

Sign will change from left to right so for any Dichotomy of DHI points, choose polynomial matches signs of each point maximischotomy = 2 N = 2 P, M (1) E 2 N 00 m + (N) = D+1 can be shattered by H



b) since we have Divoots then for D+2 Points, we will have at least two Points on left most of right most that have 8ame 35911 .. O+2 points cont be shoultered by H From @ 8(b) duc, = D+1



** Problem 2024 EX3: hypothesis g that gets min. Em En191= 3 [[(x) - h(x)] - 2 [xi - (qxi+b)] En(9) = -2 & X: (X;2-9 X; Va En (9) = x,2-ax,-b+x2-ax2-



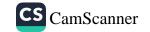
1. get q(X) > FIX X ? [-1,1] -> For nSamples: 1000 . Sample 2 date pts Flor unitalm alistribates compute of (x) using a, 6 derived append go (x) to list golist take mean of golist



2. To compute bias, vouvience, out-of-sample error > For n Doda Samples: # eng. 1000 · Sample X From uniform distribution [-1,1] a calculate q(X) to generate array at Jalues of function go (x) evaluated at given X · Compute the varience : Ep[(qD(X)-g(X))2] · Use q(x) and calculate [q(x)-f(x))2 at each · USE array of values to compute array of (5(X)-levis · get mean of resulting array state average à aprise calculated, we get Ex [ED (90 (x) -3(x))2], Ex[[(g(x)-{x))2]], Ex [ED (gD(x)-f(x))2]] bias Gaut-of-sample error



Varience = Ex ((50 [9](x)) - 9(x))]
= Ex (50 [(x) + x)) x - 9(x) bias = Ex [(g(x)-f(x))] Ent = Ex [ED [(qD(x)-F(x)) 2]



" X, X, mole Pendence = g(X)=ED[X2]X+ED[X]X-EDEX2]ED[X] - data X follows uniform distribution [-1,1] « E [X,] = ED [X2]=0 = 9(X)=0 varience = Ex[ED((X,+X,)2x2+X,2x22X,X,(X,+X2)X, $= E_{X} \left[X^{2} E_{0} (X_{1}^{2} + X_{2}^{2} + 2X_{1} X_{2}) + E_{0} (X_{1}^{2} X_{2}^{2}) - 2X E_{0} (X_{1}^{2} X_{2}^{2}) - 2X E_{0} (X_{1}^{2} X_{2}^{2}) + 2X_{1}^{2} X_{2}^{2} + 2X_{1}^{2} X_{2}^{2}) + E_{0} (X_{1}^{2} X_{2}^{2}) - 2X E_{0} (X_{1}^{2} X_{2}^{2}) + 2X_{1}^{2} X_{2}^{2} + 2X_{1}^{2} X_{2}^{2}) + E_{0} (X_{1}^{2} X_{2}^{2}) - 2X_{1}^{2} E_{0} (X_{1}^{2} X_{2}^{2}) + 2X_{1}^{2} E_{0}$ bias = Ex [X4] = = = = 20-2 ED [Eart (9D)] = Var + bias = = = 8 = 0.53



e) Novience = ED [(9°(X)-9(X))] Co= Xs = (Clist - g (X))2 bias = (g(X)-P(X))2 East = Ep Ex[(9°(x)-P(x))2] = ED EX [(C-list - YZ = Z = ED EX [C- 65+2 X = 1 V47 = ED [EX(XY)-2 C-15-1 = EX(XZ)+ Clist2] =ED[= 2. C. list, 1: 1/C-list ?] 00 Uniform distribution = ED[X]=O, ED[X2]=L, ED[XY]=L



8 hawthat His idempotent, symmetric & positive semi-define " H= X(XTX)-1XT = H= X(XTX)-1 XTX(XTX)-1XT H2-X[XTX)-12T =H -(D) H- [X(XTX)-1XT] = X/1XTX T 1 XT = X(XTX)-1 = 1 from (1) & (2) His aprojection matrix # y = Hy is y is the projection of y anto the space spanned by x

