Homework 1

Guozhen Li
STA 208 - Statistical Machine Learning

April 14, 2018

1 Exercise 1

1.1 Predictor minimizing true risk

The true risk is

$$R(g) = \mathbb{E}[\ell(Y, g(X))]$$

By conditioning on X, we can write $R(g)$ as

$$R(g) = \mathbb{E}_X \ell(Y, g(X)) \cdot Pr(Y|X)$$

Minimize $R(g)$ pointwise:

$$\hat{g}(x) = \arg \min_{h \in \{0,1\}} \ell(Y, h) Pr(Y|X = x)$$

With $\ell()$ being the Hamming loss function this simplifies to:

$$\hat{g}(x) = \arg \max_{h \in \{0,1\}} Pr(Y = h|X = x)$$

* Reference: ESL pg. 20

1.2 True risk of Bayes classifier

2 Exercise 2