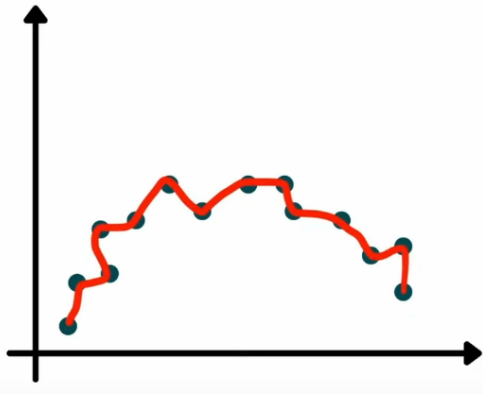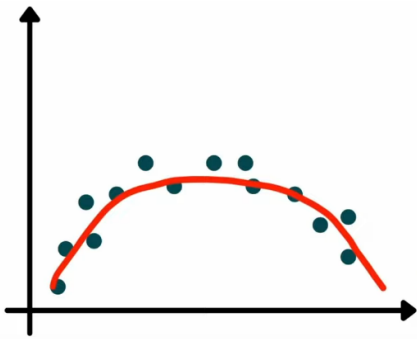## ◼ Overfitting:

➤ In deep learning, overfitting happens when a neural network learns to memorize training data instead of generalizing from it, resulting in poor performance on new, unseen data.

Mathi ko figure maa overfitting vako xa , tesle training data lai matra cover gareko xa ani generalized pani xaina.

➤ Lets see the generalized curve ,

Yo chai alik generalized nai xa ,yesma training examples ko sath sathai new unseen data lai pani kaam garxa ,error pani mathi ko overfitted data vanda kam error dinxa.
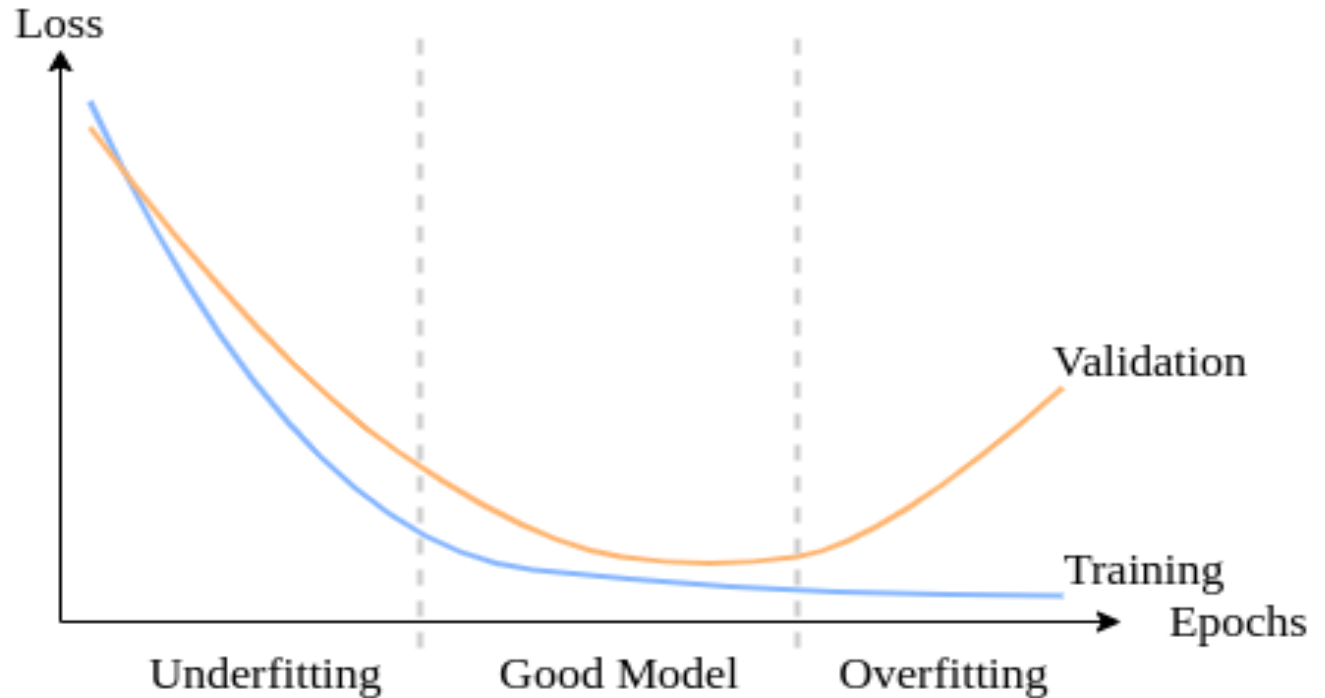
◼ **Underfitting:**

➤ Underfitting in deep learning is when your neural network is too basic to learn from your data, so it doesn't perform well on the training data or new data.

➤ Underfitting is not being able to understand the data .
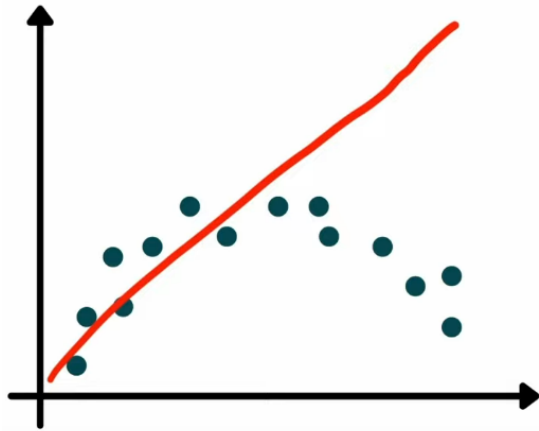
Data maa kunai pattern navetye ko situation ,data fit garna nasakeko ,simply vanna parda data lai understand garnai nasakeko situation nai underfitting ho.

◼ Keep an eye on Validation Loss and Training Loss:

➤ We can determine if our model is underfitting when both the training loss and validation loss are high, and it's overfitting if the training loss is low but the validation loss is significantly higher.
➤ An ideal model would have both the training loss and validation loss as low as possible and close to each other, indicating that it has learned the underlying patterns in the data without underfitting or overfitting.

Loss (y-axis), Epochs (x-axis). Regions labeled: Underfitting, Good Model, Overfitting. Curves: Validation, Training.

◼ Bias and Varience :

➤ **Bias:** difference between mean of prediction and mean of actual values.
➤ It represents the systematic error in predictions, reflecting how far the model's average prediction deviates from the actual values.
(predicted value actual value vanda kati tadha xata.)

➤ **Variance:** the spread of the predictions.
➤ It measures the model's sensitivity to fluctuations in the training data, indicating the extent to which predictions can vary for different datasets.

High bias leads to consistently inaccurate predictions, while high variance results in predictions that are highly sensitive to fluctuations in the training data, leading to inconsistency.
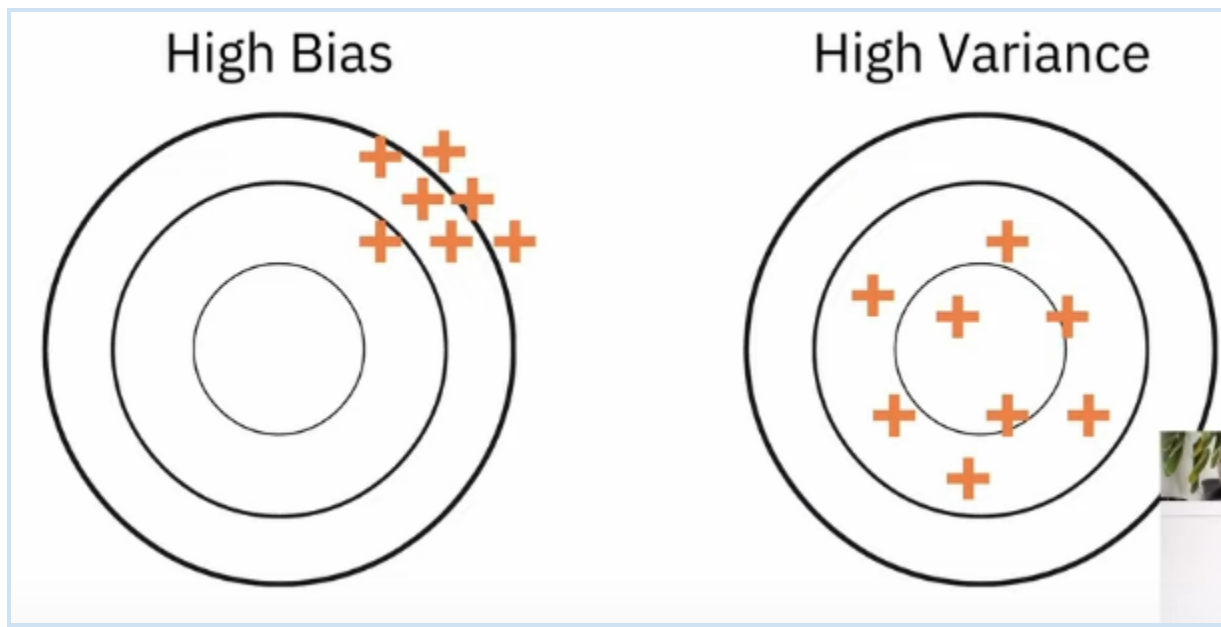
Problem	High Bias (Training performance is low)	High Variance (Validation performance is low)
Causes	Underfitting	Overfitting
Solutions	1. Train more 2. Increase model complexity 3. Try a different model architecture	1. Introduce more data 2. Use regularization 3. Try a different model architecture

- No more trade off

(This means that traditionally, there was a trade-off between bias and variance. Increasing model complexity (reducing bias) would often lead to higher variance, and vice versa. However, modern techniques, like regularization, aim to mitigate this trade-off and allow for models that are both complex (low bias) and generalize well (low variance).)

- Increasing model complexity will lower bias
  (by using regularization)
  (Regularization is a technique used to prevent a model from becoming too complex and overfitting the training data. It helps reduce bias by allowing a model to be more complex while still controlling variance, thereby achieving a better balance between bias and variance.)

- Introducing more data will reduce overfitting.
  (Having a larger dataset can help reduce overfitting (high variance) because the model has more examples to learn from, making it harder for it to memorize the training data and, instead, generalize better to new, unseen data. More data helps in achieving a better balance between bias and variance.)