

Crib 4

# 04 Gaussian Discriminant Analysis, Decompositions

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## 1 Models

1. **Generative Model:** builds probability model for all variables
2. **Discriminative Model:** builds probability model only for target variables
3. Decision boundary: skips probability models entirely but no confidence metric

Model	Classification or Regression	Generative or Disc
Gaussian Discriminant Analysis	Classification	Generative
Linear Regression	Regression	Discriminative
Logistic Regression	Classification	Discriminative
K nearest neighbor classifier	Classification	Generative
Support Vector Machine (SVM)	Both	Discriminative

## 2 Gaussian Discriminant Analysis

1. Assumes a Gaussian prior.
2. **Quadratic Discriminant Analysis** has a quadric decision boundary
3. **Linear Discriminant Analysis** has hyperplane decision boundary; assumes all covariance matrices are the same

## 3 Decompositions

1. **positive semidefinite (PSD)** iff  $\forall x^T Ax \geq 0$  iff all eigenvalues  $\geq 0$ .
2. **positive definite (PD)** iff  $\forall x, x^T Ax > 0$  iff all eigenvalues  $> 0$ .
3. If a matrix  $A$  is PSD, eigenvalues of  $A$  are the same as singular values.
4. A real, symmetric matrix  $A$  admits an eigendecomposition.