Exercise 4 (26.10.2015)

1) Read the rest of chapter 2 from Haykin's book (2nd edition). Summarize or sketch your insights in mind-map or an outline or a summary.

2) Consider the space of instances X corresponding to all points in the x, y plane. Give the VC dimension of the following hypothesis spaces:

   a. Hr = the set of all rectangles in the x,y plane. i.e. Hr = $\{((a<x<b) \wedge (c<y<d)) \mid a, b, c, d \in IR\}$

   b. Hc = the set of all circles in the x,y plane. Points inside the circle are classified as positive examples.

   c. Ht = the set of all triangle in the x,y plane. Points inside the triangle are classified as positive examples.

3)

   Definition: consistent learner

   - A learner is ***consistent*** if it outputs hypotheses that perfectly fit the training data, whenever possible. It is quite reasonable to ask that a learning algorithm be consistent, given that we typically prefer a hypothesis that fits the training data over one that does not.

   Task:

   - Write a consistent learner for H_r from last Exercise (i.e. $H_r = \{((a < x < b) \wedge (c < y < d)) \mid a, b, c, d \in IR\}$). Generate a variety of target concept rectangles at random, corresponding to different rectangles in the plane. Generate random examples of each of these target concepts, based on a uniform distribution of instances within the rectangle from (0,0) to (100, 100). Plot the generalization error as a function of the number of training examples, m. On the same graph, plot the theoretical relationship between e and m, for d = .95. Does theory fit experiment?

4) Rephrase the Ex2.21 of chapter 2 from Haykin's book in such way that the next students will understand it better.

5) Please upload 3 questions and their brief answers on the reading material in a separate txt file.