Confidence Interval (CI) vs. Prediction Interval (PI)

What is the distinction between CI & PI?

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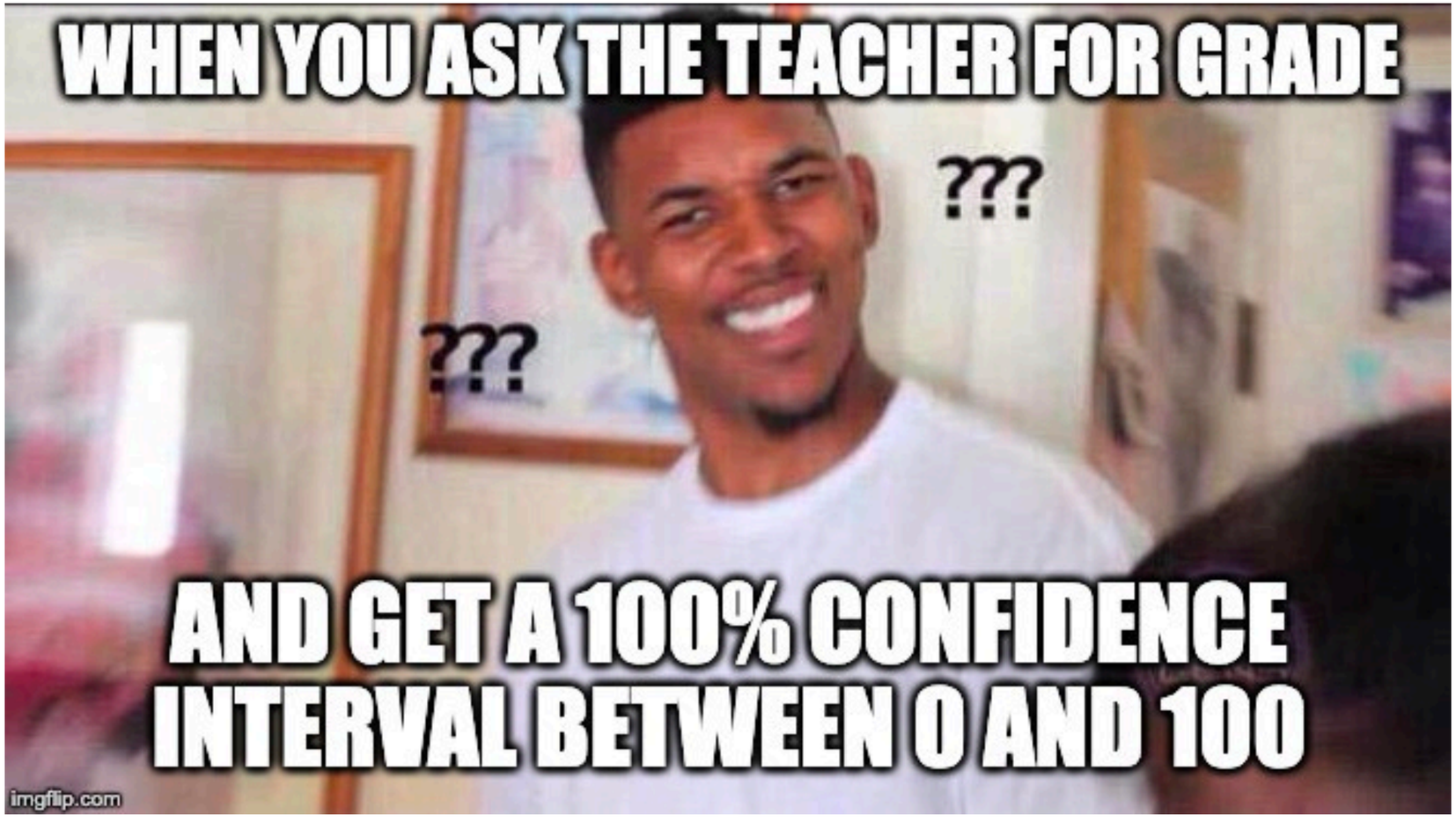
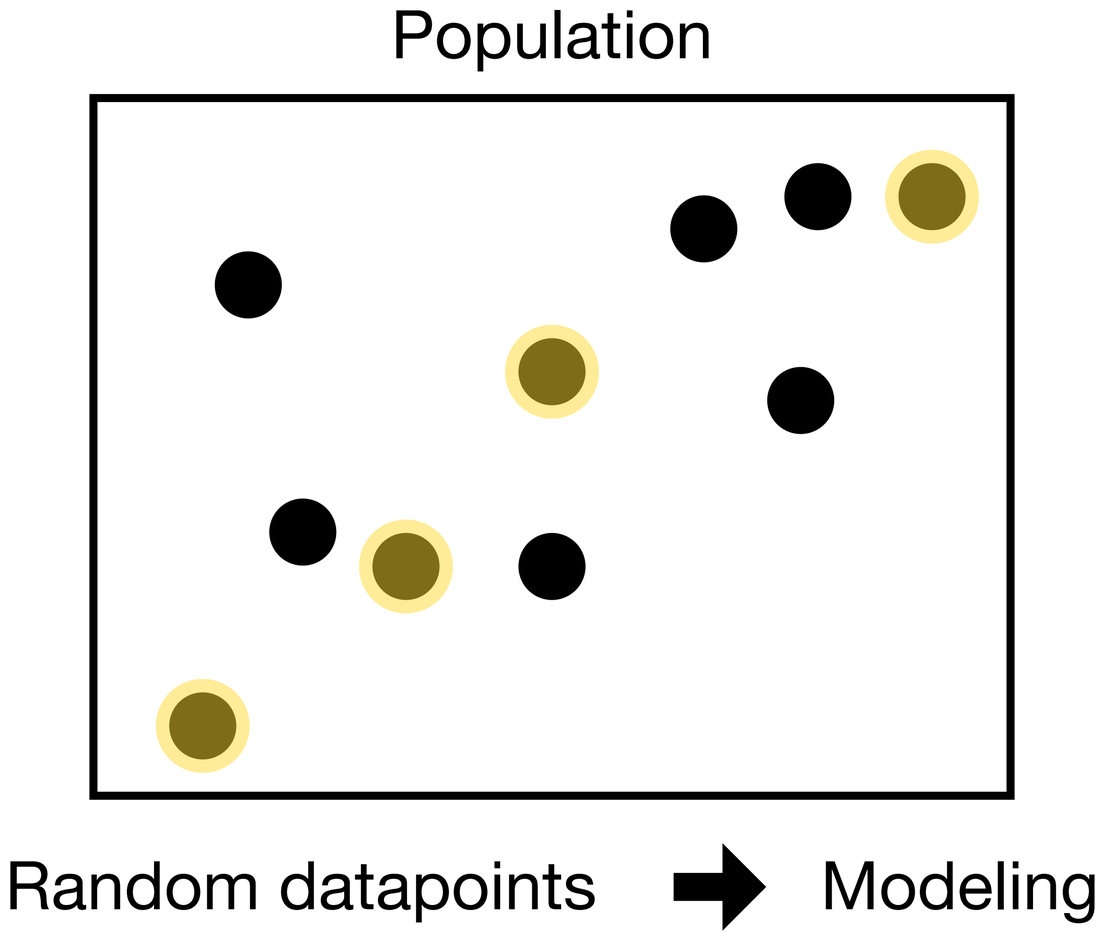

WHEN YOU ASK THE TEACHER FOR GRADE
???
???
AND GET A 100% CONFIDENCE INTERVAL BETWEEN 0 AND 100
imgflip.com

Uncertainty



Uncertainty

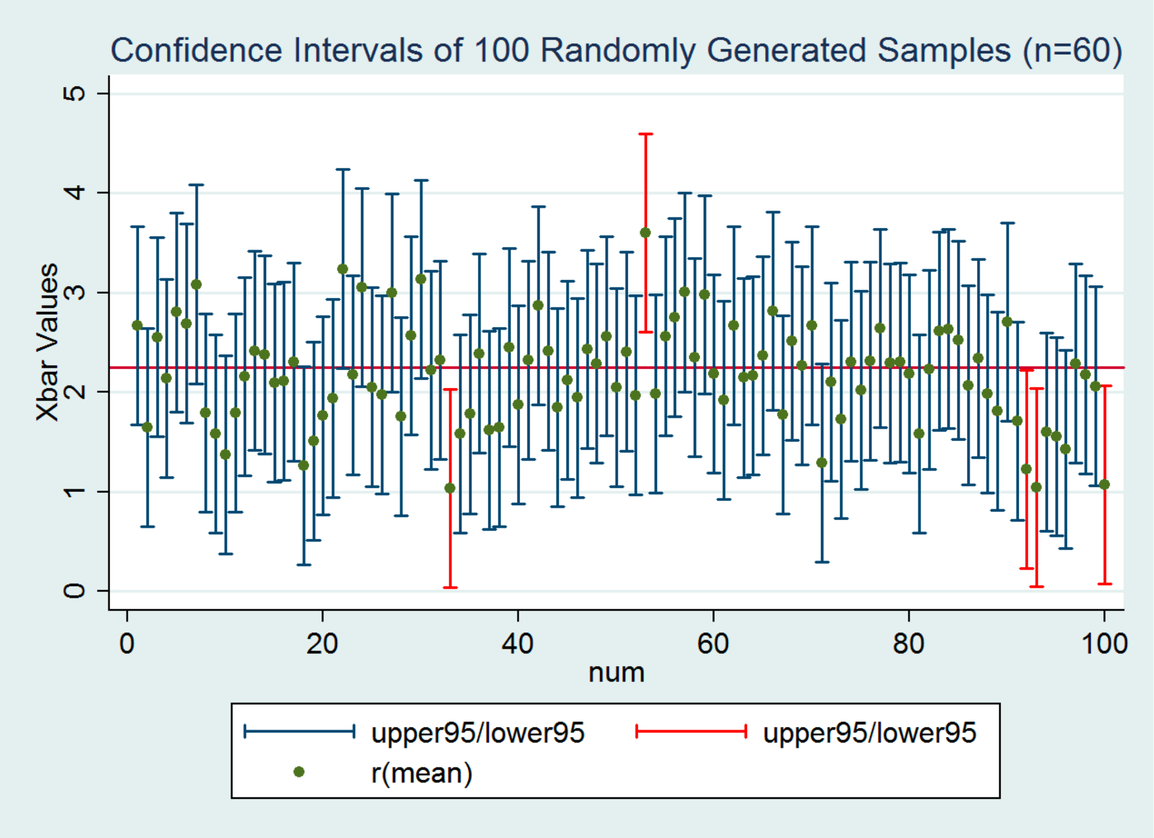
Population

Intervals

estimation method in statistics

Random datapoints → Modeling

Confidence Intervals

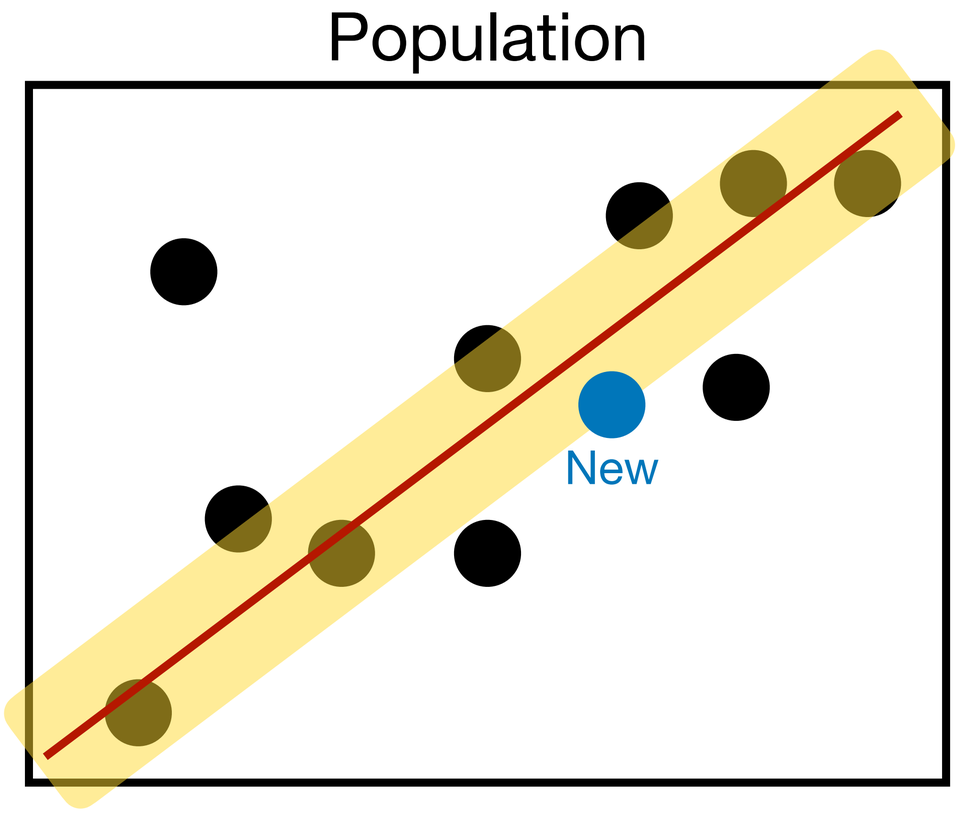


95% of samples
contain true population value

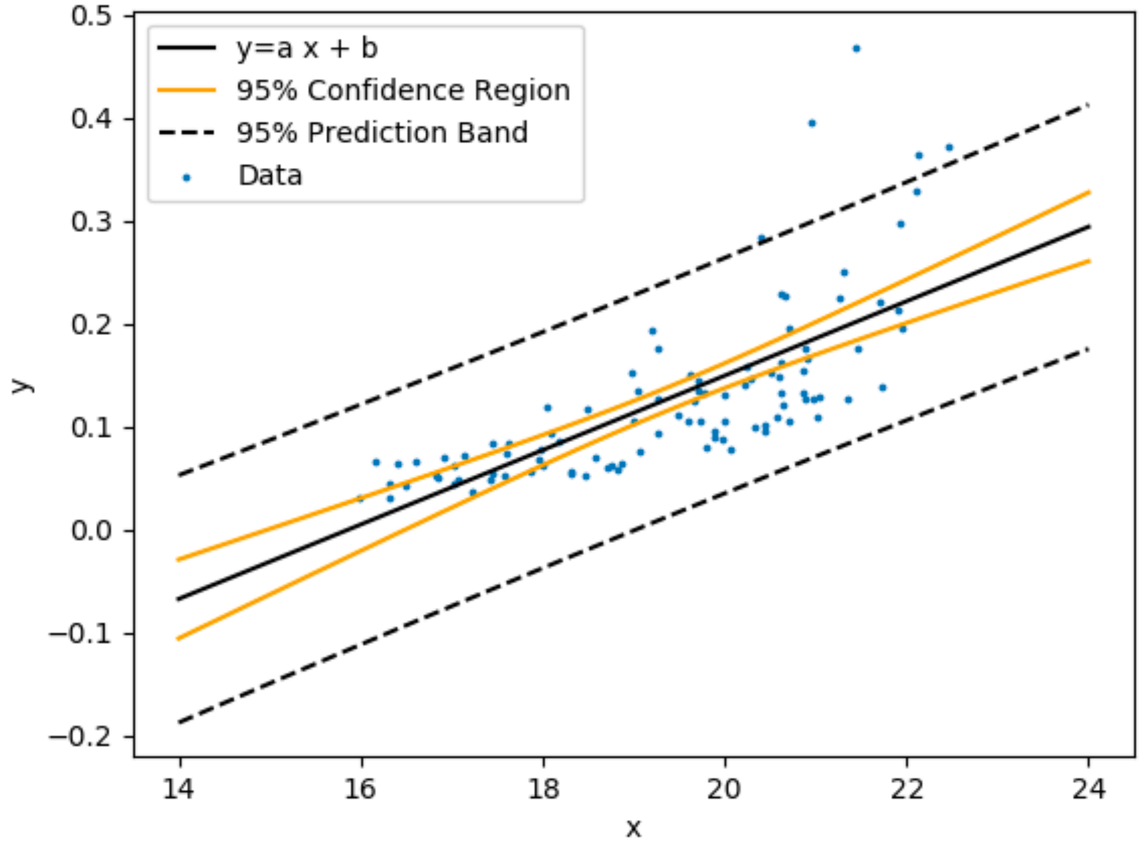
5% don't

Prediction Intervals

What we predict in regression is **the value of dependent variable!**



CI vs. PI



Confidence Interval

$$\hat{y}_h \pm t_{(1-\alpha/2,n-2)} \times \sqrt{MSE\left(\frac{1}{n} + \frac{(x_h - \bar{x})^2}{\sum(x_i - \bar{x})^2}\right)}$$

Prediction Interval

$$\hat{y}_h \pm t_{(1-\alpha/2,n-2)} \times \sqrt{MSE \times \left(1 + \frac{1}{n} + \frac{(x_h - \bar{x})^2}{\sum(x_i - \bar{x})^2}\right)}$$

wider than CI

CI vs. PI

Confidence Interval

shows the likely range of values
associated with some statistical parameter of the data
(e.g. population mean)

VS.

Prediction Interval

predicts in what range
a future individual observation will fall

References

- https://towardsdatascience.com/how-confidence-and-prediction-intervals-work-4592019576d8
- https://towardsdatascience.com/confidence-intervals-vs-prediction-intervals-7b296ae58745
- https://statisticsbyjim.com/hypothesis-testing/confidence-prediction-tolerance-intervals/
- https://medium.com/analytics-vidhya/confidence-interval-vs-prediction-interval-2f9e36f752e3

Thank You

& Happy New Year 💛