Set 3

Claire Goeckner-Wald

October 15, 2016

Generalization Error

1) A. 500

$$
\begin{aligned}
0.03 &\geq 2Me^{-2(\epsilon)^2N} \\
0.03 &\geq 2(1)e^{-2(0.05)^2N} \\
0.03 &\geq 2e^{(-.005)N} \\
\frac{0.03}{2} &\geq e^{(-.005)N} \\
\ln(\frac{0.03}{2}) &\geq (-.005)N \\
\frac{\ln(\frac{0.03}{2})}{-.005} &\geq N \\
\frac{\ln(\frac{0.03}{2})}{-.005} &\approx 840
\end{aligned}
$$

2) B. 1000

$$
\begin{aligned}
0.03 &\geq 2Me^{-2(\epsilon)^2N} \\
0.03 &\geq 2(10)e^{-2(0.05)^2N} \\
0.03 &\geq 20e^{(-.005)N} \\
\frac{0.03}{20} &\geq e^{(-.005)N} \\
\ln(\frac{0.03}{20}) &\geq (-.005)N \\
\frac{\ln(\frac{0.03}{20})}{-.005} &\geq N \\
\frac{\ln(\frac{0.03}{20})}{-.005} &\approx 1300
\end{aligned}
$$

3) C. 1500

$$
\begin{aligned}
0.03 &\geq 2Me^{-2(\epsilon)^2N} \\
0.03 &\geq 2(100)e^{-2(0.05)^2N} \\
0.03 &\geq 200e^{(-.005)N} \\
\frac{0.03}{200} &\geq e^{(-.005)N} \\
\ln(\frac{0.03}{200}) &\geq (-.005)N \\
\frac{\ln(\frac{0.03}{200})}{-.005} &\geq N \\
\frac{\ln(\frac{0.03}{200})}{-.005} &\approx 1761
\end{aligned}
$$

Break Point

4) B. 5

Since the d_{vc} is 1 less than the break point, and since $d_{vc} = d + 1$, then for $\mathbb{R}^3$, then $d = 3$. Thus, the break point is 5.

Growth Function

5) The growth function is polynomial in the case that the hypothesis set has a break point. Otherwise, it is 2^N.

i. $1 + N$

As shown in lecture 5, example 1, the growth function is $1 + N$.

ii. $1 + N + \binom{N}{2}$

iii. $\sum_{i=1}^{\lfloor\sqrt{N}\rfloor} \binom{N}{i}$

iv. $2^{\lfloor N/2 \rfloor}$

This function is neither polynomial nor 2^N.

v. 2^N

As shown in lecture 5, example 3, the convex set in $\mathbb{R}^2$ shatters N points. Thus, the growth function is 2^N.

Fun with Intervals

6)

7)

8)

The Triangle

9)

Non-Convex Sets: Concentric Circles

10)