Homework Assignment 1

Lecturer: Kyunghyun Cho

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1. When defining a perceptron, we have augmented an input vector $\mathbf{x}$ with an extra 1:

$$M(\mathbf{x}) = \text{sign}(\mathbf{w}^\top \tilde{\mathbf{x}}),$$

where $\tilde{\mathbf{x}} = [\mathbf{x}; 1]$. Why is this necessary? Provide an example in which this extra 1 is necessary.

2. We used the following distance function for perceptron in the lecture:

$$D(M^*(\mathbf{x}), M, \mathbf{x}) = -\left(M^*(\mathbf{x}) - M(\mathbf{x})\right)\left(\mathbf{w}^\top \tilde{\mathbf{x}}\right).$$

This distance function has a problem of a trivial solution. What does it mean by this? What is the trivial solution?

3. PROGRAMMING ASSIGNMENT