

# Exploring Monte-Carlo-integration techniques in Bayesian model selection

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(Dated: February 15, 2021)

An article usually includes an abstract, a concise summary of the work covered at length in the main body of the article.

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## I. INTRODUCTION

We mainly write everything that is in [1]. Here an awesome introduction will form

## II. THEORY

### A. Bayes' Theorem

Here we have to write cool stuff and so on about bayes theorem.

## III. METHODS

Here we write up the used algorithms.

### A. Monte-Carlo integration

Here we will explain Monte-Carlo sampling, that is *Sequential Monte Carlo* and therein METROPOLIS-HASTINGS. its probably better to put these two sub-sections in separate sections.

## IV. EXAMPLES

### A. Betabinomial example (coin flip)

Let us now consider as a starting example, the flipping of a two-sided coin, i.e. an experiment where we can measure either heads (H) or tails (T) with 50% probability, respectively. This, while simple, allows us an intuitive approach to Bayesian inference and model selection as well as to the MCMC techniques discussed before. Furthermore is this example easily altered to many real-life problems, such as birth rates, ..., or anything with the option of either success or failure.

#### 1. Analytical approach?

Assume we throw a coin 20 times. We observe 6 H and 14 T. "Is this a fair coin?" might be a question to ask yourself since the bias in outcome is quite large. Naively expecting a fair coin we could assign a *prior* to the probability of heads  $\theta$  as centred around 0.5, so for example a gaussian with  $\mu = 0.5, \sigma = 0.1$ .

#### 2. Numerical approach

### B. Fitting a polynomial of unknown degree

#### 1. Analytical approach?

#### 2. Numerical approach

## V. DISCUSSION

## VI. SUMMARY

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[1] D. Sivia and J. Skilling. *Data Analysis - A Bayesian tutorial*, volume 2. Oxford University Press, 2006.

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