



SNS COLLEGE OF TECHNOLOGY

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Department of Biomedical Engineering

Course Name: 19AMT301 & DEEP LEARNING
III Year : V Semester

Unit I- INTRODUCTION TO NEURAL NETWORKS

Topic : Back propagation

19AMT301/Deep learning/Unit 1/Mr. Karthik G.L./AP/BME

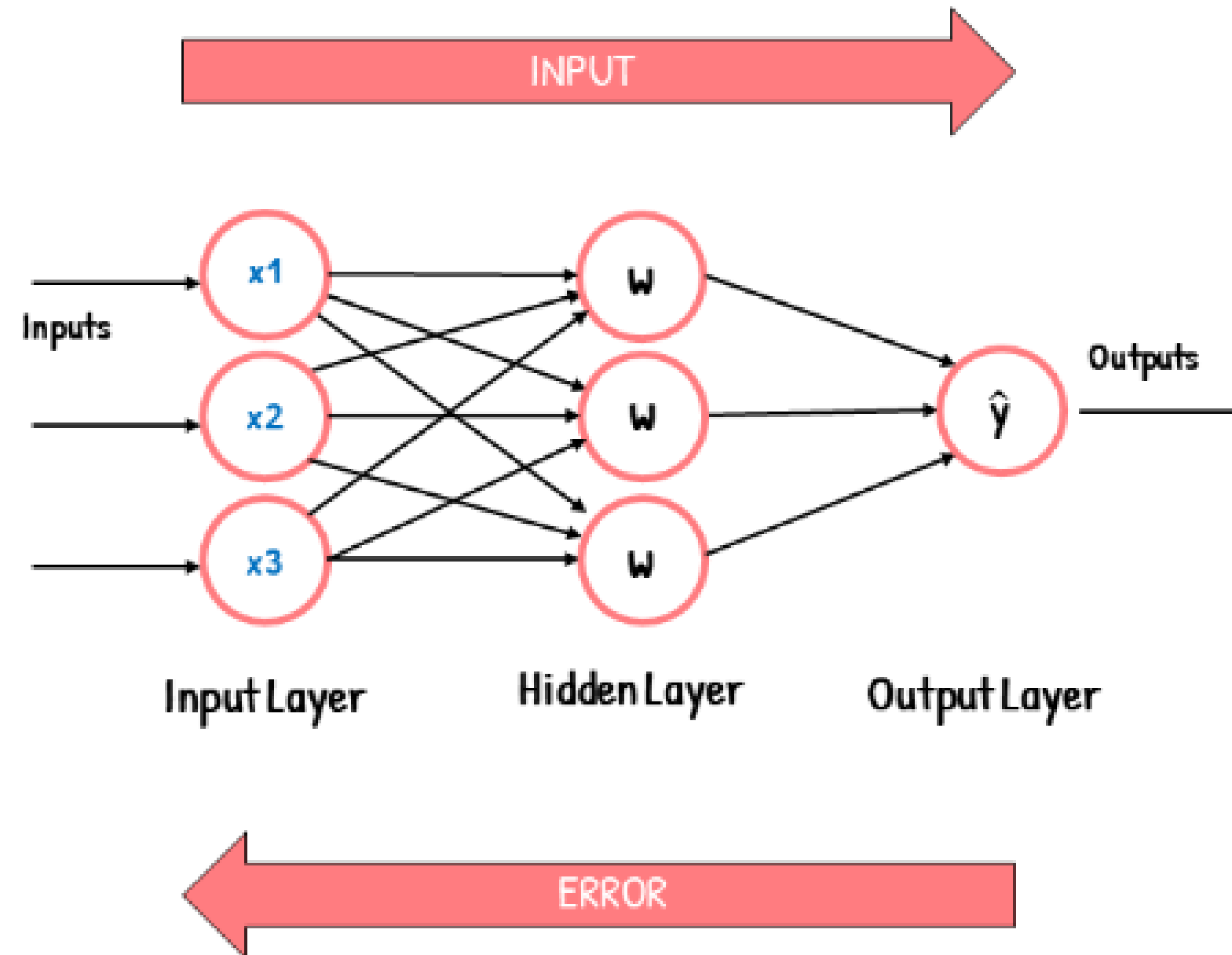


What is Back propagation?

- [Backpropagation](#) is a training algorithm used for training feedforward neural networks.
- It plays an important part in improving the predictions made by neural networks. This is because backpropagation is able to improve the output of the neural network iteratively.
- Feed forward NN- Input layer \rightarrow Output layer
- Backpropagation – Output layer \rightarrow Input layer



Back propagation in Feedforward NN



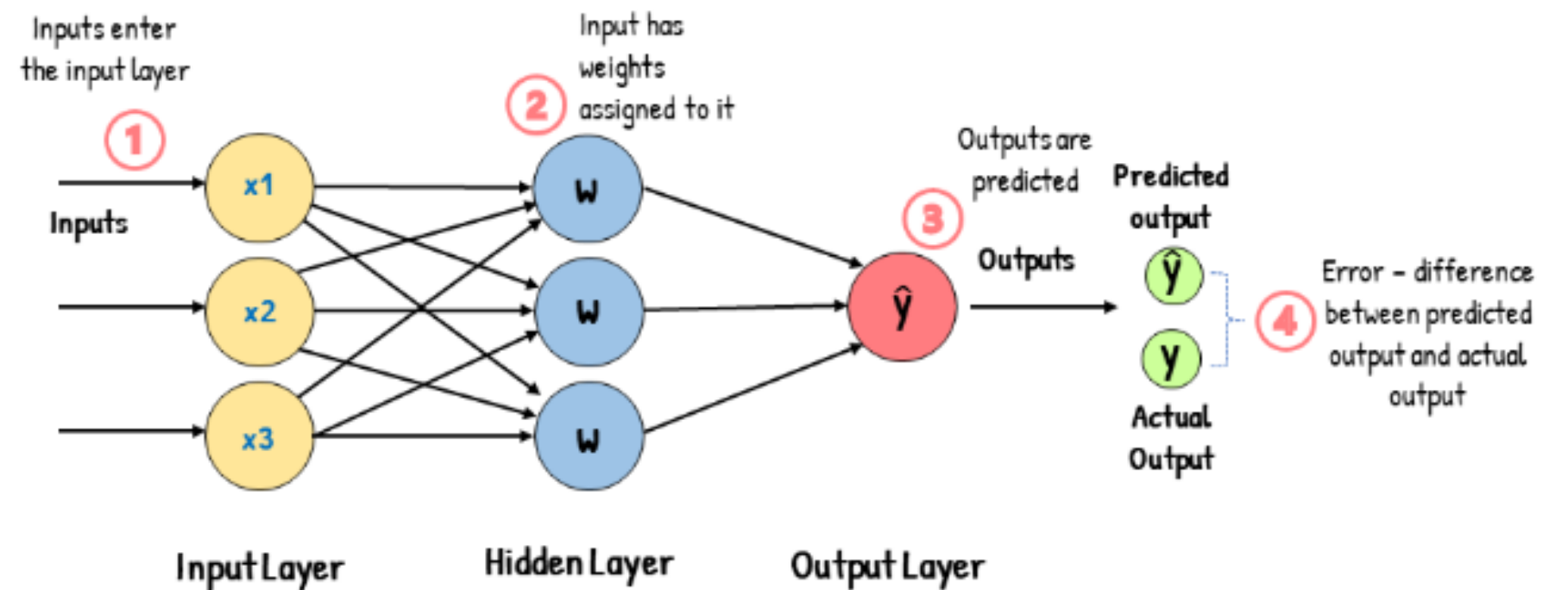
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How does Back propagation works?

- Feed Forward NN consists of One input layer, one or more hidden layer and one output layer
- Weights of inputs is proportional to the significance of the input

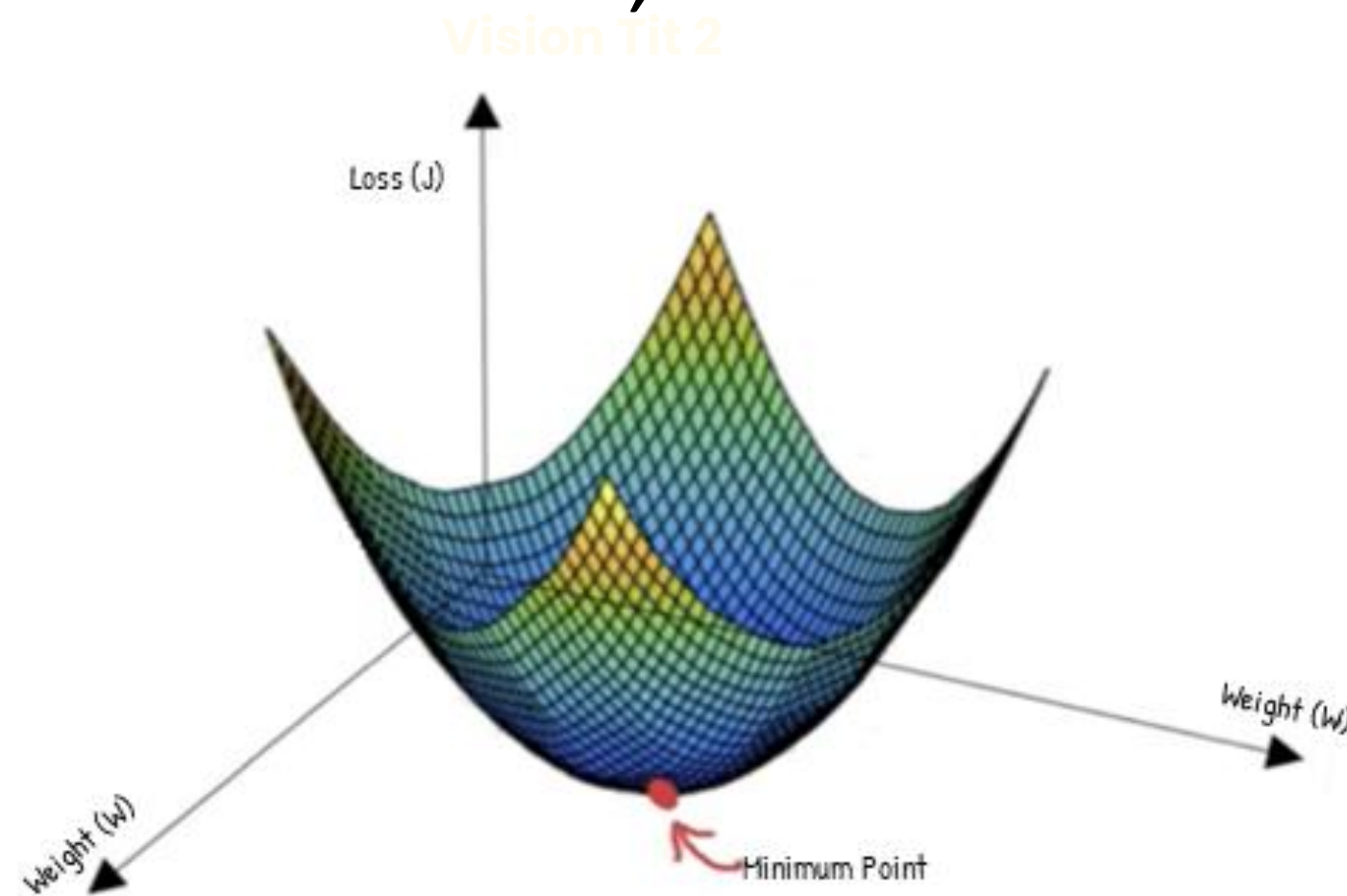
Feed-Forward Neural Network





Cost Function (J)

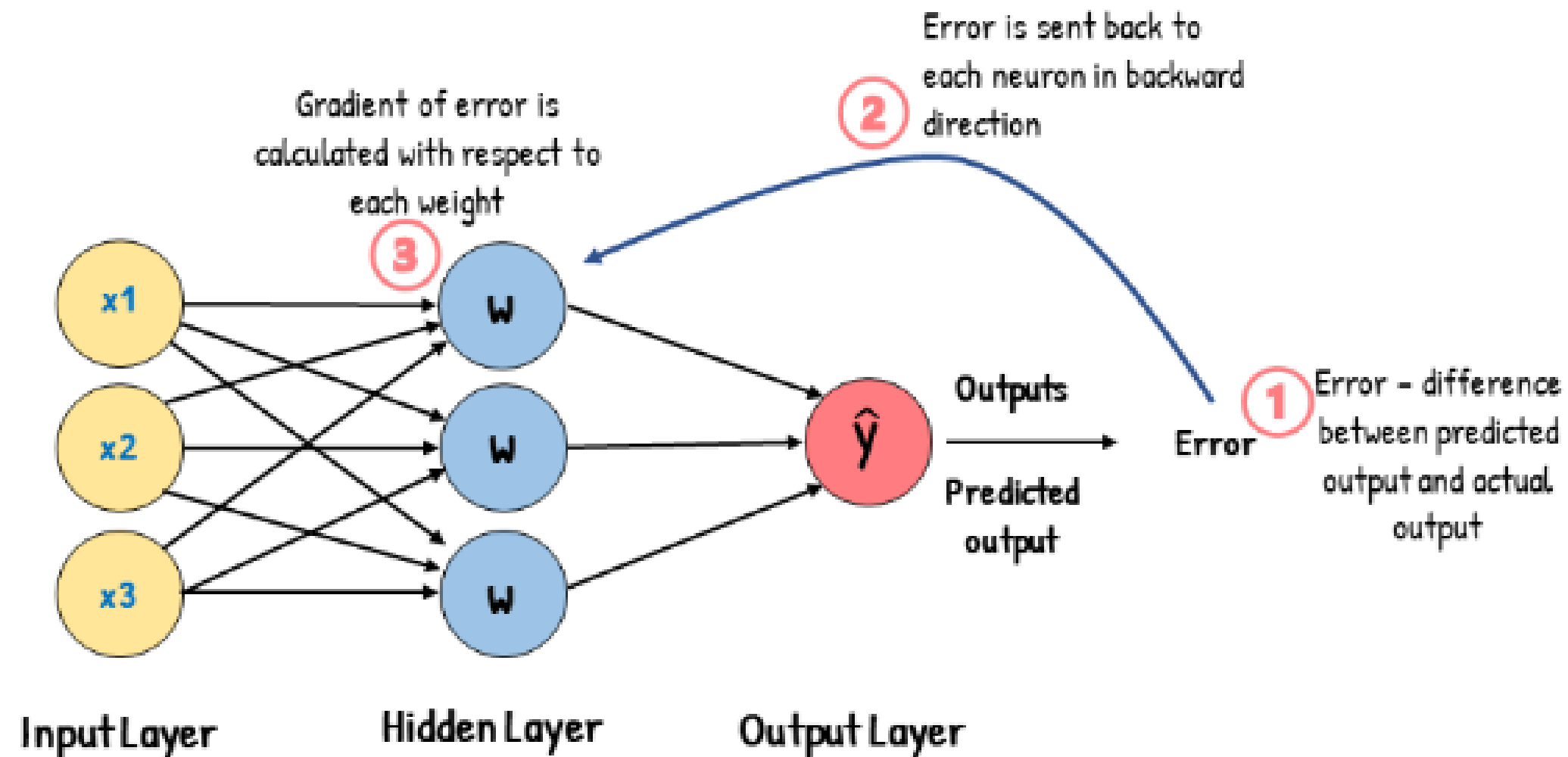
- The **cost function (J)** indicates how accurately the model performs. It tells us how far-off our predicted output values are from our actual values. It is also known as the error. Because the cost function quantifies the error, we aim to minimize the cost function.





Backpropagation to reduce loss or error

Backpropagation





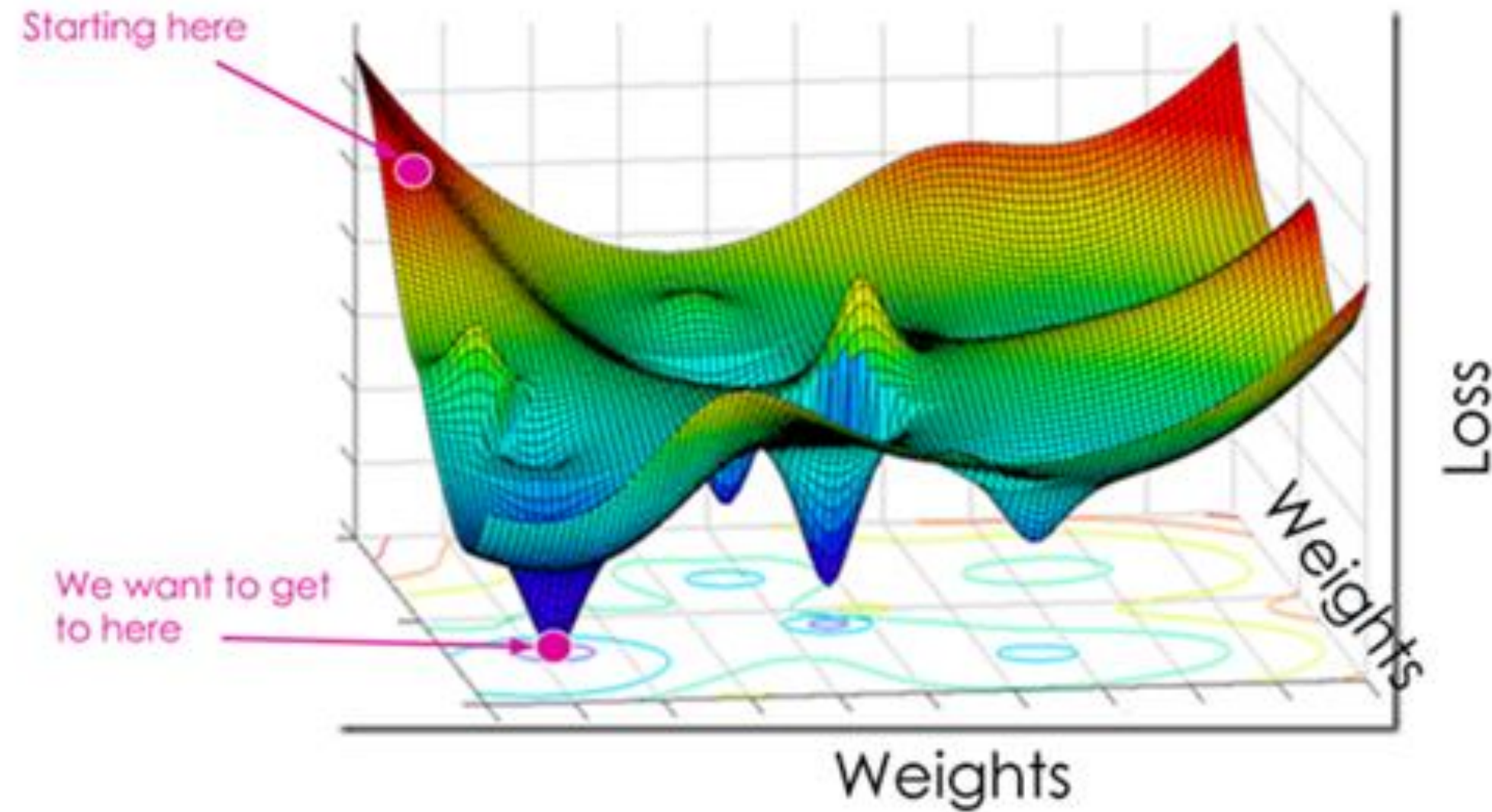
Gradient Descent



- The weights are adjusted using a process called gradient descent.
- Gradient descent is an optimization algorithm that is used to find the weights that minimize the cost function.
- Minimizing the cost function means getting to the minimum point of the cost function.
- So, gradient descent aims to find a weight corresponding to the cost function's minimum point.



Navigation of cost function



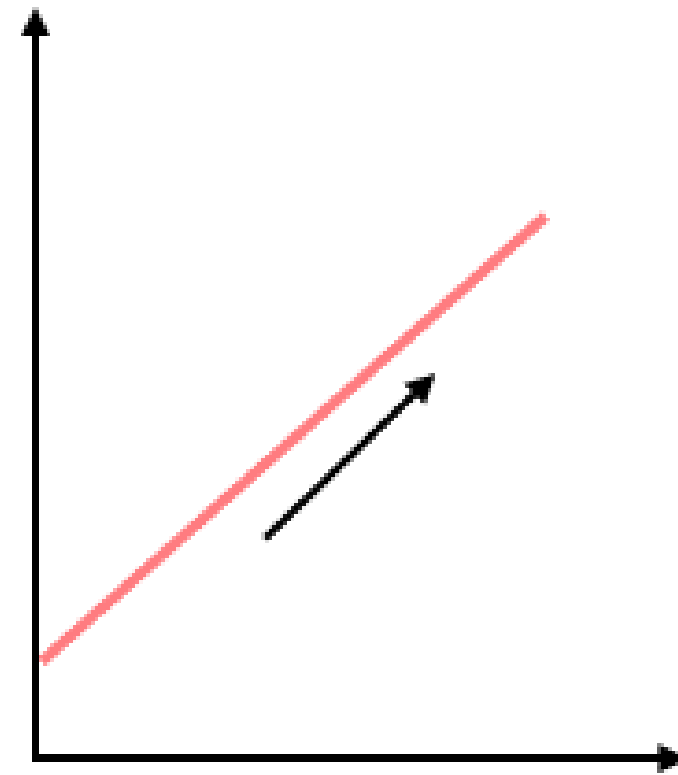
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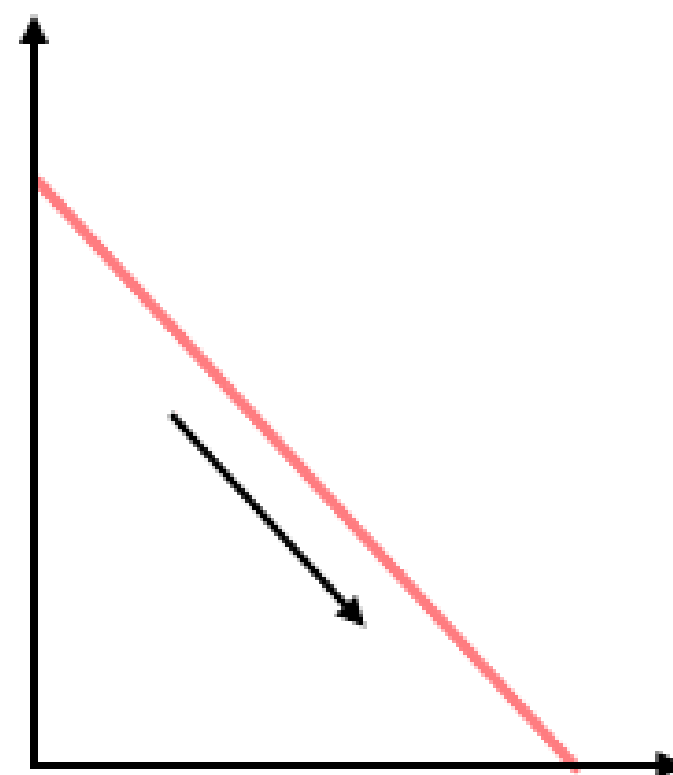
Finding direction using gradient



Positive Gradient



Negative Gradient



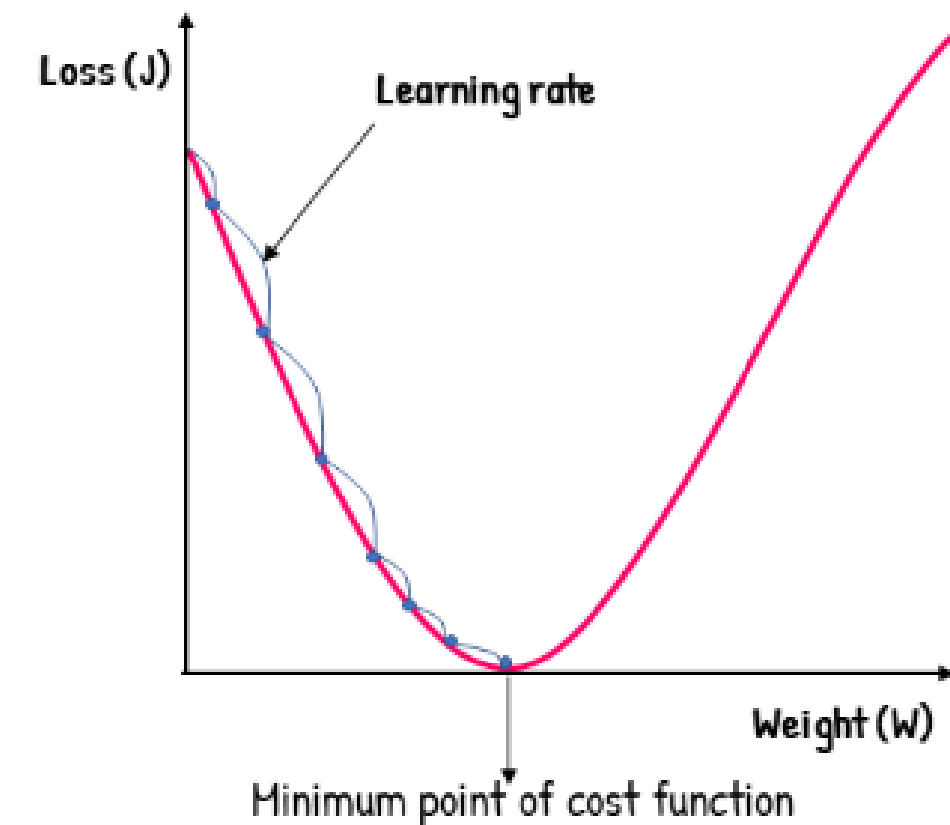
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The step size and Learning rate

- The step size for navigating the cost function is determined using the learning rate.
- The learning rate is a tuning parameter that determines the step size at each iteration of gradient descent. It determines the speed at which we move down the slope.
- Alpha (α) is termed as the Learning rate
- The step size plays an important part in ensuring a balance between optimization time and accuracy.

Learning Rate

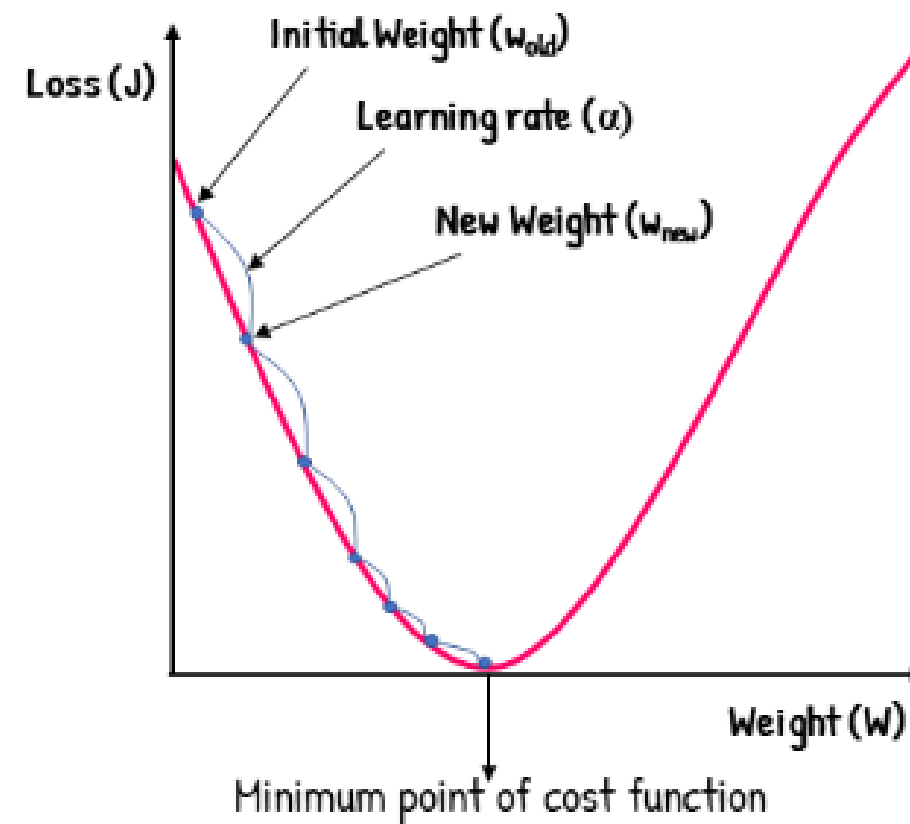




Descending the cost function

Gradient Descent

$$W_{\text{new}} = W_{\text{old}} - \alpha \underbrace{\frac{dJ}{dw}}_{\text{Gradient}}$$



$$w_{\text{new}} = w_{\text{old}} - \alpha \frac{\delta J}{\delta w}$$



Backpropagation Vs Gradient Descent



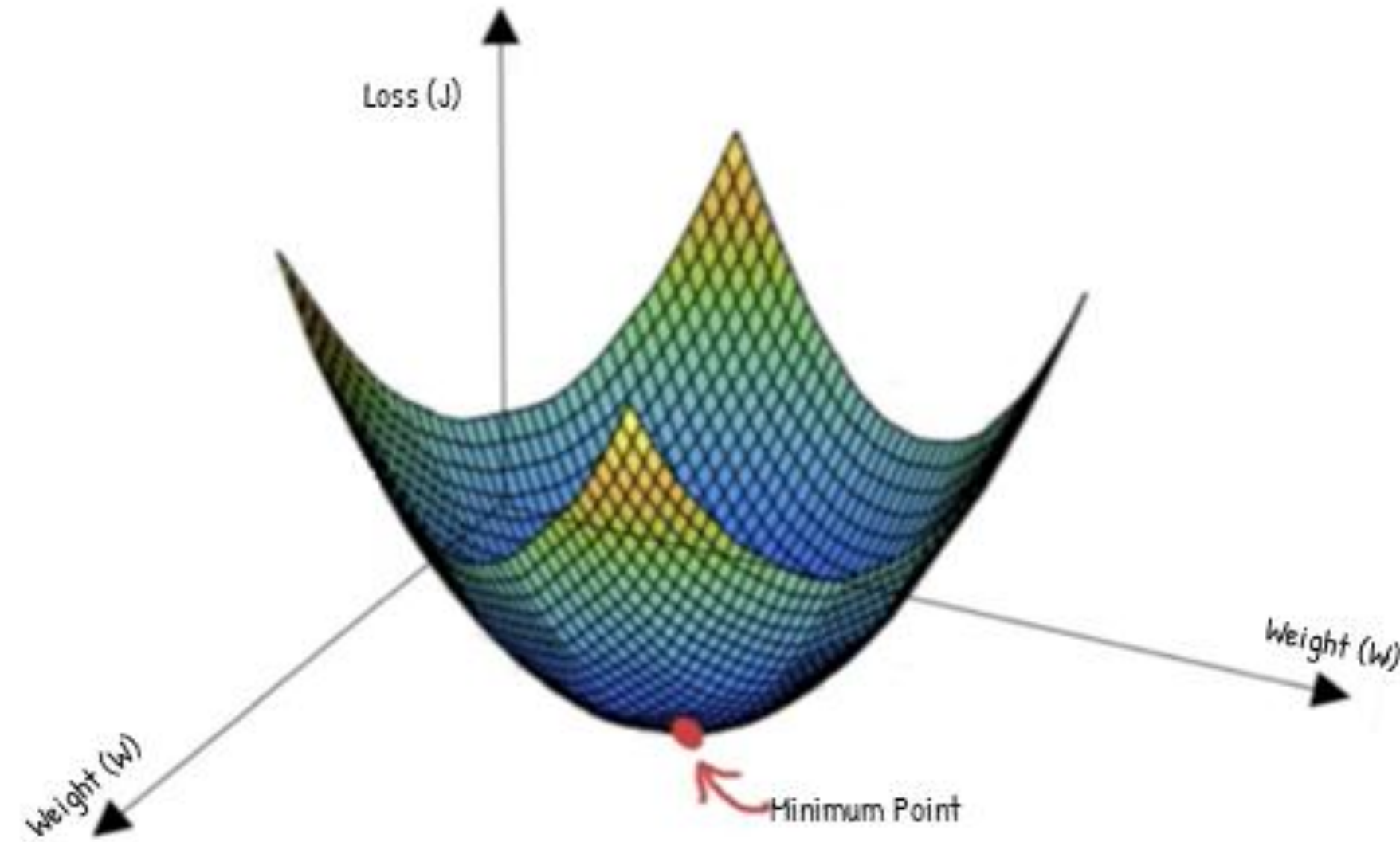
	Backpropagation	Gradient Descent
Definition	An algorithm for calculating the gradients of the cost function	Optimization algorithm used to find the weights that minimize the cost function
Requirements	Differentiation via the chain rule	<ul style="list-style-type: none">• Gradient via Backpropagation• Learning rate
Process	Propagating the error backwards and calculating the gradient of the error function with respect to the weights	Descending down the cost function until the minimum point and find the corresponding weights

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Quiz

Identify the below diagram,



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Quiz



What is the relation between Learning rate and Step size?

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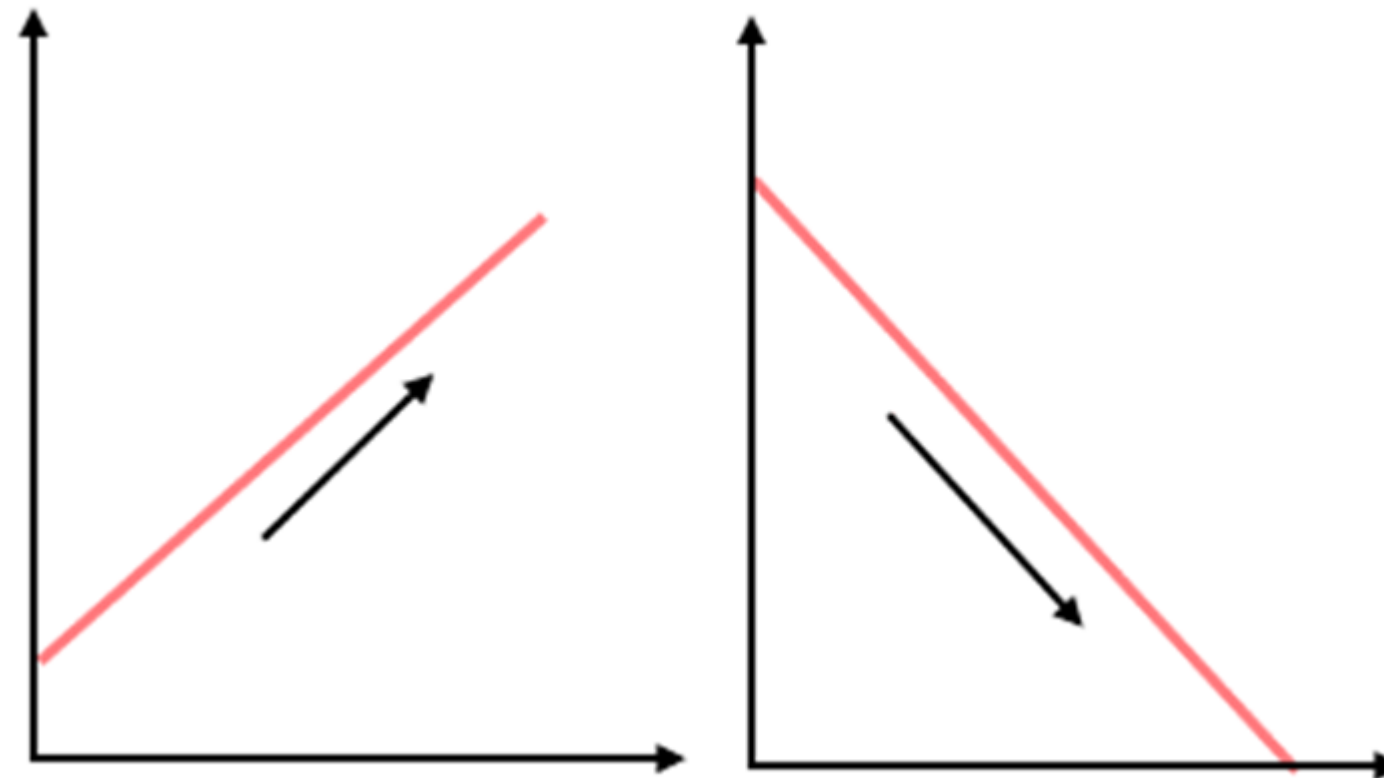
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Quiz



Identify the below diagrams,



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Quiz



How to calculate error?

What is the relation between Step size and accuracy in Gradient descent?

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THANK YOU !!!

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