

Linear Models for Classification – Discriminant

Functions Introduction to Linear Models for Classification

Linear models for classification are used to separate data points of different classes using a linear decision boundary. These models are particularly useful when the relationship between the input features and the class labels is approximately linear. One of the fundamental concepts in linear classification is the **discriminant function**, which helps decide the class to which a data point belongs.

Discriminant Functions

A **discriminant function** is a function that assigns a score to each data point, allowing the classification model to decide which class the data point belongs to based on these scores. The basic idea is to create a linear function that outputs a different score for each class, and then assign the class with the highest score to the data point.

Types of Discriminant Functions

1. Linear Discriminant Function:

The simplest form of a discriminant function is linear. It assumes that the decision boundary between classes is a linear function of the input features.

2. Fisher's Linear Discriminant:

Fisher's Linear Discriminant is a specific type of linear discriminant function that is particularly useful for binary classification problems.

It aims to find a projection (a linear combination of features) that maximizes the separation between two classes by maximizing the ratio of between-class variance to within-class variance.

3. Quadratic Discriminant Analysis (QDA):

QDA extends the concept of a linear discriminant function by allowing for a **quadratic decision boundary**.

Unlike linear discriminant functions that assume a linear boundary, QDA allows for more complex boundaries, which can provide better classification accuracy for certain datasets.

4. Logistic Regression:

Although typically associated with regression, logistic regression is a linear classifier that uses a logistic function to model the probability that a data point belongs to a particular class. The decision boundary is linear, and logistic regression is commonly used for binary classification problems.