Daniel Campos: campod2 Sep 26th, 2013

CSCI 4100 Machine Learning 660996361

For this problem set I worked with Zoe Konrad

Problem Set 4

1. Exercise 2.4(300)
   1. First Way:

Space of x is d+1 dimension it is possible to find d+1 linearly independent points in x ad their constraint matrix where rows represent d+1 points.

Since all points are linearly independent a is non singular which means for any (d+1) **x vector b there exists only one (d+1)**x |vector y so ay=b which means that all dichotomies can be achieved and x can be shattered.

Second way:

To show that  we show that a set size of d+1 can be shattered by a function. In this case we make a function



First of we set  and 

Based on these definitions  and for all  and thus X can be shattered by F

* 1. Suppose we have a span in x of {v1,v2,…vd+1} then for any other vector we have v’=a1v2+a2v2…a(d+1)v(d+1), a1,a2….a(d+1)

suppose we need to show dichotomy sign(B) is (d+2)\*1 and a weight factor y

 and y=

then b’=y’\*y=a1v1Y+a2v2Y…=a1b1+a2b2….

Which is deterministic that the sign b’ is fixed which makes dichotomies.

Assume sign( c) as c= there is one and only one y to satisfy

\*Y=

Since v is the correct span

V’\*Y=b’=!-b’ so there is a non implemented dichotomy since the sign must be positive but it is negative and vice verse.

1. Problem 2.3 (300)
   1. For a positive or negative ray the max amount of we have 2 directions
      1. Dichotomies M(N)=2(N+1)-2=2N dichotomies
      2. The Dvc is 2 because the breakpoint is at 3 and
   2. For positive or negative interval the max amount of
      1. Since we have the boundary cases where the end points are equal they have a value of 2N the dichotomies becomes 2(  )-2N= our breakpoint is at 4 since 14-2^4
      2. The Breakpoint is 4 so dvc is 3
   3. Two concentric spheres max amount of
      1. Result is  and because it is the same for 1 2 and 3 dimensions for all d dimensions it is 
      2. And the breakpoint is 3 so the dvc is 2
2. Problem 2.8 (200)

Theorem: If [(k)<2^k](javascript:;) for some (any) [http://book.caltech.edu/vblatex/img/8ce4b16b22b58894aa86c421e8759df3-1.gif](javascript:;), then *for all* N, [(N)\le N^{k-1}+1](javascript:;).

* 1.  is possible
  2.  is possible
  3.  is possible
  4.  not possible
  5.  isn’t possible
  6.  Not Possible

1. Problem 2.10(100)

Assume  we then separate a set of 2N points into two separate sets each containing N points. Each N will produce K dichotomies at best. Combining the two via cross product we get  and it will produce at best dichotomies. By this cross product  thus proving the question and initial point of 

1. Problem 2.12(100)

🡪



I graphed this in excel as bellow

|  |  |  |
| --- | --- | --- |
| N | RHS | A>B |
| 10,000 | 330934.0869 | FALSE |
| 330934.0869 | 435544.5068 | FALSE |
| 435544.5068 | 444334.1953 | FALSE |
| 444334.1953 | 444973.5547 | FALSE |
| 444973.5547 | 445019.5669 | FALSE |
| 445019.5669 | 445022.8757 | FALSE |
| 445022.8757 | 445023.1136 | FALSE |
| 445023.1136 | 445023.1307 | FALSE |
| 445023.1307 | 445023.132 | FALSE |
| 445023.132 | 445023.132 | FALSE |
| 445023.132 | 445023.1321 | FALSE |
| 445023.1321 | 445023.1321 | FALSE |
| 445023.1321 | 445023.1321 | FALSE |
| 445023.1321 | 445023.1321 | FALSE |
| 445023.1321 | 445023.1321 | FALSE |
| 445023.1321 | 445023.1321 | TRUE |
| 445023.1321 | 445023.1321 | TRUE |
| 445023.1321 | 445023.1321 | TRUE |
|  | ((8/(0.05^2)\*(LN((4\*((2\*A2)^10))/0.05)))) | |

And found that the size is around 445023.1321 so 445024