@R_Trotta

Bayesian inference: Principles and applications

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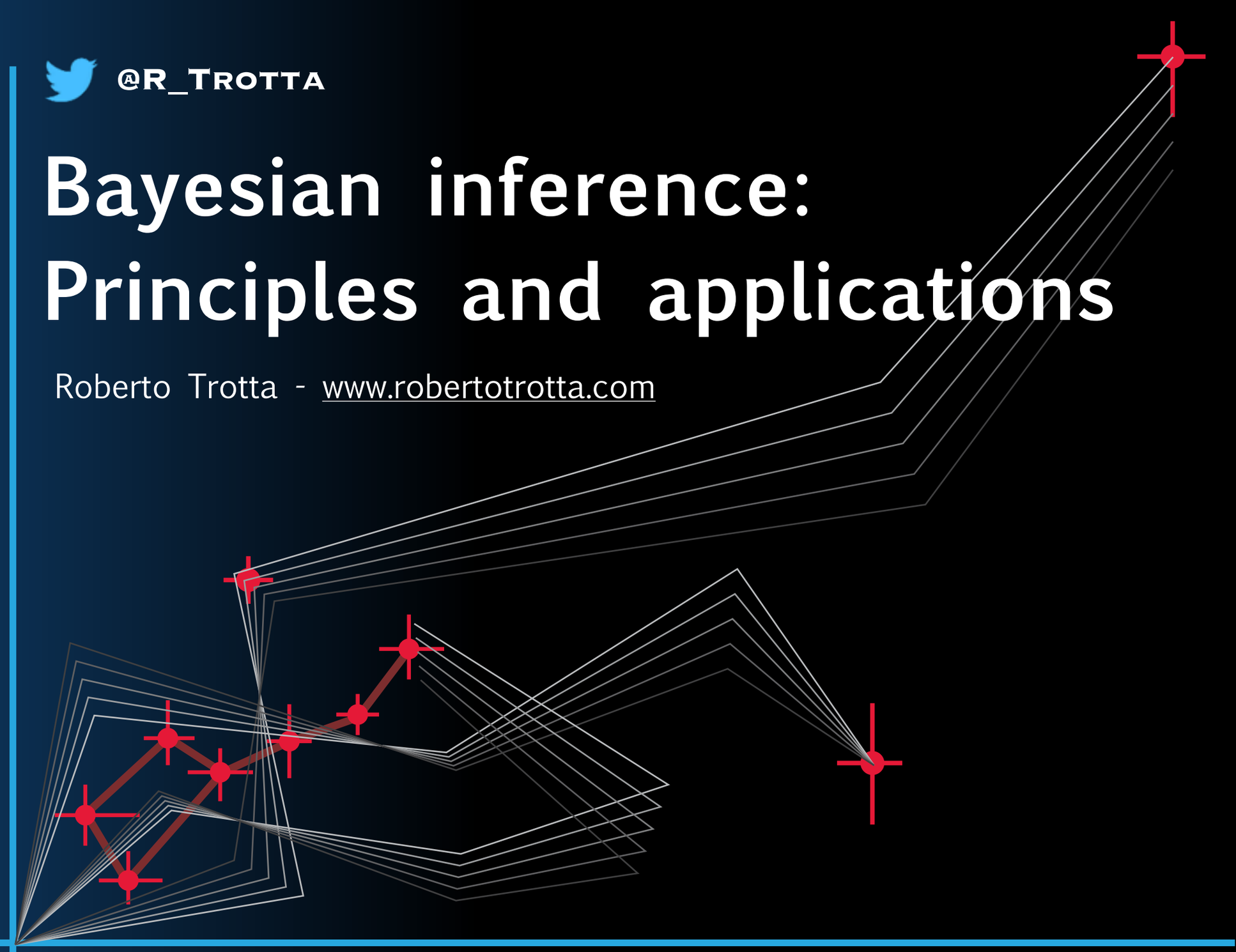

ICIC
Imperial Centre for Inference & Cosmology

Copenhagen PhD School
Oct 6th-10th 2014

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What do we mean by this statement?

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$$t \quad = 13.798 \pm 0.037$$

billion years

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Questions, please!

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Let’s keep the discussion going:

R_Trotta, #copstats2014

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Question 0

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- The founder of Bayesian statistics was:
  - 1. Thomas Bayes
  - 2. Benjamin Franklin
  - 3. Albert Einstein

Question 1

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- You throw a coin N=10 times and get 10 heads. You now throw it once more. The probability of heads is now:
  - 1. More than 50%, since the coin must be biased
  - 2. Less than 50%, since in the long run heads and tails must balance out
  - 3. 50%, as tosses are independent

Question 2

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- You throw N=10 times a fair coin (p=0.50) and N=20 times a bent coin (p=0.25). The probability of getting 5 heads is:
  - 1. The same in each case
  - 2. Larger for the p=0.50 coin prob = 0.246
  - 3. Larger for the p=0.25 coin prob = 0.202

Question 3

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- You flip a coin N=10 times an get H=7 heads. Then you flip it N=100 times and get H=70 heads. The confidence with which you can rule out the fair coin hypothesis is:
  - 1. Greater for the N=10 case
  - 2. Greater for the N=100 case
  - 3. The same in both cases

Question 4

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- In the frequentist framework, the statement $x = 25 \pm 2$ means that:
  - 1. The true value of x has a 68.3% probability of being in the “confidence interval” [23;27]
  - 2. The true value of x is contained within the measured confidence intervals 68.3% of the times over many repetitions of the experiment
  - 3. The maximum likelihood value of x is contained within [23;27] 68.3% of the times over many repetitions of the experiment

Question 5

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- You take 2 sets of 3 measurements each of a quantity. Each measurement is Gaussian and independent, with the same standard deviation.
  Set 1: -10, -2, 4
  Set 2: -1, +2, +3

The 1-sigma confidence interval on the mean is:

- 1. Larger for set 1
- 2. Larger for set 2
- 3. The same for both sets

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- You take 2 sets of 3 measurements each of a quantity. Each measurement is Gaussian and independent, with the same standard deviation.
  Set 1: -10, -2, 4
  Set 2: -1, +2, +3

Which instrument is more accurate?

- 1. Instrument 1 $\hat{\sigma}_{\mathrm{ML}} = 7.0$
- 2. Instrument 2 $\hat{\sigma}_{\mathrm{ML}} = 2.1$
- 3. They have the same accuracy