Regression Loss Functions:

1. **Mean Squared Error (MSE):**
   - Formula: $(\frac{1}{N}\sum(y_{\text{true}} - y_{\text{pred}})^2)$
   - Example:

     ```
     loss = keras.losses.MeanSquaredError()
     ```

   - Use Case: Useful for regression problems where the goal is to minimize the difference between predicted and true values.
2. **Mean Absolute Error (MAE):**
   - Formula: $(\frac{1}{N}\sum|y_{\text{true}} - y_{\text{pred}}|)$
   - Example:

     ```
     loss = keras.losses.MeanAbsoluteError()
     ```

   - Use Case: Useful for regression problems, especially when the dataset contains outliers.

Classification Loss Functions:

1. **Binary Crossentropy:**
   - Formula: $(-\sum(y_{\text{true}}\log(y_{\text{pred}}) + (1 - y_{\text{true}})\log(1 - y_{\text{pred}})))$
   - Example:

     ```
     loss = keras.losses.BinaryCrossentropy()
     ```

   - Use Case: Ideal for binary classification problems.
2. **Categorical Crossentropy:**
   - Formula: $(-\sum y_{\text{true}}\log(y_{\text{pred}}))$
   - Example:

     ```
     loss = keras.losses.CategoricalCrossentropy()
     ```

   - Use Case: Best suited for multi-class classification problems where the labels are one-hot encoded.
3. **Sparse Categorical Crossentropy:**
   - Example:

     ```
     loss = keras.losses.SparseCategoricalCrossentropy()
     ```

   - Use Case: Suitable for multi-class classification problems where the labels are integers instead of one-hot encoded.
4. **Hinge Loss:**
   - Formula: $(\max(0, 1 - y_{\text{true}} \cdot y_{\text{pred}}))$
   - Example:

     ```
     loss = keras.losses.Hinge()
     ```

   - Use Case: Generally used in binary classification problems and often used in SVMs.

Clustering Loss Functions:

1. **Kullback-Leibler Divergence (KL Divergence):**
   - Formula: $(\sum y_{\text{true}}\log(\frac{y_{\text{true}}}{y_{\text{pred}}}))$
   - Example:

```
loss = keras.losses.KLDivergence()
```

- Use Case: Useful when comparing two probability distributions, often used in tasks like clustering or in models like Variational Autoencoders (VAEs).

Summary Table

Loss Function	Formula	Example	Use Case	Commonly Used Models
Mean Squared Error (MSE)	$(\frac{1}{N}\sum(y_{\text{true}} - y_{\text{pred}})^2)$	`loss = keras.losses.MeanSquaredError()`	Regression problems	Linear Regression, Neural Networks
Mean Absolute Error (MAE)	$(\frac{1}{N}\sum\lvert y_{\text{true}} - y_{\text{pred}}\rvert)$	`loss = keras.losses.MeanAbsoluteError()`	Regression with outliers	Linear Regression, Neural Networks
Binary Crossentropy	$(-\sum(y_{\text{true}}\log(y_{\text{pred}}) + (1 - y_{\text{true}})\log(1 - y_{\text{pred}})))$	`loss = keras.losses.BinaryCrossentropy()`	Binary classification	Logistic Regression, Neural Networks
Categorical Crossentropy	$(-\sum y_{\text{true}}\log(y_{\text{pred}}))$	`loss = keras.losses.CategoricalCrossentropy()`	Multi-class classification with one-hot encoded labels	Neural Networks
Sparse Categorical Crossentropy	Similar to Categorical Crossentropy	`loss = keras.losses.SparseCategoricalCrossentropy()`	Multi-class classification with integer labels	Neural Networks
Hinge Loss	$(\max(0, 1 - y_{\text{true}} \cdot y_{\text{pred}}))$	`loss = keras.losses.Hinge()`	Binary classification	SVM, Neural Networks
Kullback-Leibler Divergence (KL)	$(\sum y_{\text{true}}\log(\frac{y_{\text{true}}}{y_{\text{pred}}}))$	`loss = keras.losses.KLDivergence()`	Comparing two probability distributions	Variational Autoencoders (VAEs), Neural Networks