Monte Carlo

We want to evaluate some statistic $T(X)$ whether that be, Std dev, mean, slope etc

process

Generate M samples from the same theoretical dist^{n} then take the average value observed

Theoretic $E(\bar{x}) \simeq \hat{E}(\bar{x}) = \frac{1}{M} \sum_{m=1}^{M} \bar{x}_m$

Theoretic $var(\bar{x}) \simeq \hat{var}(\bar{x}) = \frac{1}{M-1} \sum_{m=1}^{M} (\bar{x}_m - E(\bar{x}))^2$

when x_i are iid with $E(x) = \mu$, $var(x) = \sigma^2$ then,

$$\bar{x} \sim N\left(\mu, \frac{\sigma^2}{N}\right) \qquad (CLT)$$

↳ MC estimates should be that

$\hat{E}(\bar{x}) = \mu = E(T(x))$

$\hat{var}(\bar{x}) \simeq \frac{\sigma^2}{N}$

↳ Std error of variance = Std. deviation

Std = $\sqrt{\text{variance}} = \frac{\sigma}{\sqrt{N}}$

↳ Confidence intervals = $\bar{x} \pm 1.96$ (Std error)

-> Generate Noise
-> Fit model

(only thing changing here is the noise)