

# Package ‘BayesReversePLLH’

October 6, 2020

**Type** Package

**Title** Fits the Bayesian Piecewise Linear Log-Hazard Model

**Version** 1.4

**Date** 2020-10-6

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**Description** Contains posterior samplers for the Bayesian piecewise linear log-hazard and piecewise exponential hazard models, including Cox models. Posterior mean restricted survival times are also computed for non-Cox and Cox models with only treatment indicators. The `ApproxMean()` function can be used to estimate restricted posterior mean survival times given a vector of patient covariates in the Cox model. Functions included to return the posterior mean hazard and survival functions for the piecewise exponential and piecewise linear log-hazard models. Chapple, AG, Peak, T, Hemal, A (2020). Under Revision.

**License** GPL-2

**Encoding** UTF-8

**Imports** Rcpp (>= 0.12.18)

**LinkingTo** Rcpp, RcppArmadillo

**RoxygenNote** 7.1.1

**NeedsCompilation** yes

**Repository** CRAN

**Date/Publication** 2020-10-06 19:50:03 UTC

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ApproxMean	<i>Returns the approximate restricted posterior mean survival for the PLLH model.</i>
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## Description

Uses a grid and parameter values to approximate the restricted posterior mean survival for the PLLH model using the integral of the survival function.

## Usage

```
ApproxMean(Y, s, lam, J)
```

## Arguments

Y	Sequence from 0.01 to the maximum observed event time used to compute the approximate restricted mean survival time. Smaller spaced sequences results in better approximation but longer computation time.
s	Vector of split points. The first and last entries must be 0 and max(Y).
lam	Vector of log-hazard values at each split point location. Must be same length as s.
J	Number of split points.

## Value

Returns the approximate restricted posterior mean survival time for the PLLH model.

## Examples

```
##Generate Data
Y1=rweibull(100,4,1)
##Create sequence from (0,max(Y1)) for approximation
Y=seq(.01,max(Y1),.01)
##Parameters used to approximate the mean
s=c(0,1,max(Y1))
lam=c(-2,0,-2)
J=1
ApproxMean( Y, s, lam, J)
```

---

BayesPiecewiseHazard *Samples from the PEH model without covariates.*

---

### Description

Samples from the Piecewise Exponential Hazard (PEH) model and returns a list containing posterior parameters and posterior restricted mean survival.

### Usage

```
BayesPiecewiseHazard(Y, I1, Poi, B)
```

### Arguments

Y	Vector of event or censoring times.
I1	Vector of event indicators.
Poi	Prior mean number of split points.
B	Number of iterations for MCMC.

### Value

Returns a list containing posterior samples of (1) the split point locations, (2) the log-hazards at each split point, (3) the number of split points, (4) the variance parameter for the log-hazard values, (5) the posterior mean restricted survival time.

### Examples

```
##Generate Data
Y=rweibull(20,4,1)
I=rbinom(20,1,.5)
##Hyperparameter for number of split points
Poi=5
##Number of iterations for MCMC
B=200
BayesPiecewiseHazard( Y, I, Poi, B)
```

---

BayesPiecewiseHazardCOV

*Samples from the PEH Cox model with a patient covariate vector.*

---

### Description

Samples from the Piecewise Exponential Hazard (PEH) Cox model with a patient covariate vector and returns a list containing posterior parameters and posterior restricted mean survival.

**Usage**

```
BayesPiecewiseHazardCOV(Y, I1, COV, Poi, B)
```

**Arguments**

Y	Vector of event or censoring times.
I1	Vector of event indicators.
COV	Matrix of size nxp containing p patient covariates.
Poi	Prior mean number of split points.
B	Number of iterations for MCMC.

**Value**

Returns a list containing posterior samples of (1) the split point locations, (2) the log-hazards at each split point, (3) the number of split points, (4) the variance parameter for the log-hazard values, (5) the coefficients in the Cox model.

**Examples**

```
##Generate Data
Y=rweibull(20,4,1)
I=rbinom(20,1,.5)
COV = matrix(rnorm(40,0,1),ncol=2)
##Hyperparameter for number of split points
Poi=5
##Number of iterations for MCMC
B=200
BayesPiecewiseHazardCOV( Y, I,COV, Poi, B)
```

---

```
BayesPiecewiseHazardTrt
```

*Samples from the PEH Cox model with a patient covariate vector.*

---

**Description**

Samples from the Piecewise Linear Log-Hazard (PLLH) Cox model and returns a list containing posterior parameters and posterior restricted mean survival.

**Usage**

```
BayesPiecewiseHazardTrt(Y, I1, Trt, Poi, B)
```

**Arguments**

Y	Vector of event or censoring times.
I1	Vector of event indicators.
Trt	Vector containing patient treatment/control assignment.
Poi	Prior mean number of split points.
B	Number of iterations for MCMC.

**Value**

Returns a list containing posterior samples of (1) the split point locations, (2) the log-hazards at each split point, (3) the number of split points, (4) the variance parameter for the log-hazard values, (5) the treatment coefficient, (6) the mean restricted survival time of the control therapy, (7) the mean restricted survival time of the treatment therapy.

**Examples**

```
##Generate Data
Y=rweibull(20,4,1)
I=rbinom(20,1,.5)
Trt=rbinom(20,1,.5)
##Hyperparameter for number of split points
Poi=5
##Number of iterations for MCMC
B=200
BayesPiecewiseHazardTrt( Y, I,Trt, Poi, B)
```

---

BayesPiecewiseLinearLogHazard

*Samples from the PLLH model without covariates.*

---

**Description**

Samples from the Piecewise Linear Log-Hazard (PLLH) model and returns a list containing posterior parameters and posterior restricted mean survival.

**Usage**

```
BayesPiecewiseLinearLogHazard(Y, I1, Poi, B)
```

**Arguments**

Y	Vector of event or censoring times.
I1	Vector of event indicators.
Poi	Prior mean number of split points.
B	Number of iterations for MCMC.

**Value**

Returns a list containing posterior samples of (1) the split point locations, (2) the log-hazards at each split point, (3) the number of split points, (4) the variance parameter for the log-hazard values, (5) the posterior mean restricted survival time.

**Examples**

```
##Generate Data
Y=rweibull(20,4,1)
I=rbinom(20,1,.5)
##Hyperparameter for number of split points
Poi=5
##Number of iterations for MCMC
B=200
BayesPiecewiseLinearLogHazard( Y, I, Poi, B)
```

---

BayesPiecewiseLinearLogHazardCOV

*Samples from the PLLH Cox model with a patient covariate vector.*

---

**Description**

Samples from the Piecewise Linear Log-Hazard (PLLH) Cox model with a patient covariate vector and returns a list containing posterior parameters and posterior restricted mean survival.

**Usage**

```
BayesPiecewiseLinearLogHazardCOV(Y, I1, COV, Poi, B)
```

**Arguments**

Y	Vector of event or censoring times.
I1	Vector of event indicators.
COV	Matrix of size nxp containing p patient covariates.
Poi	Prior mean number of split points.
B	Number of iterations for MCMC.

**Value**

Returns a list containing posterior samples of (1) the split point locations, (2) the log-hazards at each split point, (3) the number of split points, (4) the variance parameter for the log-hazard values, (5) the coefficients in the Cox model.

**Examples**

```
##Generate Data
Y=rweibull(20,4,1)
I=rbinom(20,1,.5)
COV = matrix(rnorm(40,0,1),ncol=2)
##Hyperparameter for number of split points
Poi=5
##Number of iterations for MCMC
B=200
BayesPiecewiseLinearLogHazardCOV( Y, I,COV, Poi, B)
```

---

```
BayesPiecewiseLinearLogHazardTrt
```

*Samples from the PEH Cox model with a treatment indicator.*

---

**Description**

Samples from the Piecewise Exponential Hazard (PEH) Cox model with a treatment indicator and returns a list containing posterior parameters and posterior restricted mean survival.

**Usage**

```
BayesPiecewiseLinearLogHazardTrt(Y, I1, Trt, Poi, B)
```

**Arguments**

Y	Vector of event or censoring times.
I1	Vector of event indicators.
Trt	Vector containing patient treatment/control assignment.
Poi	Prior mean number of split points.
B	Number of iterations for MCMC.

**Value**

Returns a list containing posterior samples of (1) the split point locations, (2) the log-hazards at each split point, (3) the number of split points, (4) the variance parameter for the log-hazard values, (5) the treatment coefficient, (6) the mean restricted survival time of the control therapy, (7) the mean restricted survival time of the treatment therapy.

**Examples**

```
##Generate Data
Y=rweibull(20,4,1)
I=rbinom(20,1,.5)
Trt=rbinom(20,1,.5)
##Hyperparameter for number of split points
Poi=5
```

```
##Number of iterations for MCMC
B=200
BayesPiecewiseLinearLogHazardTrt( Y, I,Trt, Poi, B)
```

---

GetALLHazLogSlope      *Computes the posterior distribution of hazard value for a vector x for the Piecewise Linear Log Hazard model (PLLH)*

---

### Description

Computes the posterior distribution of hazard value for a vector x for the Piecewise Linear Log Hazard model (PLLH)

### Usage

```
GetALLHazLogSlope(x, G1)
```

### Arguments

x                      Vector of times to compute the posterior mean hazard function  
G1                      List of posterior samples from the BayesPiecewiseLinearLogHazard function.

### Value

Matrix containing the posterior distribution of hazard values h(x)

---

GetALLHazPiece      *Computes the posterior hazard values for a vector x for the Piecewise Exponential Hazard model (PEH)*

---

### Description

Computes the posterior hazard values for a vector x for the Piecewise Exponential Hazard model (PEH)

### Usage

```
GetALLHazPiece(x, G1)
```

### Arguments

x                      Vector of times to compute the hazard.  
G1                      List of posterior samples from the BayesPiecewiseHazard function.

### Value

Matrix containing the posterior distribution of hazard values h(x)



---

GetALLSurvPEH	<i>Computes the posterior distribution of survival probabilities for a vector <math>x</math> for the Piecewise Exponential Hazard model (PEH)</i>
---------------	---

---

**Description**

Computes the posterior distribution of survival probabilities for a vector  $x$  for the Piecewise Exponential Hazard model (PEH)

**Usage**

GetALLSurvPEH( $x$ , G1)

**Arguments**

$x$	Vector of times to compute the posterior mean survival probability.
G1	List of posterior samples from the BayesPiecewiseLinearHazard function.

**Value**

Matrix containing the posterior distribution of survival probabilities  $S(x)$

---

GetALLSurvPLLH	<i>Computes posterior distribution of survival probabilities for a vector <math>x</math> for the Piecewise Linear Log Hazard model (PLLH)</i>
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---

**Description**

Computes posterior distribution of survival probabilities for a vector  $x$  for the Piecewise Linear Log Hazard model (PLLH)

**Usage**

GetALLSurvPLLH( $x$ , G1)

**Arguments**

$x$	Vector of times to compute the posterior mean survival probability.
G1	List of posterior samples from the BayesPiecewiseLinearLogHazard function.

**Value**

Matrix containing the posterior distribution survival probabilities  $S(x)$

---

PostMeanHazLogSlope	<i>Computes the posterior mean hazard value for a vector x for the Piecewise Linear Log Hazard model (PLLH)</i>
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---

**Description**

Computes the posterior mean hazard value for a vector  $x$  for the Piecewise Linear Log Hazard model (PLLH)

**Usage**

PostMeanHazLogSlope( $x$ ,  $G1$ )

**Arguments**

$x$	Vector of times to compute the posterior mean hazard function
$G1$	List of posterior samples from the BayesPiecewiseLinearLogHazard function.

**Value**

Vector containing the posterior mean hazard values  $h(x)$

---

PostMeanHazPiece	<i>Computes the posterior mean hazard values for a vector x for the Piecewise Exponential Hazard model (PEH)</i>
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---

**Description**

Computes the posterior mean hazard values for a vector  $x$  for the Piecewise Exponential Hazard model (PEH)

**Usage**

PostMeanHazPiece( $x$ ,  $G1$ )

**Arguments**

$x$	Vector of times to compute the posterior mean hazard.
$G1$	List of posterior samples from the BayesPiecewiseHazard function.

**Value**

Vector containing the posterior mean hazard values  $h(x)$

---

PostMeanSurvPEH	<i>Computes the posterior mean survival probabilities for a vector x for the Piecewise Exponential Hazard model (PEH)</i>
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---

**Description**

Computes the posterior mean survival probabilities for a vector x for the Piecewise Exponential Hazard model (PEH)

**Usage**

PostMeanSurvPEH(x, G1)

**Arguments**

x	Vector of times to compute the posterior mean survival probability.
G1	List of posterior samples from the BayesPiecewiseLinearHazard function.

**Value**

Vector containing the posterior mean survival probabilities S(x)

---

PostMeanSurvPLLH	<i>Computes the posterior mean survival probabilities for a vector x for the Piecewise Linear Log Hazard model (PLLH)</i>
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---

**Description**

Computes the posterior mean survival probabilities for a vector x for the Piecewise Linear Log Hazard model (PLLH)

**Usage**

PostMeanSurvPLLH(x, G1)

**Arguments**

x	Vector of times to compute the posterior mean survival probability.
G1	List of posterior samples from the BayesPiecewiseLinearLogHazard function.

**Value**

Vector containing the posterior mean survival probabilities S(x)

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