Package ‘bayesplay’
September 9, 2021

Type Package
Title The Bayes Factor Playground
Version 0.9.2
Description A lightweight modelling syntax for defining likelihoods and priors and for computing Bayes factors for simple one parameter models. It includes functionality for computing and plotting priors, likelihoods, and model predictions. Additional functionality is included for computing and plotting posteriors.
License MIT + file LICENSE
Encoding UTF-8
Suggests testthat, covr, knitr, rmarkdown, markdown, vdiffr, ggplot2
VignetteBuilder knitr
RoxygenNote 7.1.1
Imports methods, gginnards
NeedsCompilation no
Author Lincoln J Colling [aut, cre] (<https://orcid.org/0000-0002-3572-7758>)
Maintainer Lincoln J Colling <lincoln@colling.net.nz>
Repository CRAN
Date/Publication 2021-09-09 07:50:02 UTC

R topics documented:

extract_posterior ..................................................... 2
extract_predictions ..................................................... 2
integral ................................................................. 3
likelihood .............................................................. 3
names,bayesplay-method ............................................ 5
plot ...................................................................... 6
prior ..................................................................... 6
sd_ratio ................................................................. 8
summary,bf-method .................................................... 9
visual_compare ......................................................... 9
$,bayesplay-method .................................................. 10
extract_posterior

**Description**

Extract the posterior object from a product object

**Usage**

```
extract_posterior(x)
```

**Arguments**

- `x` a product object

**Value**

a posterior object

extract_predictions

**Description**

Extract the marginal predictions over the prior

**Usage**

```
extract_predictions(x)
```

**Arguments**

- `x` a product object

**Value**

a prediction object
integral

Compute integral

Description
Computes the definite integral of a product object over the range of the parameter

Usage
integral(obj)

Arguments

obj  a product object

Value
A numeric of the marginal likelihood

Examples

# define a likelihood
data_model <- likelihood(family = "normal", mean = 5.5, sd = 32.35)

# define a prior
prior_model <- prior(family = "normal", mean = 5.5, sd = 13.3)

# multiply the likelihood by the prior
model <- data_model * prior_model

# take the integral
integral(model)

likelihood

Specify a likelihood

Description
Define likelihoods using different distribution families

Usage
likelihood(family, ...)

Arguments

family  the likelihood distribution (see details)
...  see details
Details

Available distribution families:
The following distribution families can be used for the likelihood

- **normal**: a normal distribution
- **student_t**: a scaled and shifted t-distribution
- **noncentral_t**: a noncentral t (for t statistic)
- **noncentral_d**: a noncentral t (for one sample d)
- **noncentral_d2**: a noncentral t (for independent samples d)
- **binomial**: a binomial distribution

The parameters that need to be specified will be dependent on the family

**normal distribution:**
When family is set to normal then the following parameters must be set

- **mean**: mean of the normal likelihood
- **sd**: standard deviation of the normal likelihood

**student_t distribution:**
When family is set to student_t then the following parameters may be set

- **mean**: mean of the scaled and shifted t likelihood
- **sd**: standard deviation of the scaled and shifted t likelihood
- **df**: degrees of freedom

**noncentral_t distribution:**
When family is set to noncentral_t then the following parameters may be set

- **t**: the t value of the data
- **df**: degrees of freedom

**noncentral_d distribution:**
When family is set to noncentral_d then the following parameters may be set

- **d**: the d (mean / sd) value of the data
- **n**: the sample size

**noncentral_d2 distribution:**
When family is set to noncentral_d2 then the following parameters may be set

- **d**: the d (mean / s_pooled) value of the data
- **n1**: the sample size of group 1
- **n2**: the sample size of group 2

s_pooled is set as below:

\[
s_{\text{pooled}} = \sqrt{\frac{(n_1 - 1)s_1^2 + (n_2 - 1)s_2^2}{n_1 + n_2 - 2}}
\]

**binomial distribution:**
When the family is set to binomial then the following parameters may be set

- **successes**: the number of successes
- **trials**: the number of trials
Value

an object of class likelihood

Examples

# specify a normal likelihood
likelihood(family = "normal", mean = 5.5, sd = 32.35)

# specify a scaled and shifted t likelihood
likelihood(family = "student_t", mean = 5.5, sd = 32.35, df = 10)

# specify non-central t likelihood (t scaled)
likelihood(family = "noncentral_t", t = 10, df = 10)

# specify non-central t likelihood (d scaled)
likelihood(family = "noncentral_d", d = 10, n = 10)

# specify non-central t likelihood (independent samples d scaled)
likelihood(family = "noncentral_d2", d = 10, n1 = 10, n2 = 12)

# specify a binomial likelihood
likelihood(family = "binomial", successes = 2, trials = 10)
### plot

**Plot a bayesplay object**

**Description**

Plots an object created by bayesplay

**Usage**

```r
plot(x, ...)  
## S3 method for class 'prior'
plot(x, ...)
## S3 method for class 'likelihood'
plot(x, ...)
## S3 method for class 'posterior'
plot(x, add_prior = FALSE, ...)
## S3 method for class 'product'
plot(x, ...)
## S3 method for class 'prediction'
plot(x, ...)
```

**Arguments**

- `x`: a likelihood, prior, posterior, product or predictive object
- `...`: arguments passed to methods
- `add_prior`: set to TRUE to add prior to the posterior plot

**Value**

A ggplo2 object

---

### prior

**Specify a prior**

**Description**

Define priors using different different distribution families

**Usage**

```r
prior(family, ...)
```
Arguments

family the prior distribution (see details)

Details

Available distribution families:
The following distributions families can be used for the prior

- normal a normal distribution
- student_t a scaled and shifted t-distribution
- cauchy a Cauchy distribution
- uniform a uniform distribution
- point a point
- beta a beta distribution

The parameters that need to be specified will be dependent on the family

Normal distribution:
When family is set to normal then the following parameters may be set

- mean mean of the normal prior
- sd standard deviation of the normal prior
- range (optional) a vector specifying the parameter range

Student t distribution:
When family is set to student_t then the following parameters may be set

- mean mean of the scaled and shifted t prior
- sd standard deviation of the scaled and shifted t prior
- df degrees of freedom of the scaled and shifted t prior
- range (optional) a vector specifying the parameter range

Cauchy distribution:
When family is set to cauchy then the following parameters may be set

- location the centre of the Cauchy distribution (default: 0)
- scale the scale of the Cauchy distribution
- range (optional) a vector specifying the parameter range

Uniform distribution:
When family is set to uniform then the following parameters must be set

- min the lower bound
- max the upper bound

Point:
When family is set to point then the following parameters may be set

- point the location of the point prior (default: 0)

Beta:
When family is set to beta then the following parameters may be set

- alpha the first shape parameter
- beta the second shape parameter
Value

an object of class prior

Examples

# specify a normal prior
prior(family = "normal", mean = 0, sd = 13.3)

# specify a half-normal (range 0 to Infinity) prior
prior(family = "normal", mean = 0, sd = 13.3, range = c(0, Inf))

# specify a student t prior
prior(family = "student_t", mean = 0, sd = 13.3, df = 79)

# specify a truncated t prior
prior(family = "student_t", mean = 0, sd = 13.3, df = 79, range = c(-40, 40))

# specify a cauchy prior
prior(family = "cauchy", location = 0, scale = .707)

# specify a half cauchy prior
prior(family = "cauchy", location = 0, scale = 1, range = c(-Inf, 0))

# specify a uniform prior
prior(family = "uniform", min = 0, max = 20)

# specify a point prior
prior(family = "point", point = 0)

# specify a beta prior
prior(family = "beta", alpha = 2.5, beta = 3.8)

sd_ratio

Compute the Savage-Dickey density ratio

Description

Computes the Savage-Dickey density ratio from a posterior object at a specified point

Usage

sd_ratio(x, point)

Arguments

x a posterior object
point the point at which to evaluate the Savage-Dickey ratio
Value

A numeric of the Savage-Dickey density ratio

Examples

```r
# define a likelihood
data_model <- likelihood(family = "normal", mean = 5.5, sd = 32.35)

# define a prior
prior_model <- prior(family = "normal", mean = 5.5, sd = 13.3)

model <- extract_posterior(data_model * prior_model)

# compute the Savage-Dickey density ratio at 0
sd_ratio(model, 0)
```

Description

Provide a verbal summary of a Bayes factor and the level of evidence

Usage

```r
## S4 method for signature 'bf'
summary(object)
```

Arguments

- `object` a bf object

Value

No return, called for side effects

Description

Visually compare two models

Usage

```r
visual_compare(model1, model2, ratio = FALSE)
```
Arguments

model1  a predictive object
model2  a predictive object
ratio   show ratio rather than comparison (default: FALSE)

Value

A ggplot2 object

Examples

# define two models
data_model <- likelihood(family = "normal", .5, 1)
h0_mod <- prior(family = "point", point = 0)
h1_mod <- prior(family = "normal", mean = 0, sd = 10)
m0 <- extract_predictions(data_model * h0_mod)
m1 <- extract_predictions(data_model * h1_mod)

# visually compare the model
visual_compare(m0, m1)
# plot the ratio of the two model predictions
visual_compare(m0, m1, ratio = TRUE)

Description

Get fields from data slot

Usage

## S4 method for signature 'bayesplay'
x$name

Arguments

x  a bayesplay object
name  field name

Value

content of the named field from the data slot
Index

$, bayesplay-method, 10

extract_posterior, 2
extract_predictions, 2

integral, 3
likelihood, 3

names, bayesplay-method, 5

plot, 6
prior, 6

sd_ratio, 8
summary, bf-method, 9

visual_compare, 9