Package: bewrs (via r-universe)

June 25, 2026

Title Bayesian Early-Warning Risk Surveillance for Healthcare Performance Monitoring

Version 0.1.0

Description Provides tools for Bayesian early-warning risk surveillance in healthcare performance monitoring. The package implements functions for posterior underperformance risk estimation, Dynamic Bayesian Early-Warning Risk Score computation, temporal and external validation, calibration assessment, decision curve analysis, decision-theoretic intervention optimisation, and Expected Value of Intervention analysis. The methodology is motivated by Bayesian hierarchical modelling, healthcare provider profiling, early-warning surveillance, and decision-theoretic resource allocation, including approaches discussed by Gelman et al. (2013), Spiegelhalter (2005) <doi:10.1136/bmj.331.7512.302>, Vickers and Elkin (2006) <doi:10.1177/0272989X06295361>, and Parmigiani and Inoue (2009).

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Imports ggplot2, pROC, stats

Suggests testthat (>= 3.0.0), knitr, rmarkdown

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BugReports https://github.com/zerish12/bewrs/issues

Repository https://zerish12.r-universe.dev

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Contents

`compute_dynamic_bewrs` *Compute Dynamic BEWRS*

Description

Computes the Bayesian Dynamic Early-Warning Risk Score using current posterior underperformance probability, persistence, and deterioration.

Usage

```
compute_dynamic_bewrs(
  up,
  persistence,
  deterioration,
  alpha = 0,
  beta_up = 1,
  beta_persistence = 1,
  beta_deterioration = 1
)
```

Arguments

`up`	Numeric vector of posterior underperformance probabilities.
`persistence`	Numeric vector measuring persistence of elevated risk.
`deterioration`	Numeric vector measuring recent deterioration.
`alpha`	Intercept parameter.
`beta_up`	Coefficient for logit-transformed posterior risk.
`beta_persistence`	Coefficient for persistence.
`beta_deterioration`	Coefficient for deterioration.

Value

Numeric vector of Dynamic BEWRS probabilities.

Examples

```
compute_dynamic_bewrs(
  up = c(0.2, 0.5, 0.8),
  persistence = c(0.1, 0.4, 0.7),
  deterioration = c(0.0, 0.1, 0.2)
)
```

`compute_evi` *Compute Expected Value of Intervention*

Description

Computes the Expected Value of Intervention (EVI) as the reduction in expected loss from no action to the selected intervention.

Usage

```
compute_evi(loss_no_action, loss_intervention)
```

Arguments

`loss_no_action`	Numeric vector of expected loss under no action.
`loss_intervention`	Numeric vector of expected loss under intervention.

Value

Numeric vector of EVI values.

Examples

```
compute_evi(c(10, 5, 2), c(7, 4, 3))
```

`optimal_intervention` *Select optimal intervention*

Description

Selects the intervention with the lowest expected loss.

Usage

```
optimal_intervention(loss_matrix)
```

Arguments

loss_matrix	Numeric matrix or data.frame of expected losses. Rows represent observational units and columns represent intervention options.

Value

A data.frame containing optimal action and minimum expected loss.

Examples

```
losses <- data.frame(
  no_action = c(10, 5, 2),
  monitor = c(8, 4, 3),
  review = c(7, 6, 4)
)
optimal_intervention(losses)
```

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plot_calibration *Plot calibration curve*

Description

Plot calibration curve

Usage

```
plot_calibration(observed, predicted, groups = 10)
```

Arguments

observed	Binary observed outcome, coded 0/1.
predicted	Predicted probabilities.
groups	Number of quantile groups.

Value

A ggplot object.

plot_risk_groups *Plot risk group event rates*

Description

Plot risk group event rates

Usage

```
plot_risk_groups(observed, risk_group)
```

Arguments

observed	Binary observed outcome, coded 0/1.
risk_group	Ordered risk group factor.

Value

A ggplot object.

risk_stratify *Stratify Dynamic BEWRS risk*

Description

Classifies risk probabilities into Low, Watchlist, High, and Critical groups.

Usage

```
risk_stratify(risk, cutoffs = c(0.25, 0.5, 0.75))
```

Arguments

risk	Numeric vector of predicted risk probabilities.
cutoffs	Numeric vector of three cutoffs. Default is c(0.25, 0.50, 0.75).

Value

Ordered factor of risk categories.

Examples

```
risk_stratify(c(0.1, 0.4, 0.6, 0.9))
```

`validate_bewrs` *Validate BEWRS predictions*

Description

Computes AUC, Brier score, calibration intercept, and calibration slope.

Usage

```
validate_bewrs(observed, predicted)
```

Arguments

`observed`	Binary vector of observed outcomes, coded 0/1.
`predicted`	Numeric vector of predicted probabilities.

Value

A data.frame containing validation metrics.

Examples

```
validate_bewrs(c(0, 1, 1, 0), c(0.1, 0.8, 0.7, 0.3))
```

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