Package 'ClinicalRobustPriors'

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Title Robust Bayesian Priors in Clinical Trials: An R Package for Practitioners

Author Jairo A. Fuquene P.

Maintainer Jairo A. Fuquene P. <jairo.a.fuquene@uprrp.edu>

Description In a recent paper, Fuquene, Cook, & Pericchi (2008) (http://www.bepress.com/mdandersonbiostat/paper44) make a comprehensive proposal putting forward robust, heavy-tailed priors over conjugate, light-tailed priors in Bayesian analysis. The behavior of Robust Bayesian methods is qualitative different than Conjugate and short tailed Bayesian methods and arguably much more reasonable and acceptable to the practitioner and regulatory agencies. This package is useful to compute the distributions (prior, likelihood and posterior) and moments of the robust models: Cauchy/Binomial, Cauchy/Normal and Berger/Normal. Both, Binomial and Normal Likelihoods can be handled by the software. Furthermore, the assessment of the hyperparameters and the posterior analysis can be processed.

Depends R (>= 2.7.2)

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R topics documented:

`Berger.Normal` *Normal Log-Odds with Normal and Berger's Priors*

Description

Compute the distributions (prior, likelihood and posterior) and moments for the Normal/Normal conjugate model and Berger/Normal robust model. The plots are processed in Log-Odds and OR Scale.

Usage

```
Berger.Normal(mu,ym,tau,sigma,n0,n,min.value=NULL,max.value=NULL,OR.xlim=NULL)
```

Arguments

`mu`	the location parameter in Log-Odds Scale for Normal and Berger's Priors.
`ym`	the location parameter in Log-Odds Scale for Normal Likelihood.
`tau`	the scale parameter in Log-Odds for Normal and Berger's Priors.
`sigma`	the scale parameter in Log-Odds Normal Likelihood.
`n0`	number of prior observations.
`n`	sample size.
`min.value`	minimum value in Log-Odds scale for the plots. The default min.value is 5.
`max.value`	maximum value in Log-Odds scale for the plots. The default max.value is -5.
`OR.xlim`	maximum value for the OR scale in the plot of the Berger/Normal model. The default OR.xlim is c(0,2).

Author(s)

Jairo A. Fuquene P. <jairo.a.fuquene@uprrp.edu>

References

Berger, J. O. (1985), Statistical Decision Theory and Bayesian Analysis, second edn, Springer-Verlag.

Fuquene, J. A., Cook, J. D. & Pericchi, L. R. (2008), A Case for Robust Bayesian priors with Applications to Binary Clinical Trials. UT MD Anderson Cancer Center Department of Biostatistics Working Paper Series. Working Paper 44. 2008. http://www.bepress.com/mdandersonbiostat/paper44.

Spiegelhalter, D. J., Abrams, K. R. & Myles, J. P. (2004), Bayesian Approaches to Clinical Trials and Health-Care Evaluation, Wiley, London.

Examples

```
######################
# Example 1:
######################
Berger.Normal(-1.97,-0.73,0.31,0.15,406,170)
######################
# Example 2
######################
Berger.Normal(-1.97,-0.73,0.31,0.15,406,170,min.value=-3.5,max.value=0,OR.xlim=c(0,1))
######################
# Example 3
######################
Berger.Normal(-1.97,-0.73,0.15,0.31,406,170)
```

`Cauchy.Binomial` *The Binomial Likelihood with Beta and Cauchy Priors*

Description

Compute the distributions (prior, likelihood, posterior predictive and posterior) and moments for the Beta/Binomial conjugate model and Cauchy/Binomial robust model. The plots are processed in Log-Odds and Theta Scale.

Usage

```
Cauchy.Binomial(n,x,a,b,m,min.value=NULL,max.value=NULL,iter=NULL)
```

Arguments

`n`	sample size or number of observed patients.
`x`	number of positive responses in n trials.
`a`	the usual parameter of Beta prior and the number of positive responses in the prior information.
`b`	the usual parameter of Beta prior and the number of negative responses in the prior information.
`m`	number of additional patients for predictions
`min.value`	minimum value in Log-Odds scale for the plots. The default min.value is 5.
`max.value`	maximum value in Log-Odds scale for the plots. The default max.value is -5.
`iter`	number of iterations in rejection sampling for the moments for the Cauchy/Binomial model. The default iter is 10000.

Author(s)

Jairo A. Fuquene P. <jairo.a.fuquene@uprrp.edu>

References

Fuquene, J. A., Cook, J. D. & Pericchi, L. R. (2008), A Case for Robust Bayesian priors with Applications to Binary Clinical Trials. UT MD Anderson Cancer Center Department of Biostatistics Working Paper Series. Working Paper 44. 2008. http://www.bepress.com/mdandersonbiostat/paper44.

Spiegelhalter, D. J., Abrams, K. R. & Myles, J. P. (2004), Bayesian Approaches to Clinical Trials and Health-Care Evaluation, Wiley, London.

Examples

```
############################################
# Example 1: sample and prior are in conflict
############################################
Cauchy.Binomial(20,16,3,12,40)
############################################
# Example 2: sample and prior are consistent
############################################
Cauchy.Binomial(20,16,12,3,50,min.value=-5,max.value=5,iter=5000)
```

`Cauchy.Normal` *Normal Log-Odds with Normal and Cauchy Priors*

Description

Compute the distributions (prior, likelihood and posterior) and moments for the Normal/Normal conjugate model and Cauchy/Normal robust model. The plots are processed in Log-Odds and OR Scale.

Usage

```
Cauchy.Normal(mu,ym,tau,sigma,n0,n,min.value=NULL,max.value=NULL,OR.xlim=NULL)
```

Arguments

`mu`	the location parameter in Log-Odds Scale for Normal and Cauchy priors.
`ym`	the location parameter in Log-Odds Scale for Normal Likelihood.
`tau`	the scale parameter in Log-Odds for Normal and Cauchy priors.
`sigma`	the scale parameter in Log-Odds for Normal Likelihood.
`n0`	number of prior observations.
`n`	sample size.
`min.value`	minimum value in Log-Odds scale for the plots. The default min.value is 5.
`max.value`	maximum value in Log-Odds scale for the plots. The default max.value is -5.
`OR.xlim`	maximum value for the OR scale in the plot of the Berger/Normal model. The default OR.xlim is c(0,2).

Author(s)

Jairo A. Fuquene P. <jairo.a.fuquene@uprrp.edu>

References

Fuquene, J. A., Cook, J. D. & Pericchi, L. R. (2008), A Case for Robust Bayesian priors with Applications to Binary Clinical Trials. UT MD Anderson Cancer Center Department of Biostatistics Working Paper Series. Working Paper 44. 2008. http://www.bepress.com/mdandersonbiostat/paper44.

Pericchi, L. R. & Smith, A. F. M. (1992), 'Exact and approximate posterior moments for a normal localization parameter', Journal of the Royal Statistics Society 54, 793-804.

Spiegelhalter, D. J., Abrams, K. R. & Myles, J. P. (2004), Bayesian Approaches to Clinical Trials and Health-Care Evaluation, Wiley, London.

Examples

```
#######################
# Example
#######################
Cauchy.Normal(-1.97,-0.73,0.15,0.31,406,170,min.value=-3,max.value=0.5,OR.xlim=c(0,1))
```

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