**Exercise 12.2.1 :** Modify the training set of Fig. 12.6 so that example b also

includes the word “nigeria” (yet remains a negative example – perhaps someone

telling about their trip to Nigeria). Find a weight vector that separates the

positive and negative examples, using:

(c) The basic method with a variable threshold, as suggested in Section 12.2.4.

**Ans: N=0.5**

|  | **and** | **viagra** | **the** | **of** | **nigeira** | **θ** | **y** | **w.a** |  | **w'** | **0** | **0** | **0** | **0** | **0** | **0** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **a** | 1 | 1 | 0 | 1 | 1 | -1 | 1 | 0 | not matching | nyx | 0.5 | 0.5 | 0 | 0.5 | 0.5 | -0.5 |
|  |  |  |  |  |  |  |  |  |  | w | 0.5 | 0.5 | 0 | 0.5 | 0.5 | -0.5 |
| **b** | 0 | 0 | 1 | 1 | 1 | -1 | -1 | 1.5 | not matching | nyx | 0 | 0 | -0.5 | -0.5 | -0.5 | 0.5 |
|  |  |  |  |  |  |  |  |  |  | w | 0.5 | 0.5 | -0.5 | 0 | 0 | 0 |
| **c** | 0 | 1 | 1 | 0 | 0 | -1 | 1 | 0 | not matching | nyx | 0 | 0.5 | 0.5 | 0 | 0 | -0.5 |
|  |  |  |  |  |  |  |  |  |  | w | 0.5 | 1 | 0 | 0 | 0 | -0.5 |
| **d** | 1 | 0 | 0 | 1 | 0 | -1 | -1 | 1 | not matching | nyx | -0.5 | 0 | 0 | -0.5 | 0 | 0.5 |
|  |  |  |  |  |  |  |  |  |  | w | 0 | 1 | 0 | -0.5 | 0 | 0 |
| **f** | 1 | 0 | 1 | 1 | 0 | -1 | -1 | -0.5 | Matching | nyx |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  | w | 0 | 1 | 0 | -0.5 | 0 | 0 |
| **a** | 1 | 1 | 0 | 1 | 1 | -1 | 1 | 0.5 | Matching | nyx |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  | w | 0 | 1 | 0 | -0.5 | 0 | 0 |
| **b** | 0 | 0 | 1 | 1 | 1 | -1 | -1 | -0.5 | Matching | nyx |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  | w | 0 | 1 | 0 | -0.5 | 0 | 0 |
| **c** | 0 | 1 | 1 | 0 | 0 | -1 | 1 | 1 | Matching | nyx |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  | w | 0 | 1 | 0 | -0.5 | 0 | 0 |
| **d** | 1 | 0 | 0 | 1 | 0 | -1 | -1 | -0.5 | Matching | nyx |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  | w | 0 | 1 | 0 | -0.5 | 0 | 0 |
| **f** | 1 | 0 | 1 | 1 | 0 | -1 | -1 | -0.5 | Matching | nyx |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  | **w** | **0** | **1** | **0** | **-0.5** | **0** | **0** |

**Final weight vector:** [0,1,0,-1/2,0]

θ=0

(d) The Winnow method with a variable threshold, as suggested in Section 12.2.4.

|  | **and** | **viagra** | **the** | **of** | **nigeira** | **θ** | **y** | **w.a** |  | **w** | **1** | **1** | **1** | **1** | **1** | **1** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **a** | 1 | 1 | 0 | 1 | 1 | -1 | 1 | 3 | Matching | factor | 1 | 1 | 1 | 1 | 1 | 1 |
|  |  |  |  |  |  |  |  |  |  | w | 1 | 1 | 1 | 1 | 1 | 1 |
| **b** | 0 | 0 | 1 | 1 | 1 | -1 | -1 | 2 | Not matching | factor | 1 | 1 | 0.5 | 0.5 | 0.5 | 2 |
|  |  |  |  |  |  |  |  |  |  | w | 1 | 1 | 0.5 | 0.5 | 0.5 | 2 |
| **c** | 0 | 1 | 1 | 0 | 0 | -1 | 1 | -0.5 | Not matching | factor | 1 | 2 | 2 | 1 | 1 | 0.5 |
|  |  |  |  |  |  |  |  |  |  | w | 1 | 2 | 1 | 0.5 | 0.5 | 1 |
| **d** | 1 | 0 | 0 | 1 | 0 | -1 | -1 | 0.5 | Not matching | factor | 0.5 | 1 | 1 | 0.5 | 1 | 2 |
|  |  |  |  |  |  |  |  |  |  | w | 0.5 | 2 | 1 | 0.25 | 0.5 | 2 |
| **f** | 1 | 0 | 1 | 1 | 0 | -1 | -1 | -0.25 | Matching | factor | 1 | 1 | 1 | 1 | 1 | 1 |
|  |  |  |  |  |  |  |  |  |  | w | 0.5 | 2 | 1 | 0.25 | 0.5 | 2 |
| **a** | 1 | 1 | 0 | 1 | 1 | -1 | 1 | 1.25 | Matching | factor | 1 | 1 | 1 | 1 | 1 | 1 |
|  |  |  |  |  |  |  |  |  |  | w | 0.5 | 2 | 1 | 0.25 | 0.5 | 2 |
| **b** | 0 | 0 | 1 | 1 | 1 | -1 | -1 | -0.25 | Matching | factor | 1 | 1 | 1 | 1 | 1 | 1 |
|  |  |  |  |  |  |  |  |  |  | w | 0.5 | 2 | 1 | 0.25 | 0.5 | 2 |
| **c** | 0 | 1 | 1 | 0 | 0 | -1 | 1 | 1 | Matching | factor | 1 | 1 | 1 | 1 | 1 | 1 |
|  |  |  |  |  |  |  |  |  |  | w | 0.5 | 2 | 1 | 0.25 | 0.5 | 2 |
| **d** | 1 | 0 | 0 | 1 | 0 | -1 | -1 | -1.25 | Matching | factor | 1 | 1 | 1 | 1 | 1 | 1 |
|  |  |  |  |  |  |  |  |  |  | w | 0.5 | 2 | 1 | 0.25 | 0.5 | 2 |
| **f** | 1 | 0 | 1 | 1 | 0 | -1 | -1 | -0.25 | Matching | factor | 1 | 1 | 1 | 1 | 1 | 1 |
|  |  |  |  |  |  |  |  |  |  | **w** | **0.5** | **2** | **1** | **0.25** | **0.5** | **2** |

**Final weight vector:** [1/2,2,1,/4,1/2]

θ=2

**Exercise 12.3.2 :** The following training set obeys the rule that the positive

examples all have vectors whose components sum to 10 or more, while the sum

is less than 10 for the negative examples.

([3, 4, 5], +1)

([1, 2, 3], −1)

([2, 7, 2], +1)

([3, 3, 2], −1)

([5, 5, 5], +1)

([2, 4, 1], −1)

(a) Which of these six vectors are the support vectors?

**Ans:** The following 4 poins are support vectors.

([3,4,5], +1), ([2,7,2], +1), ([3,3,2], -1),([2,4,1], -1)

**Exercise 12.4.3** : Consider the one-dimensional training set

(1, 1), (2, 2), (4, 3), (8, 4), (16, 5), (32, 6)

Describe the function f (q), the label that is returned in response to the query

q, when the interpolation used is:

(a) The label of the nearest neighbor.

**Ans:** With this approache we will be returning label same as nearest neighbour. For example if f(x) = f(5) = 3 as for 5 nearest neighbour is 4 and it has label 3

(b) The average of the labels of the two nearest neighbors.

**Ans:** With this approach we will be returnung average of 2 nearest neighbours labels. For example if f(5) is called and 2 nearest neighbors are 4 and 8 and average of labels are 3+4/2 = 3.5.