CS 189: Introduction to Machine Learning

Scribe: Tyler Nguyen

Lecture 3: January 25, 2017

1 Perceptron Algorithm (cont'd)

- linear decision function $f(x) = w \cdot x$
- decision boundary $\{x : f(x) = 0\}$
- sample points $X_1, X_2, \ldots, X_n \in \mathbb{R}^d$; classifications $y_1, \ldots, y_n = \pm 1$
- goal: find weights w such that $y_i X_i \cdot w \geq 0$
- goal, rewritten: find w that minimizes $R(w) = \sum_{i \in V} -y_i X_i \cdot w)$ where V is the set of indices i for which $y_i X_i \cdot w < 0$.

Objects in x-space transform to objects in w-space:

x-space	w-space
hyperplane: $\{z : w \cdot z = 0\}$	point: w
point: x	hyperplane: $\{z : x \cdot z = 0\}$

If we want to enforce inequality $x \cdot w \geq 0$, that means:

- in x-space, x should be on the same side of $\{z : z \cdot w = 0\}$ as w
- in w-space, w should be on the same side of $\{z : x \cdot z = 0\}$ as x