Understanding workings of Neural Networks

Video 2: Understanding Loss Functions

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In Air

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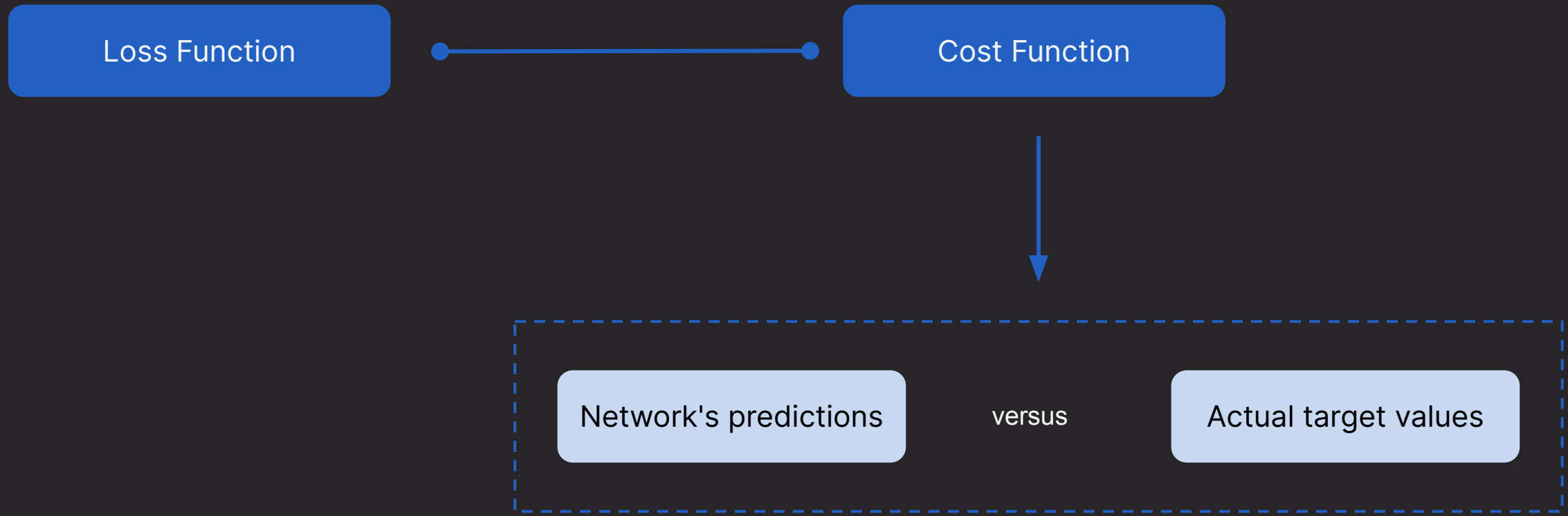
Loss Function

Method to measure the error of network's predictions



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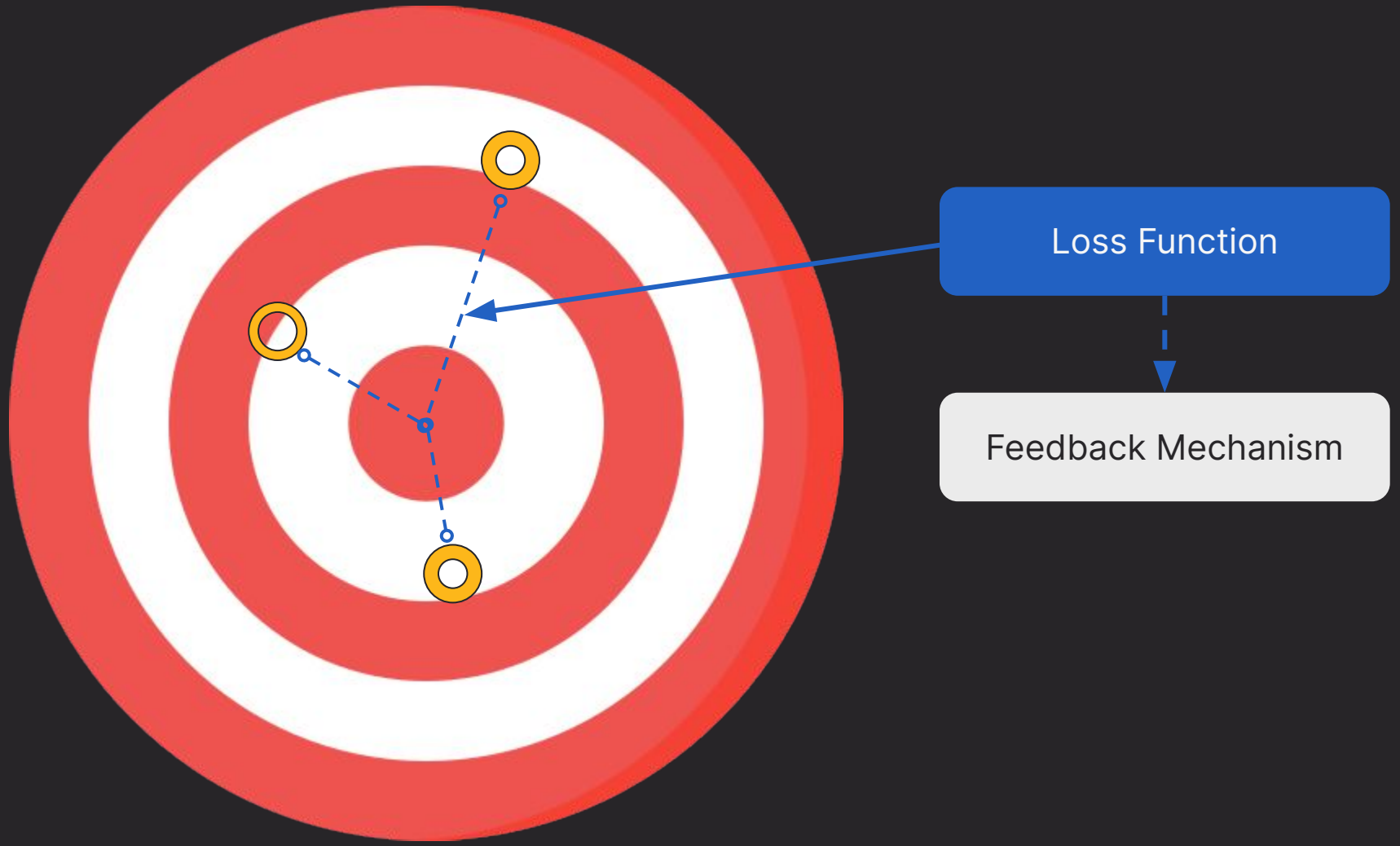
Loss Function

Loss Function



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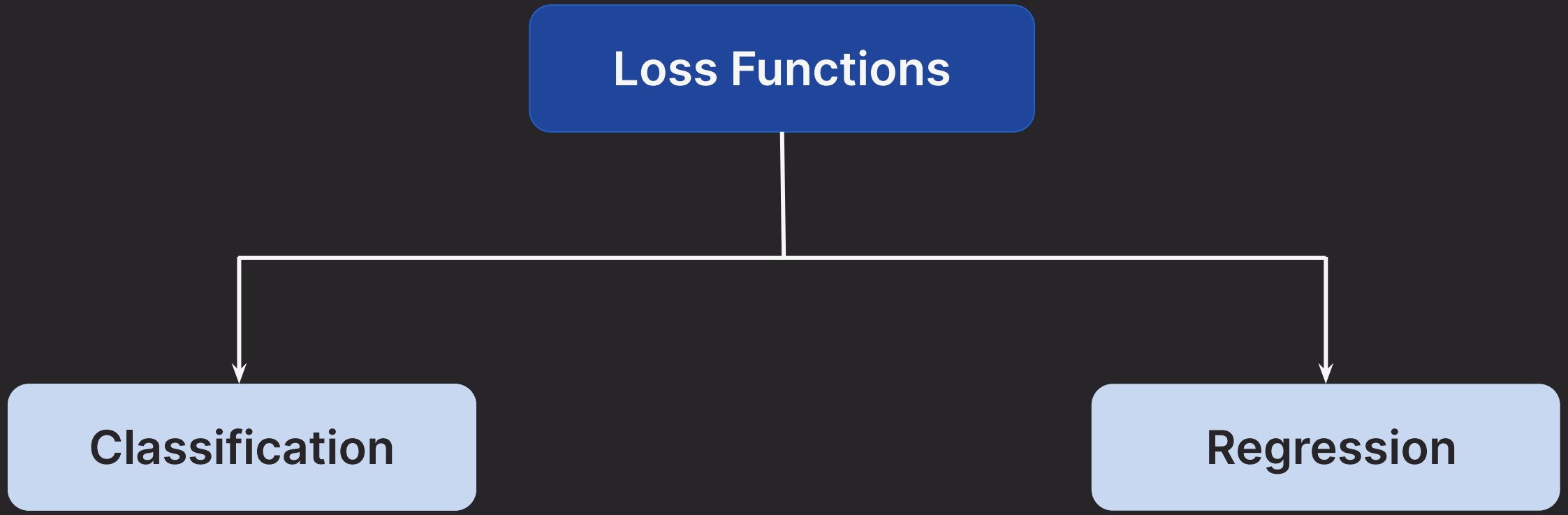
Loss Function

Categorized based on the machine learning tasks



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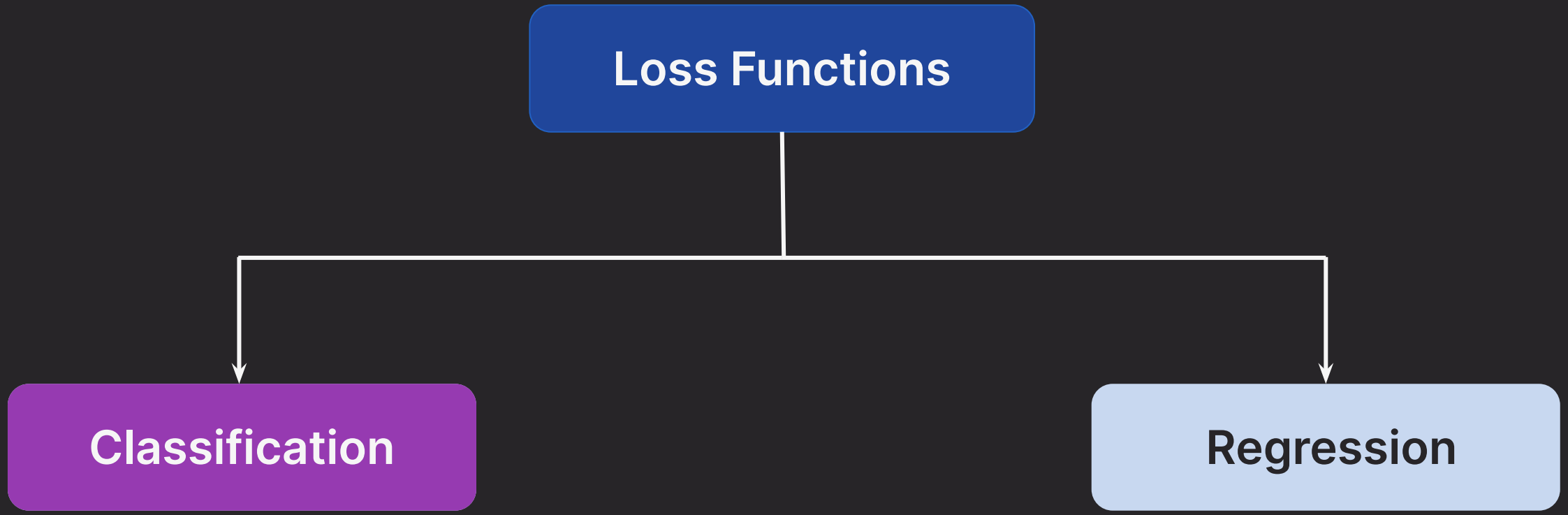
Loss Function

Categorized based on the machine learning tasks



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Binary Cross-Entropy Loss or Log Loss

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Binary Cross Entropy / Log Loss

Evaluates the accuracy of binary classification predictions against true outcomes

Difference Calculation:

y_i (actual targets) - p_i (predicted probabilities)

Logarithmic Transformation:

$-\log(p_i)$ for positive class and $-\log(1 - p_i)$ for negative class

Average Loss:

$$L(y, f(x)) = -\Sigma[y_i * \log(p_i) + (1 - y_i) * \log(1 - (p_i)]$$

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Minimize the loss value during training

Binary Cross Entropy / Log Loss

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Category Cross Entropy Loss

A variation of BCE loss applicable for multi-classification problems.

$$CCE = -\Sigma\, y_i \, Log\, (p)$$

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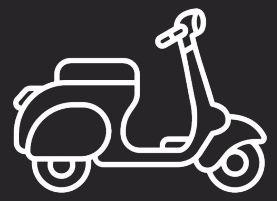
Category Cross Entropy Loss: $-\Sigma\, y_i \text{ Log } (p)$

Consider a model to guess the type of vehicle in an image from 5 options.



Two-wheeler

Autorickshaw

Car

Bus

Truck

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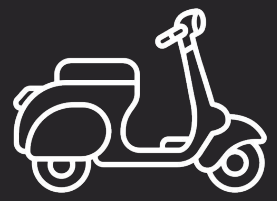
Category Cross Entropy Loss: $-\Sigma\, y_i \text{ Log } (p)$

Consider a model to guess the type of vehicle in an image from 5 options.



Two-wheeler

Autorickshaw

Car

Bus

Truck

Given Input

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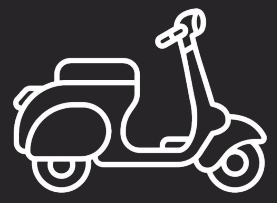
Category Cross Entropy Loss: $-\Sigma\, y_i \text{ Log } (p)$

Consider a model to guess the type of vehicle in an image from 5 options.



Two-wheeler

Probability: 0.05

Autorickshaw

Probability: 0.02

Car

Probability: 0.05

Bus

Probability: 0.85

Truck

Probability: 0.03

Given Input

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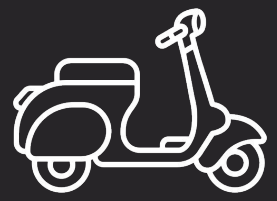
Category Cross Entropy Loss: $-\Sigma\, y_i \text{ Log } (p)$

Consider a model to guess the type of vehicle in an image from 5 options.



Two-wheeler

Probability: 0.05

Autorickshaw

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Car

Probability: 0.05

Bus

Probability: 0.85

Truck

Probability: 0.03

Target (y_i)= [0 0 0 1 0]

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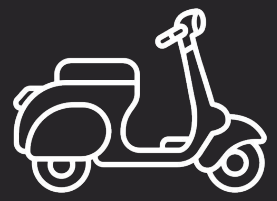
Category Cross Entropy Loss: $-\Sigma\, y_i \text{ Log } (p)$

Consider a model to guess the type of vehicle in an image from 5 options.



Two-wheeler

Probability: 0.05

Autorickshaw

Probability: 0.02

Car

Probability: 0.05

Bus

Probability: 0.85

Truck

Probability: 0.03

Target (y_i) = [0 0 0 1 0]

$$CCE_{others} = 0 * \text{Log } (p)$$

$$CCE_{bus} = -1 * \text{Log } (0.85) = 0.07$$

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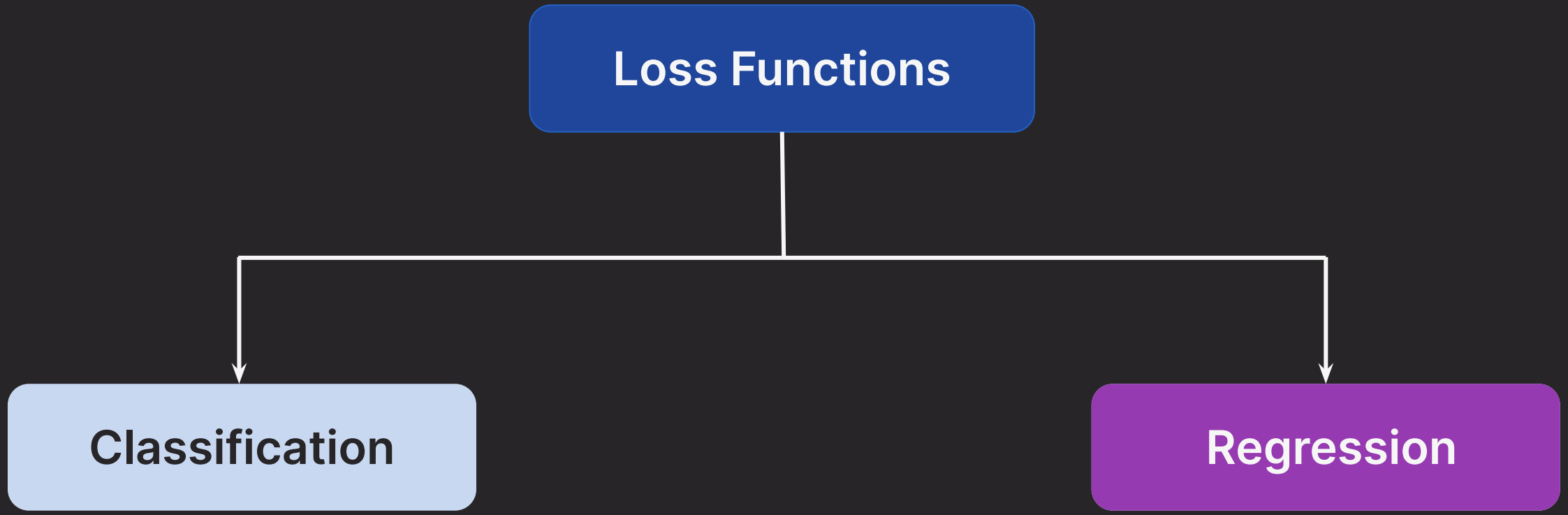
Loss Function

Categorized based on the machine learning tasks



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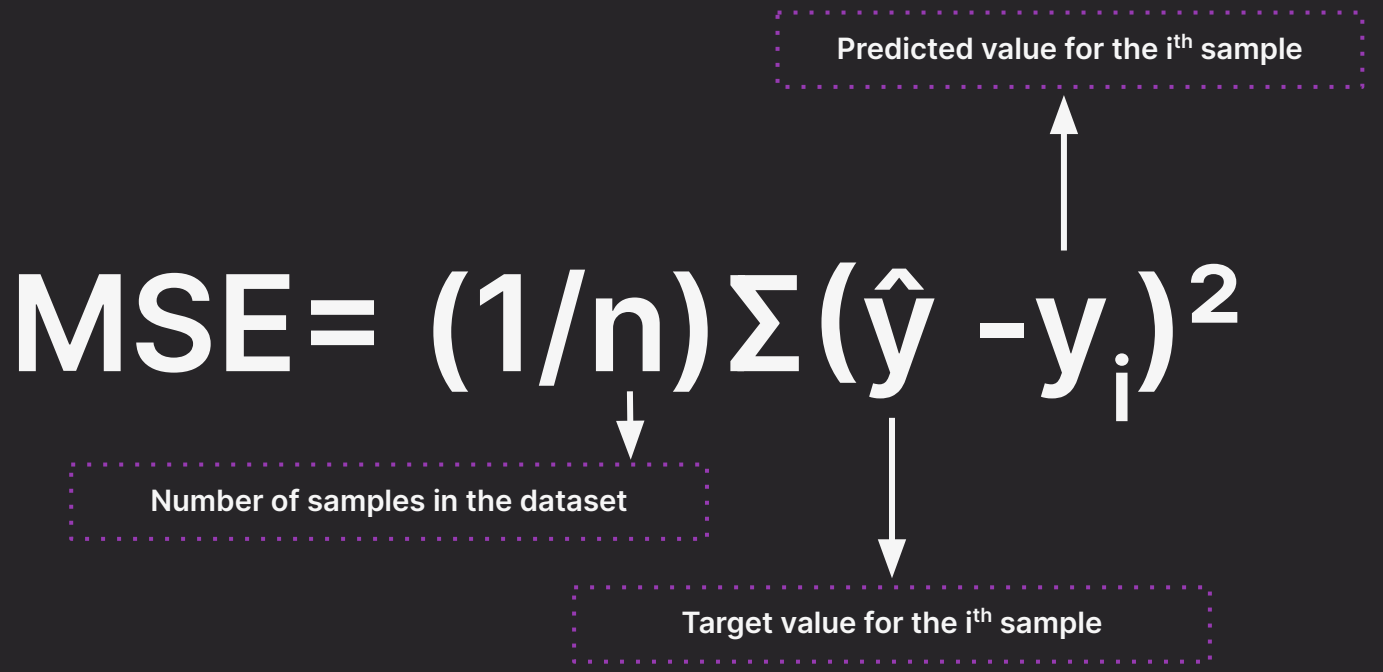
Loss functions for Regression Problems

Mean Square Error (MSE) measures the average squared difference between predictions and actual values.



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Loss functions for Regression Problems

⚠ MSE not the best choice if data contains significant outliers

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Mean Absolute Error

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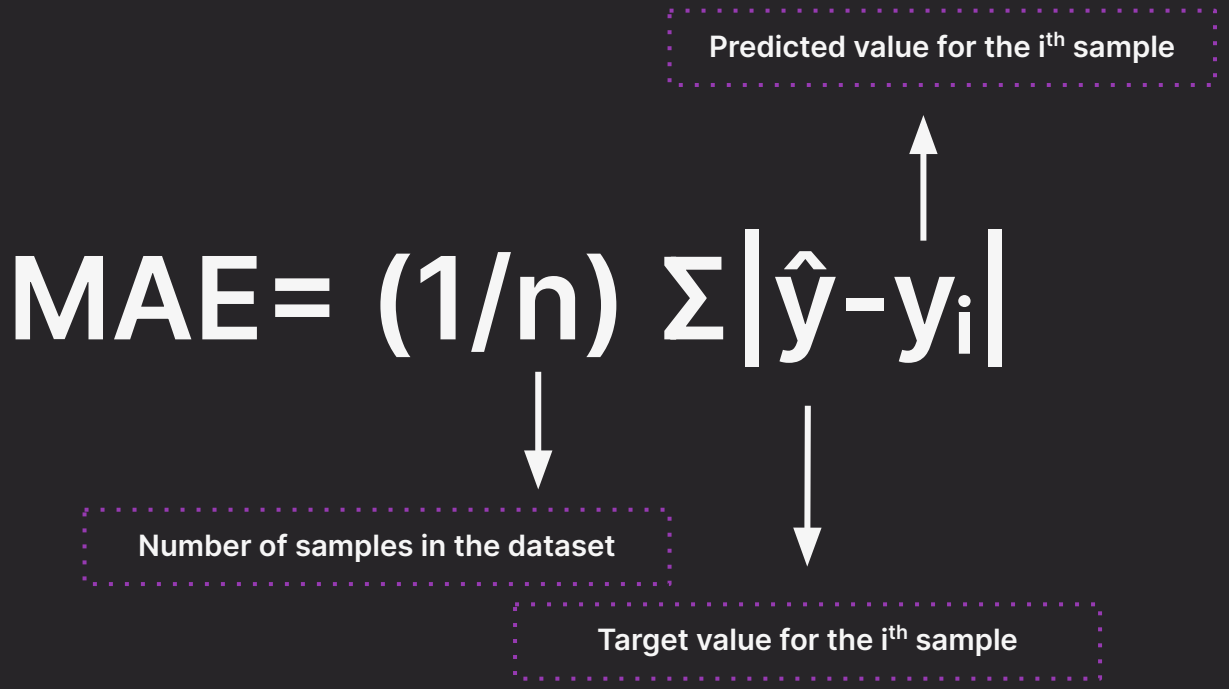
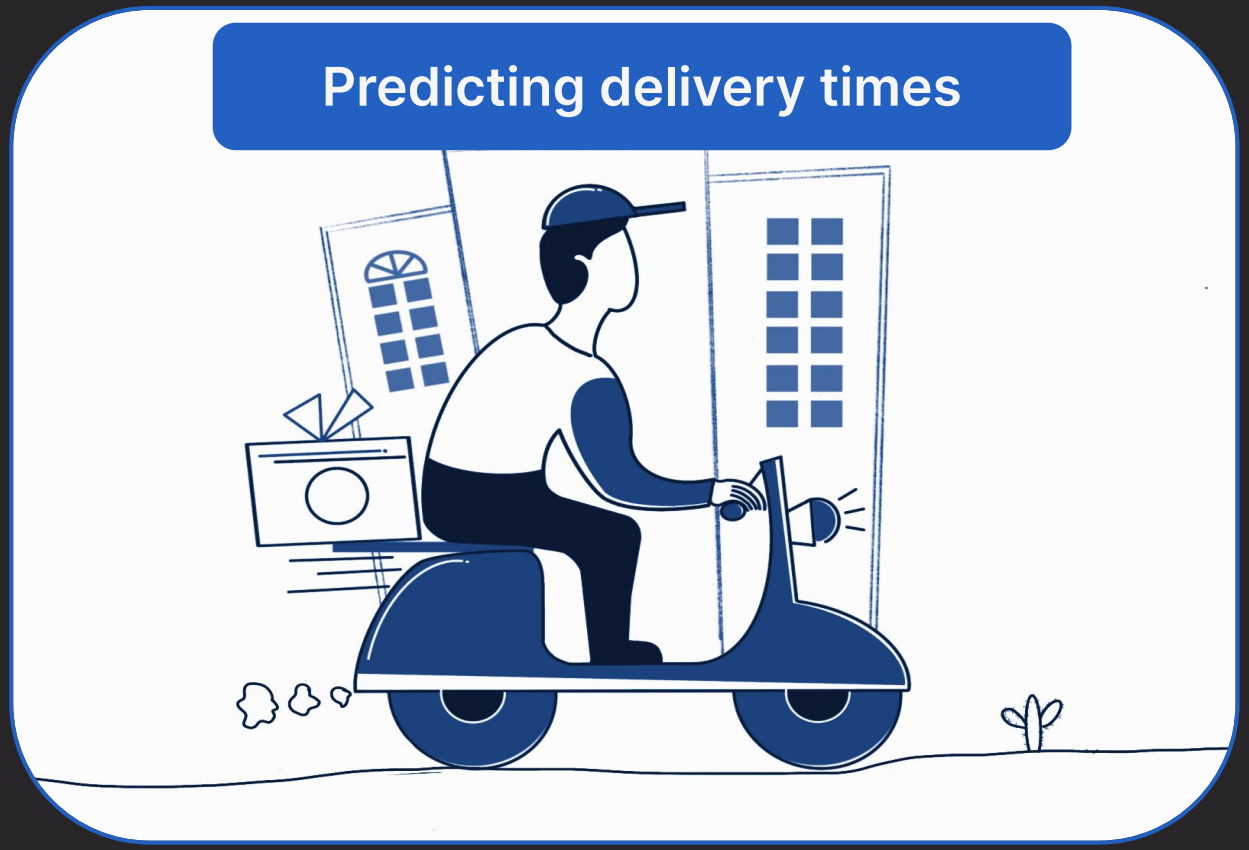
Loss functions for Regression Problems

Mean Absolute Error (MAE) averages the absolute differences between predicted and actual values.



MAE: Preferred Scenarios



Conclusion

- Binary Cross-Entropy Loss
- Mean Square Error (MSE)
- Mean Absolute Error (MAE)

Most commonly used loss functions

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Hands-on