Subject:

Year. Month. Day.

هما برغمدی

①

training set $(S) = \{(x_i, f(x_i))\}_{i=1}^{m} \subseteq (\mathbb{R}^d \times \{0,1\})^m$

$$f(x_i) = y_i \Rightarrow S = \{(x_i, y_i)\}_{i=1}^{m}$$

for the reason that $P_S(x) \geq 0$ we can use absolute value function so for all m sample we have

$$P_S(x) = \prod_{i=1}^{m} |x_i|$$

about this function, for every $y_i = 1$ we have $P_S(x_i) = 0$ or $P_S(x_i) > 0$ so what about other x?? so we can use distance of one specific x with each of the x_i then we have

$$P_S(x) = \prod_{i=1}^{m} |x - x_i|$$

by notice this fact that our goal is to reach $P_S(x) < 0$ we can change P_S into

$$P_S(x) = -\prod_{i=1}^{m} |x - x_i|$$

now we have for any other x $P_S(x) < 0$ that it leads us to overfit.

$E_{S|x \sim D^m}[L_S(h)] = L_{(D,f)}(h)$.

$$E[L_S(h)] = E\left[\frac{1}{m}\sum_{i=1}^{m} 1[h(x_i) \neq f(x_i)]\right]$$ ۲

$$= \frac{1}{m}\sum E\left[1[h(x_i) \neq f(x_i)]\right]$$

$$= m \cdot \frac{1}{m} E\left[1(h(x) \neq f(x))\right] = \underbrace{E_{x \sim D}[1(h(x) \neq f(x))]}_{L_{(D,f)}(h)}$$

۳.۱ for having A as our ERM algorithm we should pay attention to two condition: I. A can lable all the positive value that be in training set. II. besides All positive value A can lable negative value correctly.

۳.۲ as we prove in ۳.۱ the rectangle that made by A is ERM so it's smallest rectangle that be exist so we can say $R(S) \subseteq R^*$ for every S.

the error is the part that doesn't be in $R(S) \Rightarrow D(R^* - R(S))$

as we see in hint of question we defined R_1, $R_۲$, $R_۳$ and $R_۴$ so according to them we can make function F_i for our error

so we can say for each u_i that we don't have in R_i we can find it in F_i