The gaussian discriminant classifier for both classes with ientifical covariance is?

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The Gaussian discriminant classifier assumes that the data from each class follows a Gaussian (normal) distribution. When the covariance matrices for both classes are identical, this classifier is often referred to as the Linear Discriminant Analysis (LDA).

For simplicity, let's denote:

Class 1 as ω_1 with mean μ_1 and covariance Σ.
Class 2 as ω_2 with mean μ_2 and covariance Σ.

The decision boundary separating the two classes in LDA is linear and can be represented by the equation:

$$(\mathbf{x} - \mathbf{m})^T \Sigma^{-1} (\mathbf{m}_1 - \mathbf{m}_2) = \ln\left(\frac{P(\omega_1)}{P(\omega_2)}\right)$$

where:

$\mathbf{x}$ is the input vector to be classified.
$\mathbf{m} = \frac{1}{2}(\mathbf{m}_1 + \mathbf{m}_2)$ is the midpoint between the class means.
Σ is the shared covariance matrix.
$P(\omega_1)$ and $P(\omega_2)$ are the prior probabilities of classes 1 and 2 respectively.

If the prior probabilities are equal, i.e., $P(\omega_1) = P(\omega_2)$, then the decision boundary simplifies to:

$$(\mathbf{x} - \mathbf{m})^T \Sigma^{-1} (\mathbf{m}_1 - \mathbf{m}_2) = 0$$

This is a linear equation in $\mathbf{x}$, representing a linear decision boundary.