Definition: Classification

\[ D = \{ (x^{(i)}, y^{(i)}) \}_{i=1}^{N} \]

\[ \forall i, \; x^{(i)} \in \mathbb{R}^M \]

\[ \forall i, \; y^{(i)} \in \{\pm 1\} \]

\[ M = \# \text{ features} \]

\[ N = \# \text{ training examples} = |D| \]

Definition: Binary Classification

Classification where \(|Y| = 2\)

\[ \forall i, \; y^{(i)} \in \{\pm 1\} \]

\[ e \in \{\text{red, blue}\} \]

Definition: Hypothesis (aka. Decision Rule) for Binary Class.

\[ h : \mathbb{R}^M \rightarrow \{\pm 1\} \]

Train time

Learn \( h \)

Test time

Given \( \hat{x} \), predict \( \hat{y} = h(\hat{x}) \)

Example: 2D Binary Classification (\( M = 2 \), \(|Y| = 2\))

\[ h(x_1, x_2) \]
Choosing $k$ for KNN

Assume $D$ is 40% $y^{(i)} = 0$ best $k$ on validation

60% $y^{(i)} = 1$

Linear Decision Boundary

Nonlinear Decision Boundary