

CS 8725: Report for assignment 1

Chanmann Lim

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Let $\hat{\theta}$ be the estimation of the probability of the coin show up head $P(Head)$, and θ^* be the true value of $P(Head)$. If $P(|\hat{\theta} - \theta^*| > \epsilon) \leq \delta$ is true then δ would be the upper bound of the failure probability where the error is falling within the error range ϵ .

According to Hoeffding's inequality

$$P(|\hat{\theta} - \theta^*| \geq \epsilon) \leq 2e^{-2n\epsilon^2}$$

Then

$$\begin{aligned} 2e^{-2n\epsilon^2} &\leq \delta \\ \ln(2) - 2n\epsilon^2 &\leq \ln(\delta) \\ \ln(2) - \ln(\delta) &\leq 2n\epsilon^2 \\ \ln(2/\delta) &\leq 2n\epsilon^2 \\ \frac{\ln(2/\delta)}{2\epsilon^2} &\leq n \end{aligned}$$

Therefore,

$$n \geq \frac{\ln(2/\delta)}{2\epsilon^2}$$