MIT 9.520: Statistical Learning Theory **Fall 2014**

Problem Set 1

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Problem 1 To check that the square loss function can be written as $\mathcal{L}(-yf(x))$ lets expand $\|f(x) - y\|^2$:

$$(1 - yf(x))^2 = (1 - 2yf(x) + f(x)^2)$$

but $y^2 = 1$ thus:

$$\mathcal{L}(-yf(x)) = (1 - 2yf(x) + (yf(x))^2)$$

To find the minimizer c(x) we need to minimize:

$$\mathbb{E}_{x,y}[(1 - yf(x))^2]$$

and specify the function that achieves this minimum. Lets find it by taking the derivative of the above wrt to f(x) and setting it to zero:

$$\frac{d}{df(x)}\mathbb{E}_x\mathbb{E}_{y|x}[(1 - yf(x))^2] = \mathbb{E}_x\frac{d}{df(x)}E_{y|x}[(1 - yf(x))^2]$$

which can be minimized by finding the minimum of $\frac{d}{df(x)}E_{y|x}[(1 - yf(x))^2]$:

$$\frac{d}{df(x)}E_{y|x}[(1 - yf(x))^2] = E_{y|x}\left[\frac{d}{df(x)}(1 - yf(x))^2\right]$$

Problem 2 Please write your analysis on Problem 2 here

Problem 3 Please write your analysis on Problem 3 here

Problem 4 a)

Problem 5 (MATLAB) Please write your analysis on Problem 5 here