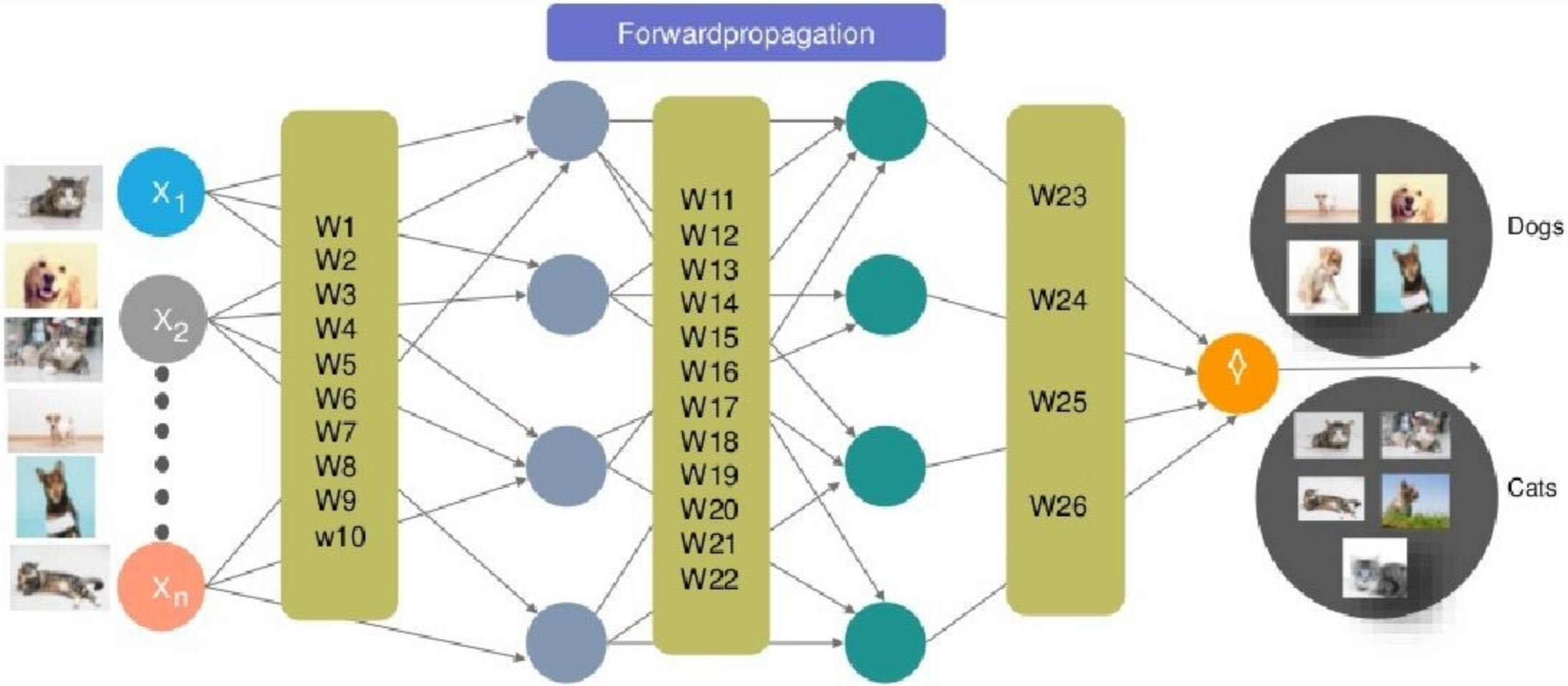
The ball will roll slower if the slope is gentle and will roll faster if the slope is steep. Likewise, a Neural Net will train slowly if the Gradient is small and it will train quickly if the Gradient is large.

Gradient Descent

Gradient Descent is an optimization algorithm for finding the minimum of a function

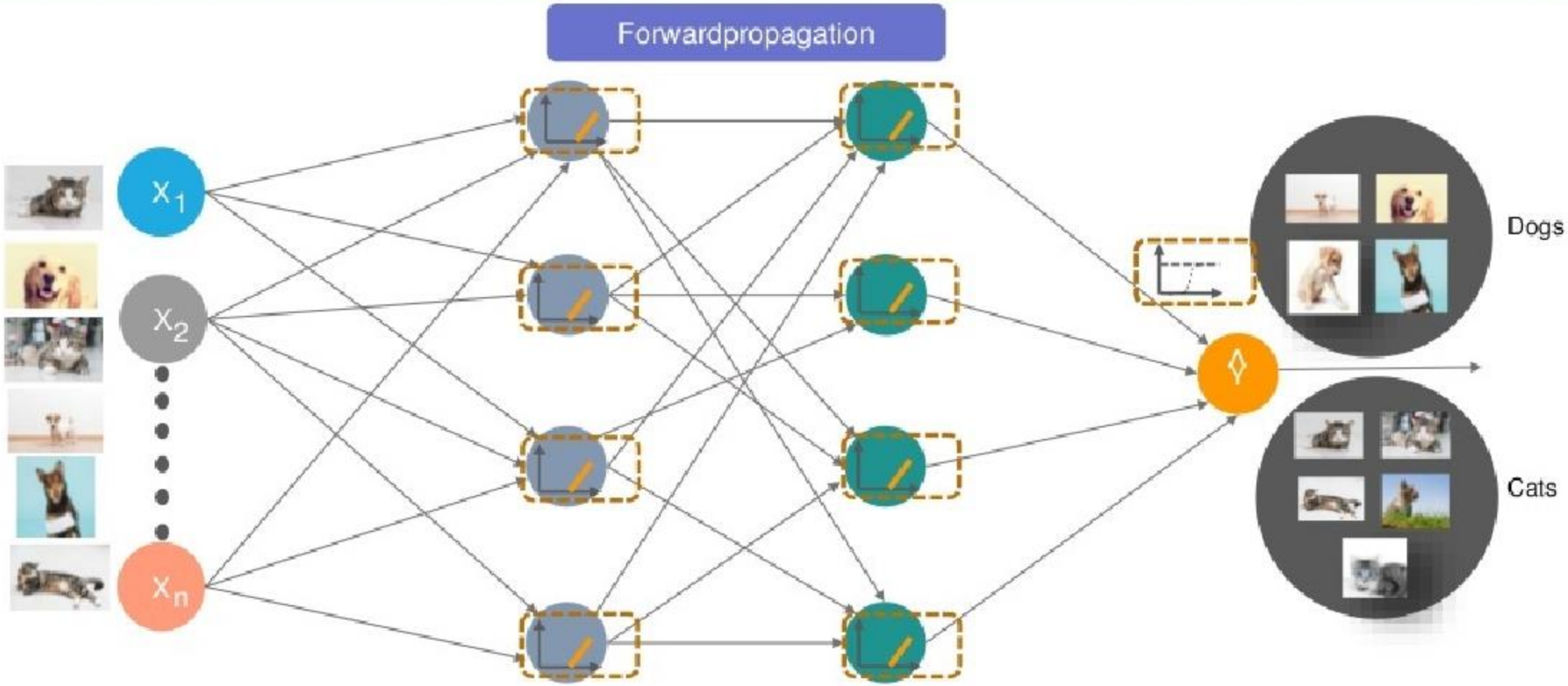


Neural Network Prediction



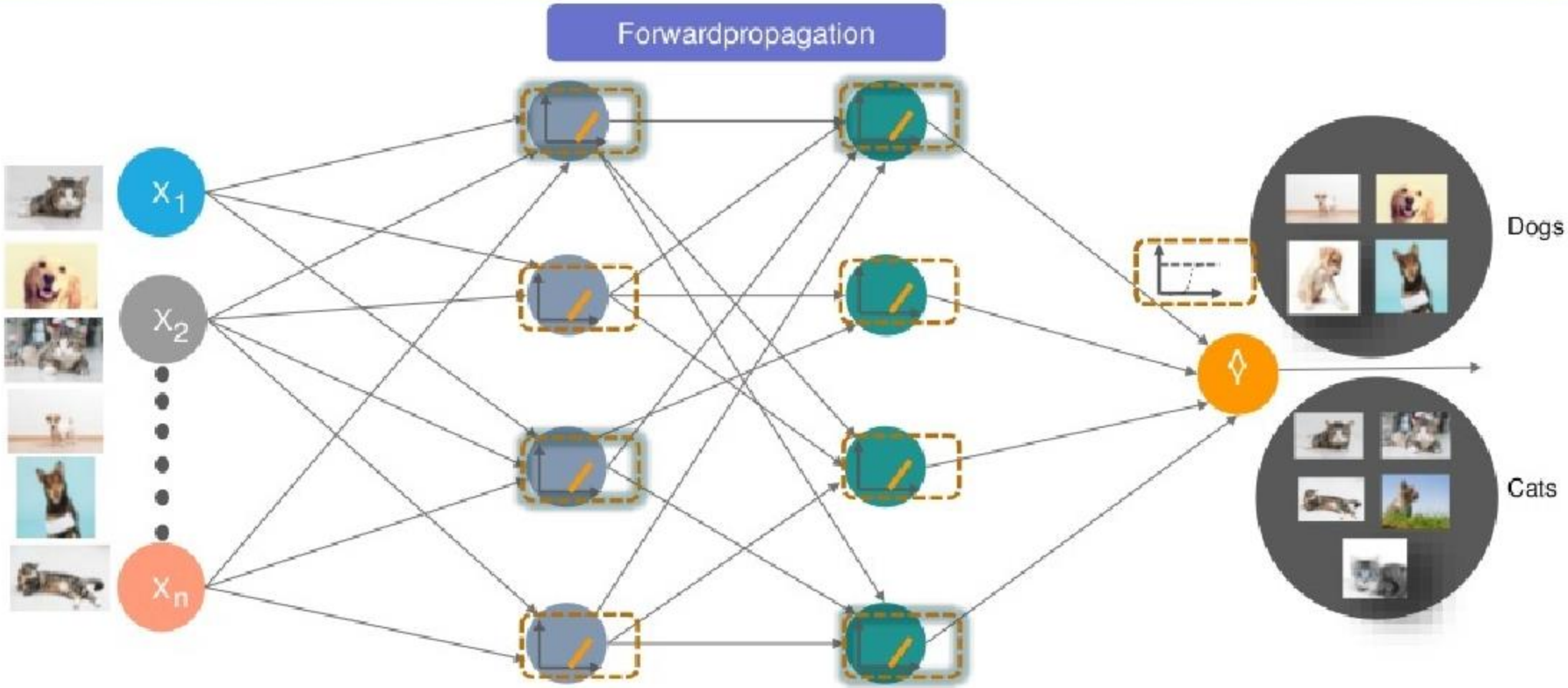
Applying the weights to each interconnection

Neural Network Prediction



Applying the activation functions to the hidden layers to decide which nodes to fire and carry out ***feature extraction***

Neural Network Prediction



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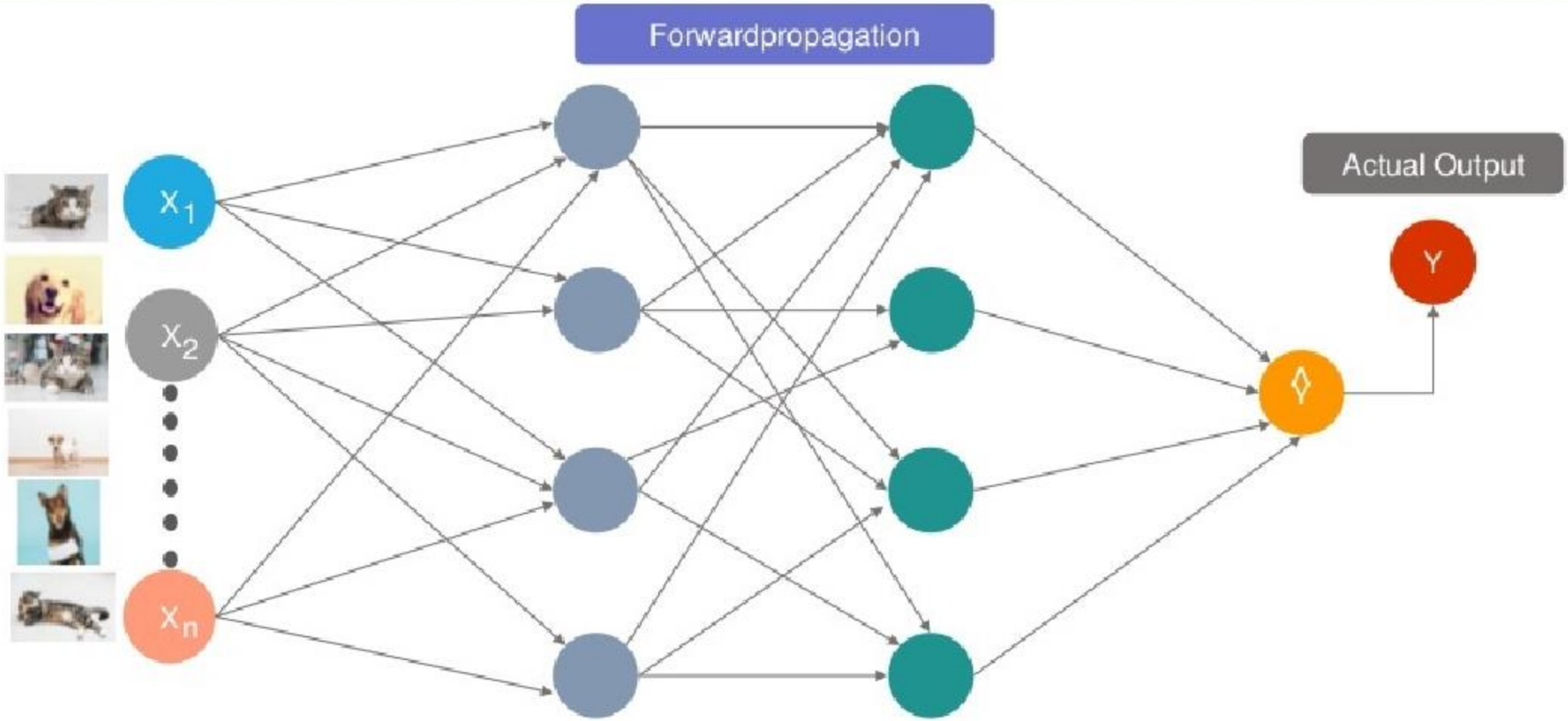
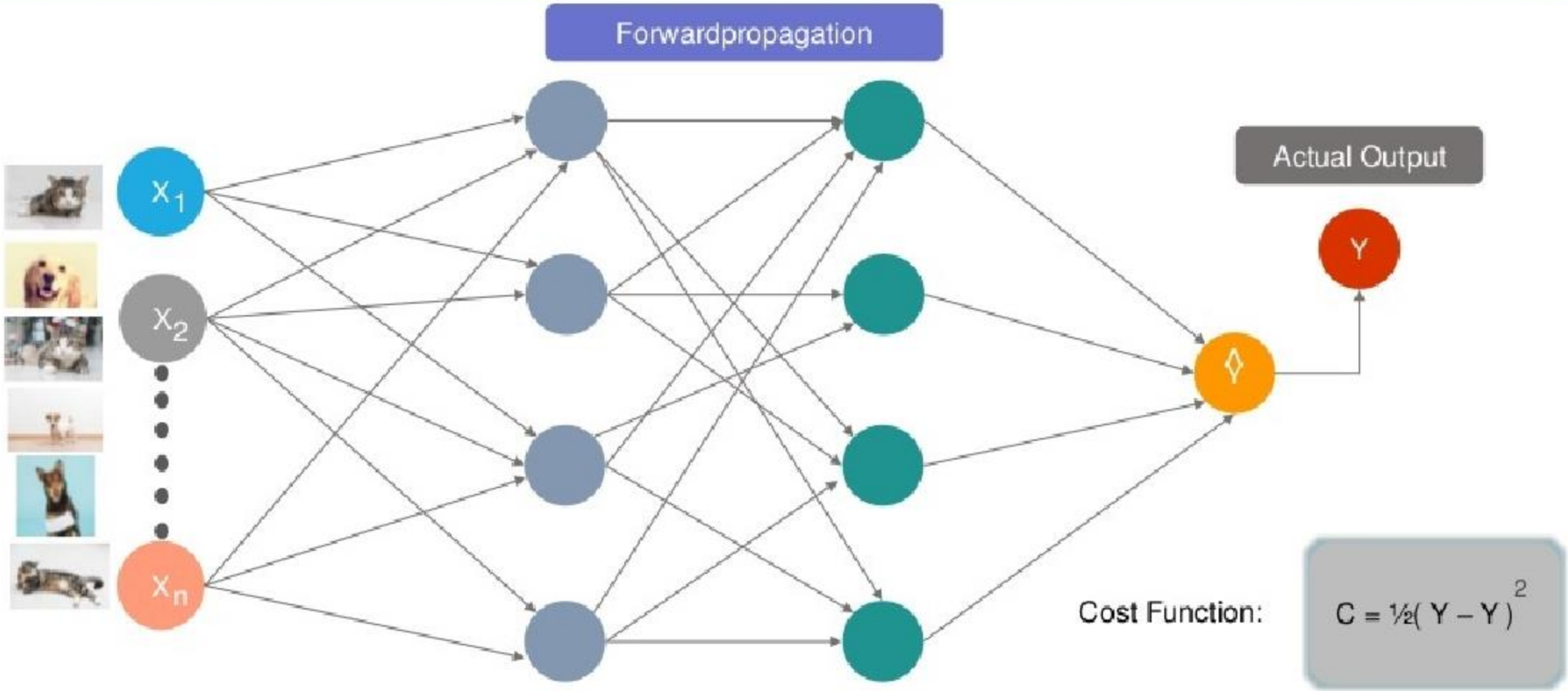


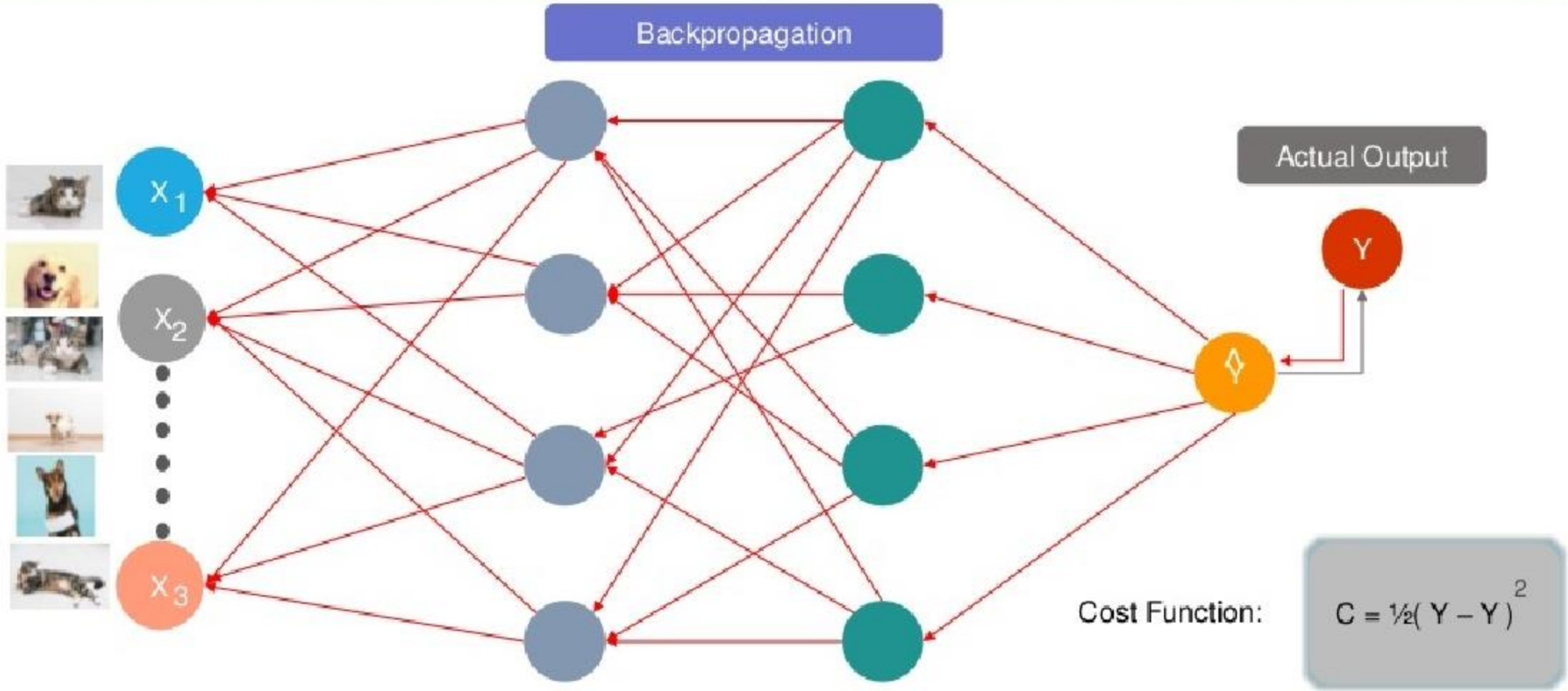
Comparing the predicted output to actual output

Neural Network Prediction



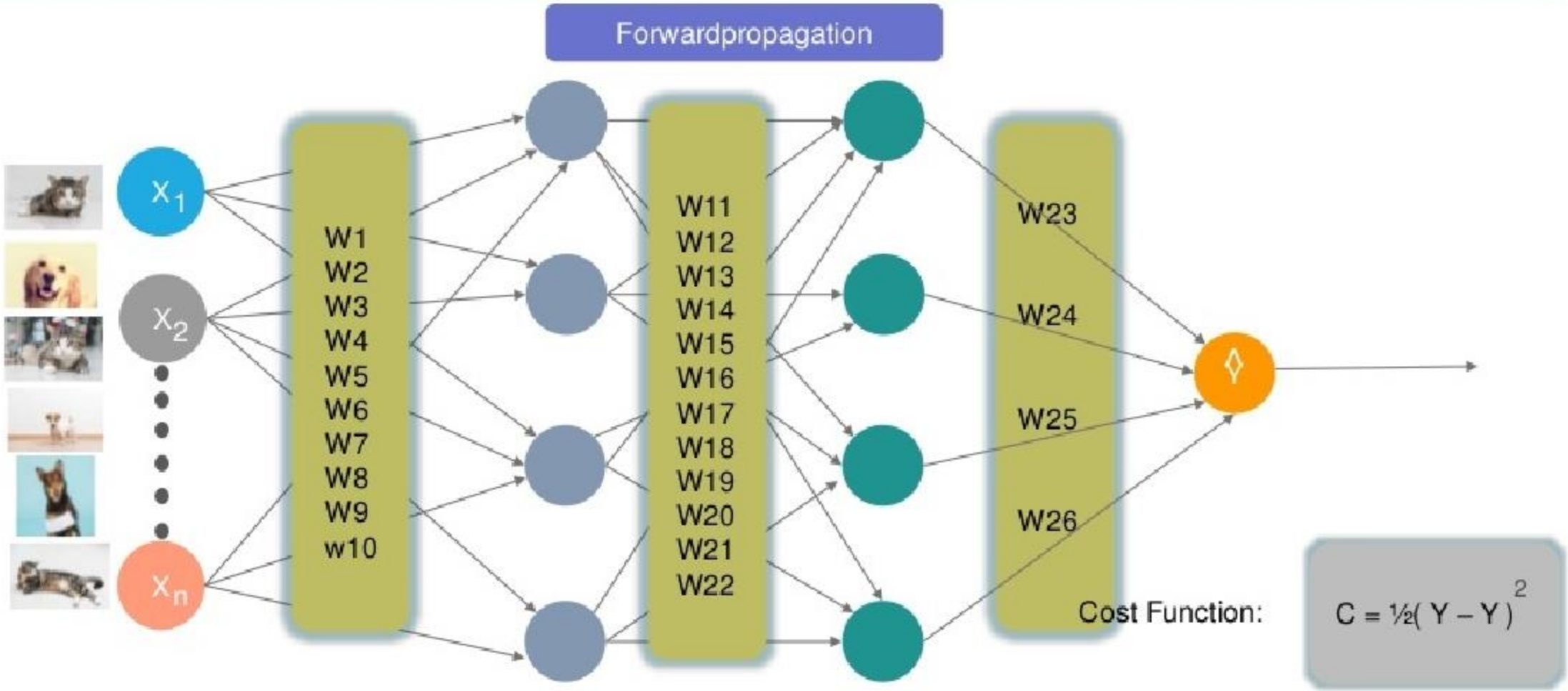
Applying the cost function to minimize the difference between predicted and actual output using gradient descent algorithm

Neural Network Prediction



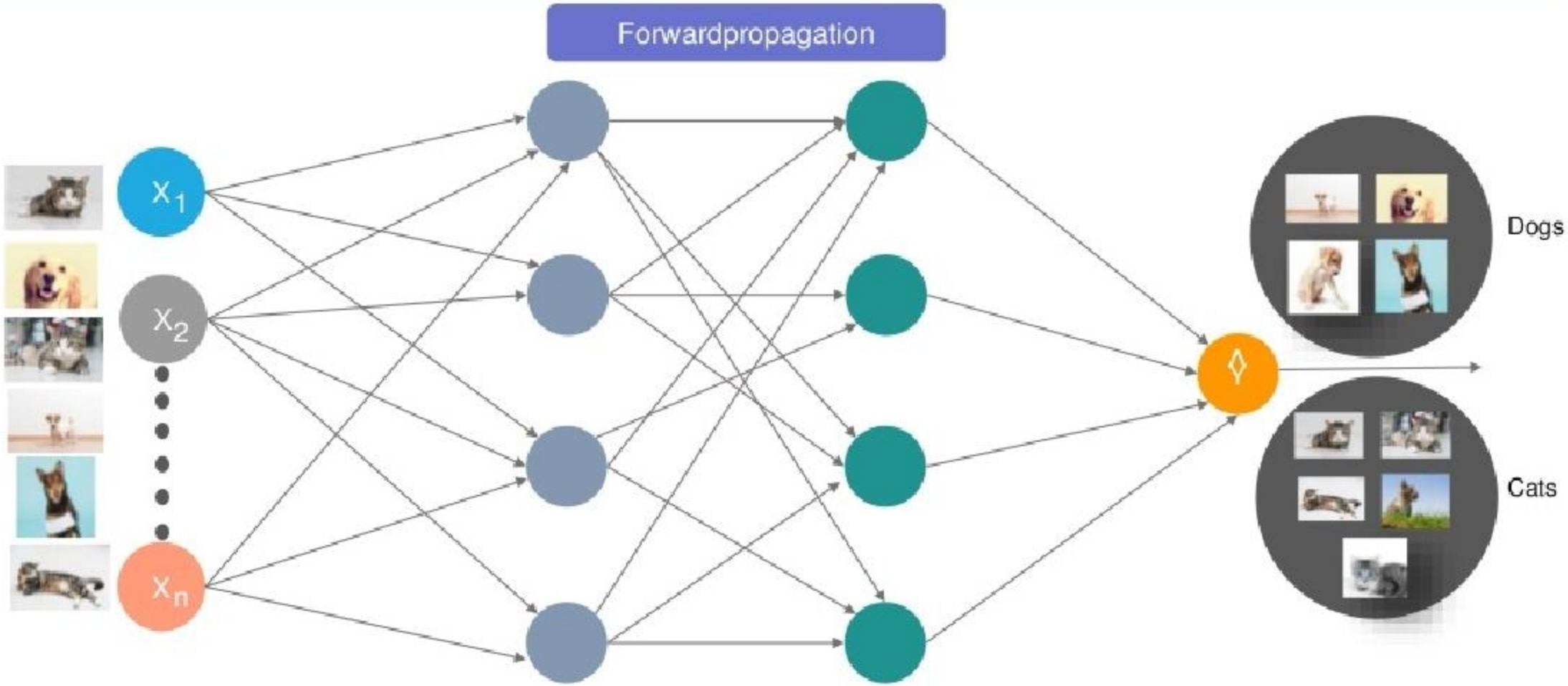
Adjusting the weights and biases using backpropagation method to improve the model

Neural Network Prediction



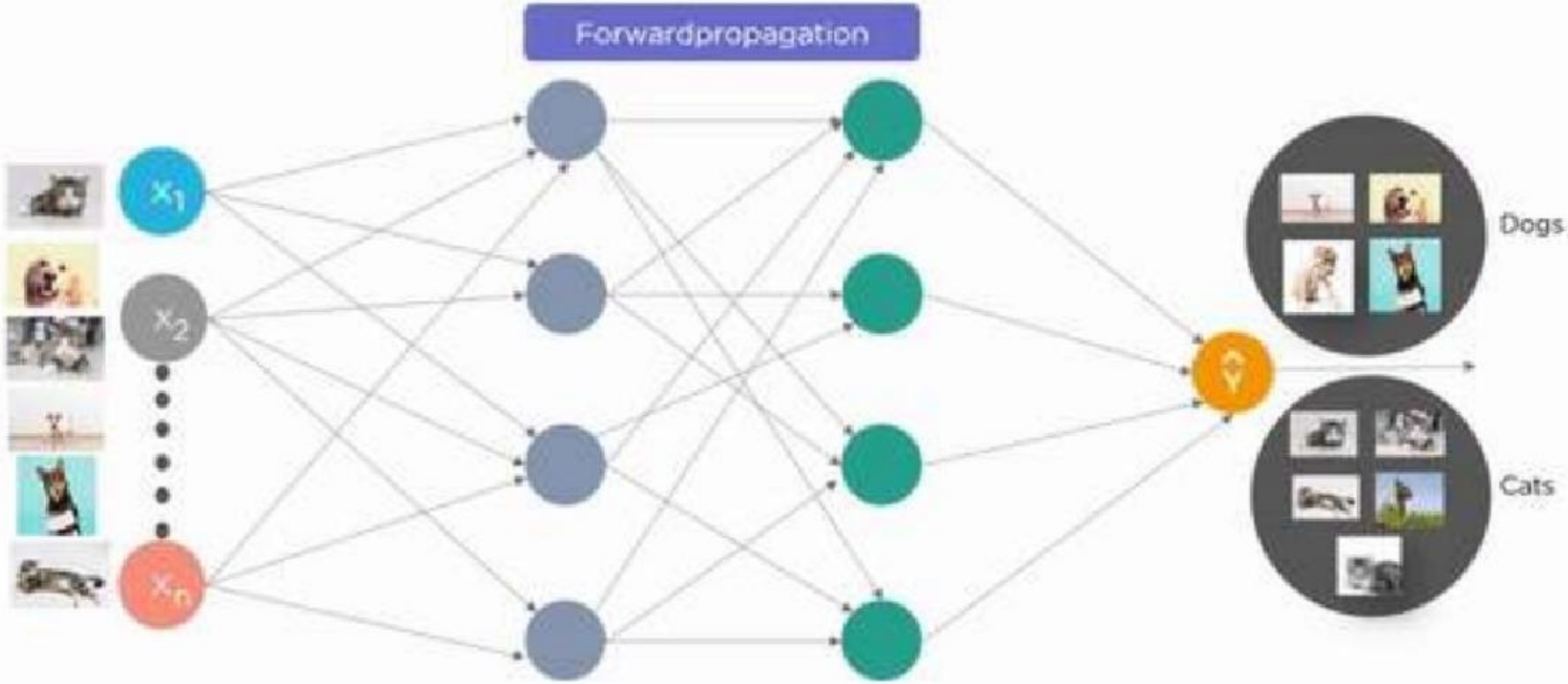
Applying the updated weights and biases to calculate the cost value in order to improve the prediction rate

Neural Network Prediction



Classifying the images based on the extracted features

Neural Network Prediction



Thank You! Questions or Comments?