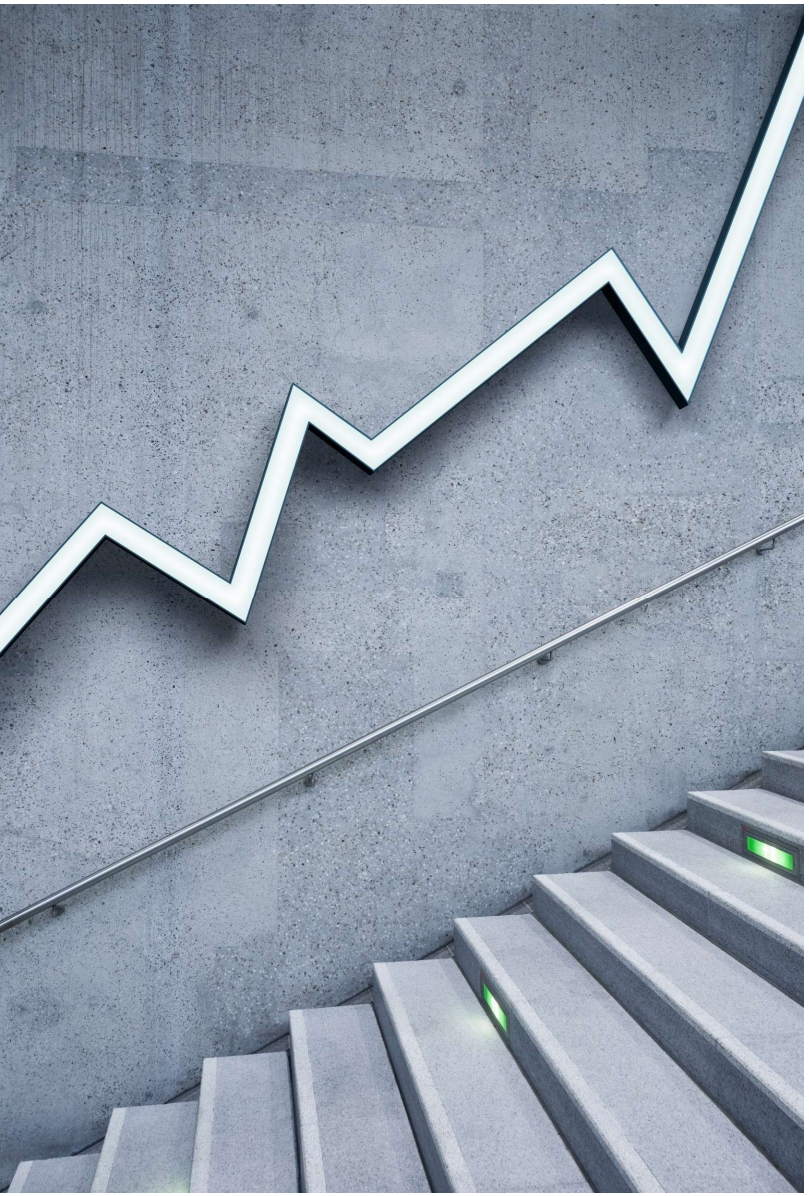


Using Bayesian to Test Success on Promotional Emails

EMILY CONRAD

The Problem

Hypothetically, I work for Talbots on the marketing & sales team, and I am the data analyst for the team. Each week a new design for an advertisement is created by the marketing team and is sent via email to our customers. If a customer clicks on the link inside the email, which directs them to our website, then we would consider the advertisement a success. If the customer does not click on the link, then we would consider this advertisement a failure.

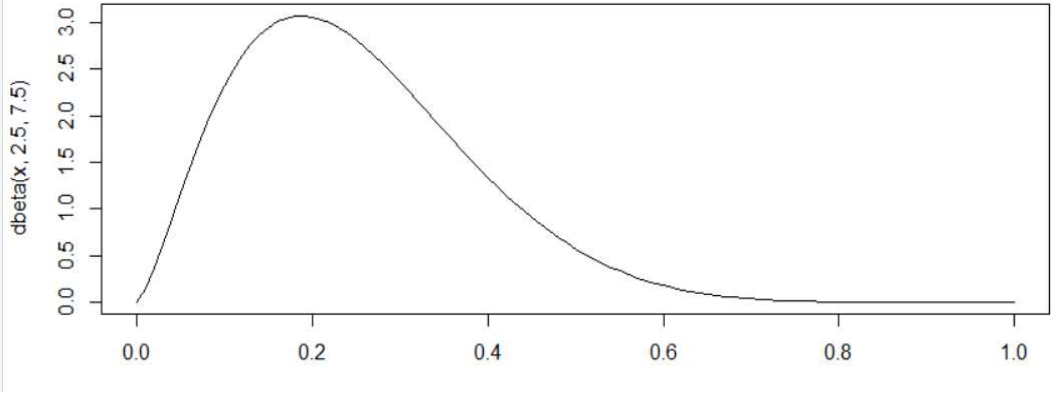
This problem has only two possible outcomes, so I will use the binomial model to determine success and failure probabilities.

This week we decided to send half of our customers ad A and the other half ad B to determine which is more successful. Ad A features a plus-sized model and ad B features a slim-sized model.

Determining the Prior

Each week we run a promotional email so from our experience we have found that about 25 percent of the customer population will click on the link to take them to our website. I don't want too much influence from the prior distribution, because we really want to measure how well this week's advertisement is in the changes that have been made. For this model I have chosen a prior with Beta (2.5, 7.5).

PRIOR DISTRIBUTION



Data Collection

Promotional Email Success Rates

Ad A -> Plus-Sized Model -> 50 clicked & 75 -> did not click frequentist rate = 50/125 = 0.40

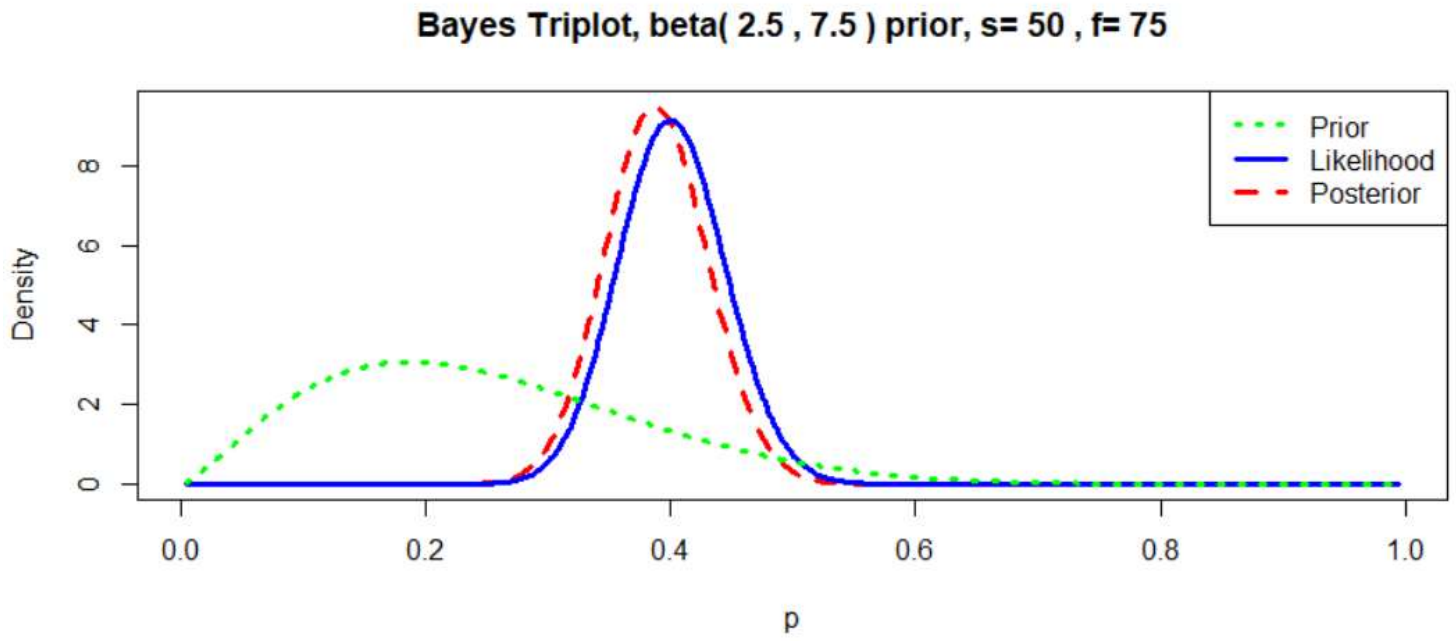
Ad B -> Slim-Sized Model -> 36 clicked & 100 -> did not click frequentist rate = 36/136 = 0.26

Posterior Distributions

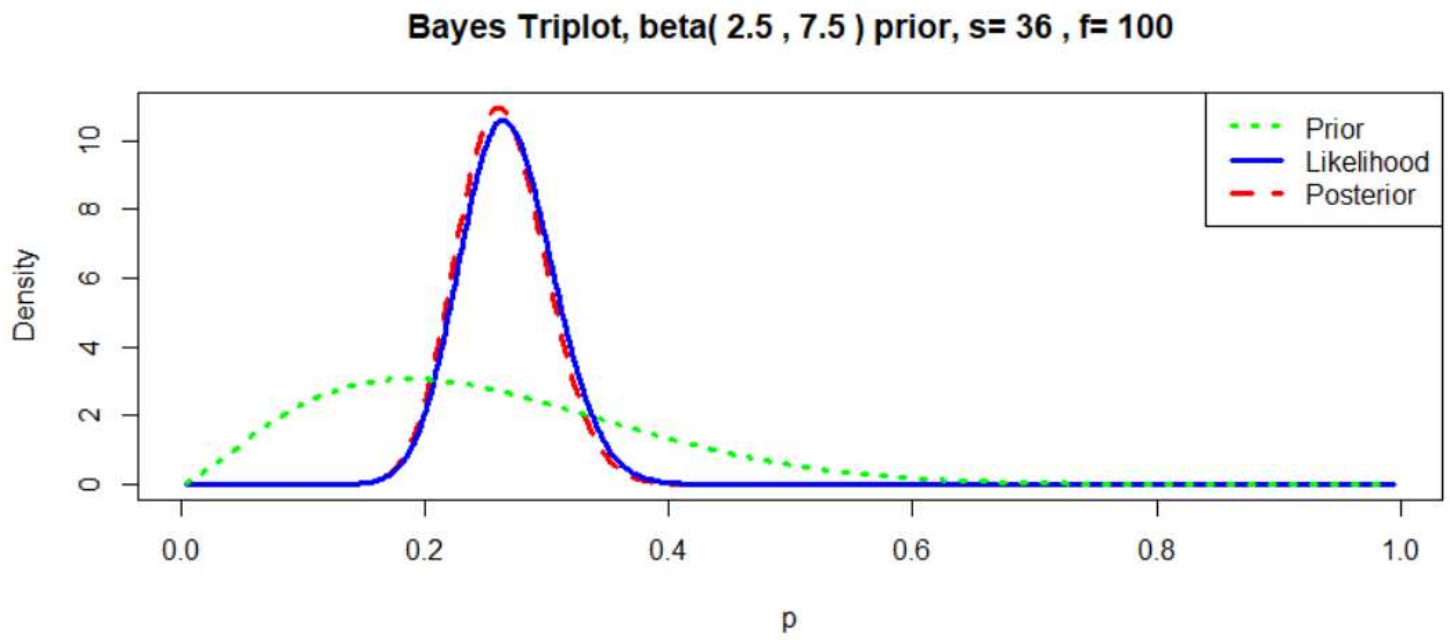
Posterior Distribution for Advertisement A -> Beta (52.5, 77.5)

Posterior Distribution for Advertisement B -> Beta (38.5, 107.5)

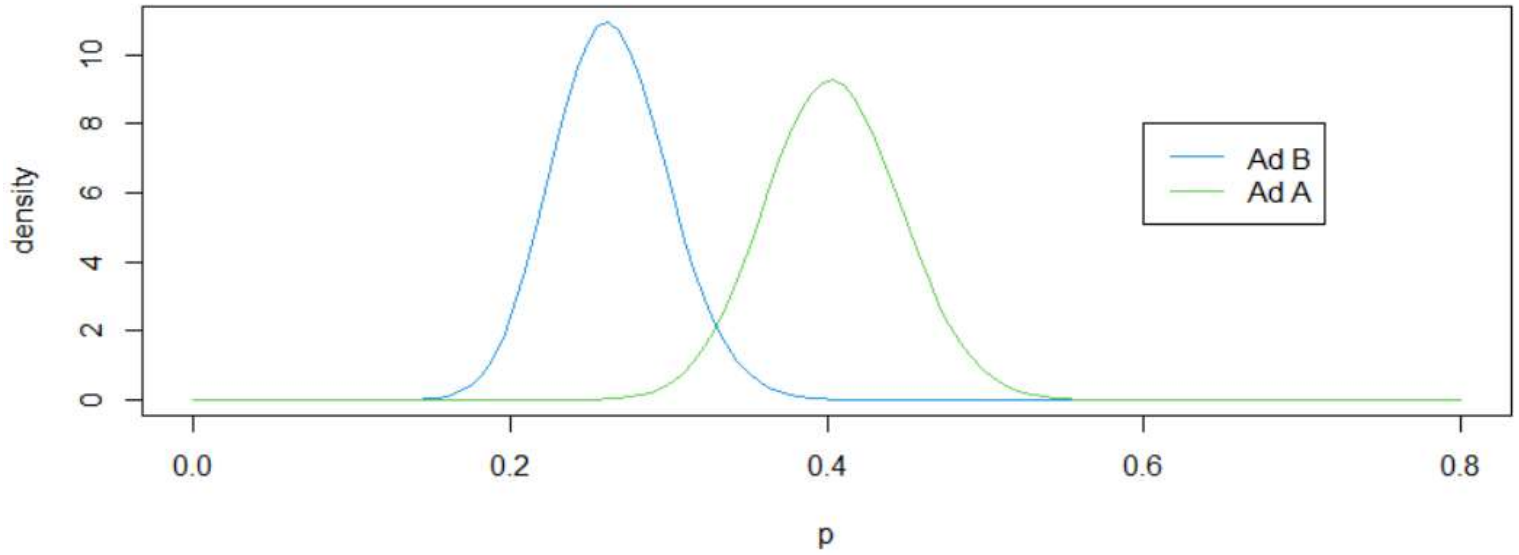
Tri-Plot for Ad A



Tri-Plot for Ad B



Posterior Distributions Side by Side



Using Monte Carlo

We can use the Monte Carlo simulation to determine how much better Ad A is compared to Ad B. To do this I will used the following code:

```
> Ad.A <- rbeta(10000, 52.5, 77.5)
> Ad.B <- rbeta(10000, 38.5, 107.5)
> Better <- sum(Ad.A > Ad.B)/10000
> Better
[1] 0.9939
```

Ad A performs better than Ad B 99% of the time.

Does this example have a Conjugate Prior?

In Bayesian probability theory, if the posterior distribution is in the same probability distribution family as the prior probability distribution, then the prior and posterior are then called conjugate distributions, and the prior is called a conjugate prior for the likelihood function.

In this example both the prior distribution and the posterior are beta functions, so we do have a conjugate distribution with a conjugate prior.

Questions?

THANK YOU!