

Bayesian Statistics

Bayesian vs. Classical Statistics

Brani Vidakovic

Professor

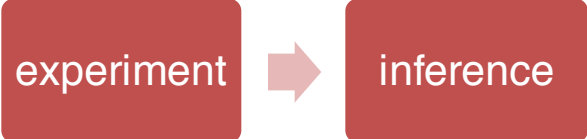
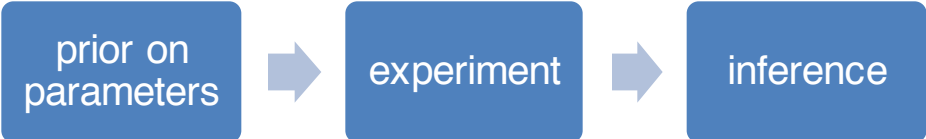
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Models & Parameters

Before We Begin...



Classical vs. Bayesian

Classical	Bayesian
<ul style="list-style-type: none">• Observations modeled• Parameters fixed, but unknown	<ul style="list-style-type: none">• Observations modeled but considered fixed after the experiment• Parameters modeled, uncertainty expressed by a statistical model
 <pre>graph LR; A[experiment] --> B[inference]</pre>	 <pre>graph LR; A[prior on parameters] --> B[experiment]; B --> C[inference]</pre>

Summary



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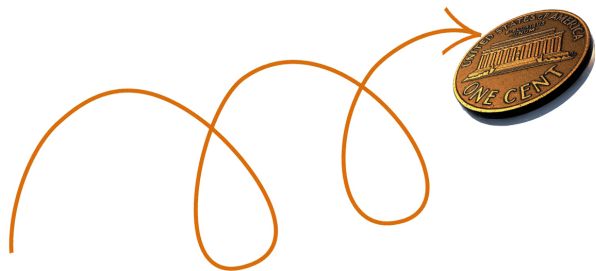
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10 Coin Flips

Before We Begin...



10 flips of a Coin



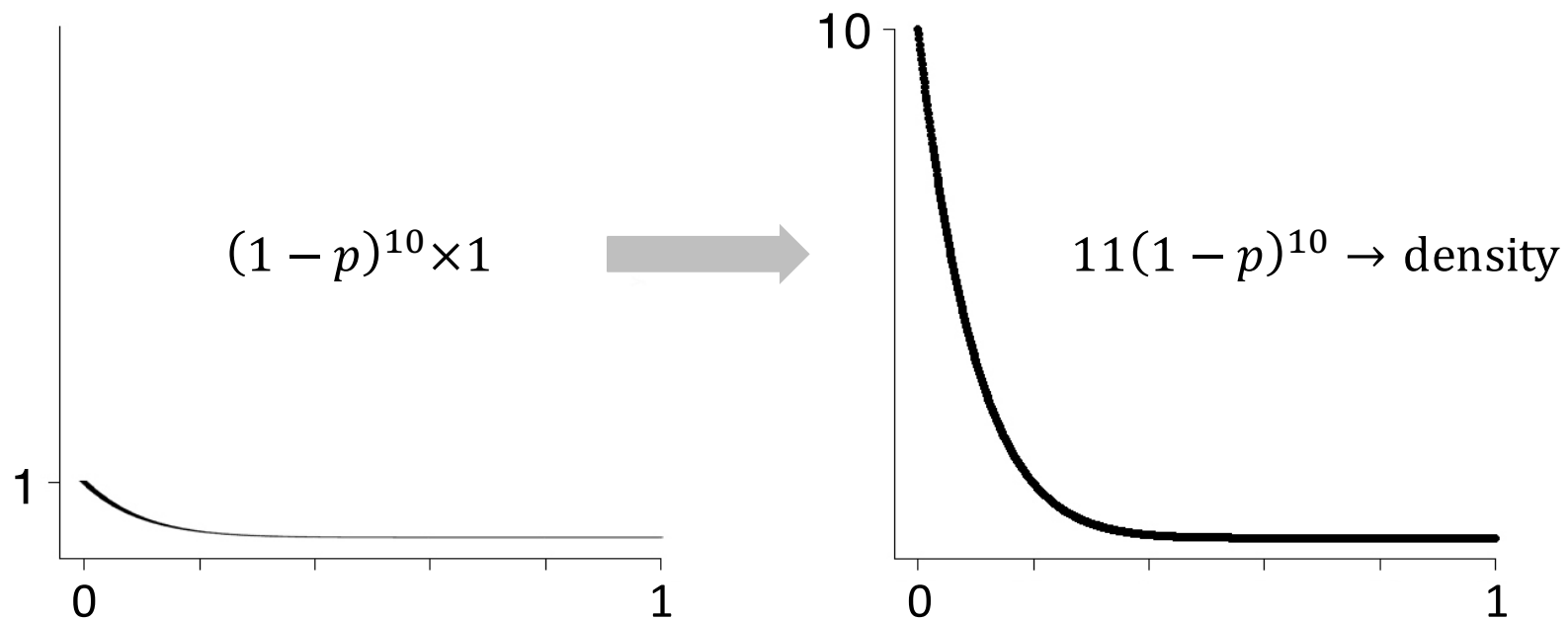
- interested in $p = P("H")$
- conduct experiment to estimate p
- 10 flips
- result: 0 heads, 10 tails

Classical

$$\hat{p} = \frac{X}{n}, X = \# \text{ of successes (heads)}$$
$$= \frac{0}{10} = 0, \text{ or}$$
$$L(p) = (1 - p)^{10} \text{ max at } p = 0$$

Bayesian

Experiment + Prior about p
Say $\pi \equiv 1$



Bayes estimate of p is the $\left\{ \begin{array}{l} \text{mean} \\ \text{median} \\ \text{mode} \end{array} \right.$

For the mean: $\widehat{p}_B = \frac{1}{12}$ [Check this!]

More reasonable than $\widehat{p}_C = 0$!

Summary

