Let $\hat{\mathcal{X}} = \mathcal{X}$.

1. Square-error: $d(x, \hat{x}) = (x - \hat{x})^2$, where $\mathcal{X}$ and $\hat{\mathcal{X}}$ are real.

2. Hamming distortion:

$$d(x, \hat{x}) = \begin{cases} 0 & \text{if } x = \hat{x} \\ 1 & \text{if } x \neq \hat{x} \end{cases}$$

where the symbols in $\mathcal{X}$ do not carry any particular meaning.

Let $\hat{X}$ be an estimate of X.

1. If d is the square-error distortion measure, $Ed(X, \hat{X})$ is called the mean square error.

2. If d is the Hamming distortion measure,

$$Ed(X, \hat{X}) = \Pr\{X = \hat{X}\} \cdot 0 + \Pr\{X \neq \hat{X}\} \cdot 1 = \Pr\{X \neq \hat{X}\}$$

is the probability of error. For a source sequence $\mathbf{x}$ and a reproduction sequence $\hat{\mathbf{x}}$, the average distortion $d(\mathbf{x}, \hat{\mathbf{x}})$ gives the frequency of error in $\hat{\mathbf{x}}$.