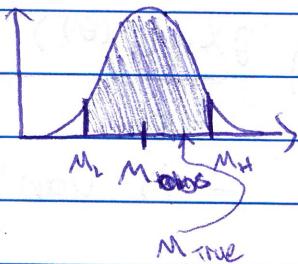


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Confidence Levels



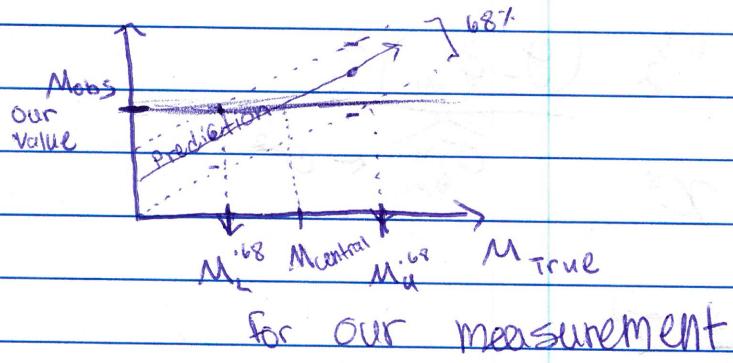
Confidence interval

$[M_L, M_H]$ is a fn of
the data + the confidence
level chosen

$$P(M_L < M_{\text{true}} < M_H) = CL$$

Probabilistic Statement

Neyman - Pearson
Confidence belt



Say we
know form
of PDF + σ
then we can make
Prediction for what
we would observe
+ Corresponding Con.
Intervals given
Some value for
 M_{true}

Then we go + make
a measurement, the
confidence interval is
just the intersection
of our value + the
confidence belts

Expanding the NLL near the minimum

$$NLL = -\ln L(\hat{\theta}_{ML}) - (\theta - \hat{\theta}_{ML}) \frac{\partial \ln L(\theta)}{\partial \theta} \Big|_{\hat{\theta}_{ML}}$$

$$- \frac{1}{2} (\theta - \hat{\theta}_{ML})^2 \frac{\partial^2 \ln L(\theta)}{\partial \theta^2} \Big|_{\hat{\theta}_{ML}} + \dots$$

\rightarrow vanishes

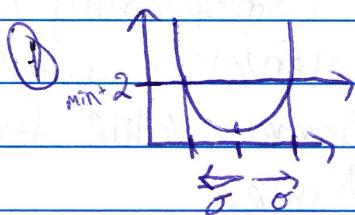
define

$$\widehat{\sigma^2}_{\hat{\theta}_{ML}} = - \left(\frac{\partial^2 \ln L(\theta)}{\partial \theta^2} \right)^{-1} \Big|_{\hat{\theta}_{ML}}$$

$$\sim NLL = NLL_{\min} + \frac{1}{2} (\theta - \hat{\theta}_{ML})^2$$

$$2NLL = 2NLL_{\min} + \chi^2$$

3 ways to get σ^2



- ② go calculate the curvature
@ the minimum

- ③ Generate Pseudo-Datasets Using MC

$\sim \sigma^2$ Sample for suitably large trials
Fisher information

$$I_x(\theta) \equiv E \left[\left(\frac{\partial \ln L(\theta)}{\partial \theta} \right)^2 \right] \xrightarrow{\text{not obviously but probably}} = -E \left[\frac{\partial^2 \ln L(\theta)}{\partial \theta^2} \right]$$

$$\xrightarrow{\text{S}} \int L(x|\theta) d\theta$$

$$\sim \widehat{\sigma^2}_{\hat{\theta}_{ML}} = \frac{1}{I_x(\theta)}$$

$$I_{xy}(\theta) = I_x(\theta) + I_y(\theta)$$

\Rightarrow Fisher Matrix is inverse of Covariance matrix.