Machine Learning *Angjoo Kanazawa(Kim), UID:111964222*

HW02: Clustering and perceptrons

Hand in at: `http://www.cs.utah.edu/~hal/handin.pl?course=cs726`. Remember that only PDF submissions are accepted. We encourage using LaTeX to produce your writeups. See `hw00.tex` for an example of how to do so. You can make a `.pdf` out of the `.tex` by running "`pdflatex hw00.tex`".

1. Give an example of a low dimensional (approx 20 dimensions), a medium dimensional (approx 1000 dimensions) and a high dimensional (approx 100000 dimensional) problem that you care about.

   Low dimensional: spam filtering. Using existence of 10 keywords (binary yes no val for each)
   Medium dimensional:Optical character recognition on digits representing each digit with 100x100 grid pixel values
   High dimensional: Identifying cats on images using high dimensional feature vector to represent cats.

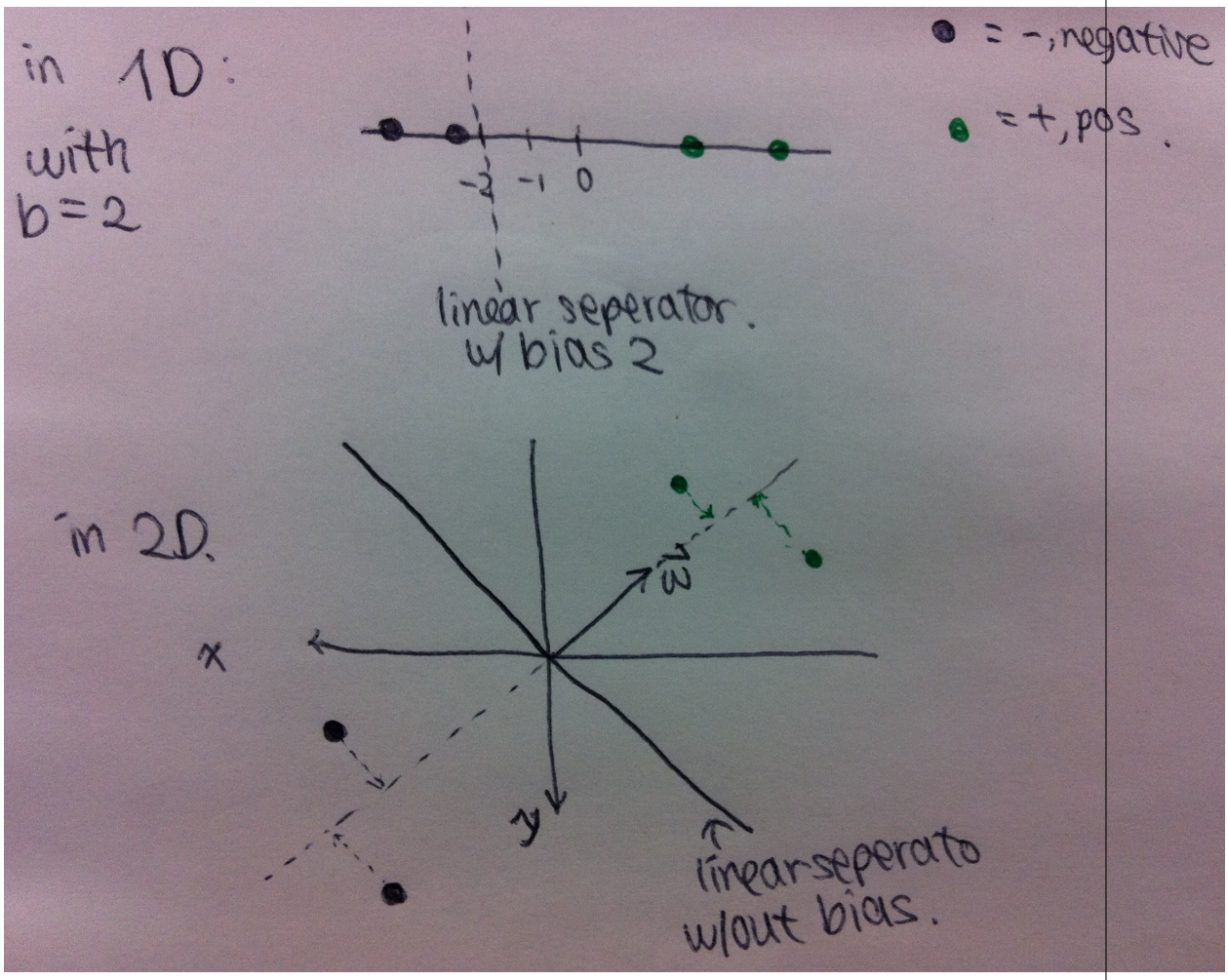
2. What does the decision boundary for a one nearest neighbor classifier on two data points (one positive, one negative) look like?

   It will be a linear line since the data is seperable by a single line.

3. (Final book question from chapter 2.) Clustering of classes was introduced as a way of making things faster. Will it make things worse, or could it help?

   Clustering will help if it's done correctly, correctly as in the optimal way to feed it to the algorithm. Clustering could make things worse if the clustering is not done well. i.e. data maybe clustered on features that we don't care about.

4. A common way to get rid of having to deal with the bias separately on a perceptron is to add a new feature. This feature always has value one, and you learn a weight for it. Thus, if you have a 100 dimensional problem with a bias, we solve it as a 101 dimensional problem without a bias. Draw a picture for *one dimensional* data and a linear separator with a (non-zero) bias and draw the corresponding picture for the same data, "lifted" into two dimensions, with the corresponding lineear separate *without* a bias. (Please make sure that the two separators are actually *equiavalent*!)


in 1D:
with
b=2
= -, negative
= +, pos.
-2
-1
0
linear seperator.
w/ bias 2
in 2D.
x
y
w
linear seperato
w/out bias.