CRAN Task View: Survival Analysis

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Survival analysis, also called event history analysis in social science, or reliability analysis in engineering, deals with time until occurrence of an event of interest. However, this failure time may not be observed within the relevant time period, producing so-called censored observations.

This task view aims at presenting the useful R packages for the analysis of time to event data.

Please let the maintainers know if something is inaccurate or missing.

Standard Survival Analysis

Estimation of the Survival Distribution

- ***Kaplan-Meier:*** The `survfit` function from the survival package computes the Kaplan-Meier estimator for truncated and/or censored data. rms (replacement of the Design package) proposes a modified version of the `survfit` function. The prodlim package implements a fast algorithm and some features not included in survival. Various confidence intervals and confidence bands for the Kaplan-Meier estimator are implemented in the km.ci package. `plot.Surv` of package eha plots the Kaplan-Meier estimator. The NADA package includes a function to compute the Kaplan-Meier estimator for left-censored data. `svykm` in survey provides a weighted Kaplan-Meier estimator. `nested.km` in NestedCohort estimates the survival curve for each level of categorical variables with missing data. The `kaplan-meier` function in spatstat computes the Kaplan-Meier estimator from histogram data. The MAMSE package permits to compute a weighted Kaplan-Meier estimate. The `KM` function in package rhosp plots the survival function using a variant of the Kaplan-Meier estimator in a hospitalisation risk context. The survPresmooth package computes presmoothed estimates of the main quantities used for right-censored data, i.e., survival, hazard and density functions. The asbio package permits to compute the Kaplan-Meier estimator following Pollock et al. (1998). The bpcp package provides several functions for computing confidence intervals of the survival distribution (e.g., beta product confidence procedure). The lbiassurv package offers various length-bias corrections to survival curve estimation. Non-Parametric confidance bands for the Kaplan-Meier estimator can be computed using the kmconfband package. The kmc package implements the Kaplan-Meier estimator with constraints.
- ***Non-Parametric maximum likelihood estimation (NPMLE):*** The Icens package provides several ways to compute the NPMLE of the survival distribution for various censoring and truncation schemes. MLEcens can also be used to compute the MLE for interval-censored data. dblcens permits to compute the NPMLE of the cumulative distribution function for left- and right-censored data. The `icfit` function in package interval computes the NPMLE for interval-censored data. The DTDA implements several algorithms permitting to analyse possibly doubly truncated survival data.
- ***Parametric:*** The fitdistrplus package permits to fit an univariate distribution by maximum likelihood. Data can be interval censored. The vitality package provides routines for fitting models in the vitality family of mortality models.

Hazard Estimation

- The muhaz package permits to estimate the hazard function through kernel methods for right-censored data.

- The `epi.insthaz` function from epiR computes the instantaneous hazard from the Kaplan-Meier estimator.
- polspline, gss and logspline allow to estimate the hazard function using splines.
- The ICE package aims at estimating the hazard function for interval censored data.
- The bshazard package provides non-parametric smoothing of the hazard through B-splines.

Testing

- The `survdiff` function in survival compares survival curves using the Fleming-Harrington G-rho family of test. NADA implements this class of tests for left-censored data.
- clinfun implements a permutation version of the logrank test and a version of the logrank that adjusts for covariates.
- The exactRankTests implements the shift-algorithm by Streitberg and Roehmel for computing exact conditional p-values and quantiles, possibly for censored data.
- `SurvTest` in the coin package implements the logrank test reformulated as a linear rank test.
- The maxstat package performs tests using maximally selected rank statistics.
- The interval package implements logrank and Wilcoxon type tests for interval-censored data.
- Three generalised logrank tests and a score test for interval-censored data are implemented in the glrt package.
- survcomp compares 2 hazard ratios.
- The TSHRC implements a two stage procedure for comparing hazard functions.
- The Survgini package proposes to test the equality of two survival distributions based on the Gini index.
- The FHtest package offers several tests based on the Fleming-Harrington class for comparing surival curves with right- and interval-censored data.
- The LogrankA package provides a logrank test for which aggregated data can be used as input.
- The short term and long term hazard ratio model for two samples survival data can be found in the YPmodel package.

Regression Modelling

- ***Cox model:*** The `coxph` function in the survival package fits the Cox model. `cph` in the rms package and the eha package propose some extensions to the `coxph` function. The package coxphf implements the Firth's penalised maximum likelihood bias reduction method for the Cox model. An implementation of weighted estimation in Cox regression can be found in coxphw. The coxrobust package proposes a robust implementation of the Cox model. `timecox` in package timereg fits Cox models with possibly time-varying effects. The mfp package permits to fit Cox models with multiple fractional polynomial. The NestedCohort fits Cox models for covariates with missing data. A Cox model model can be fitted to data from complex survey design using the `svycoxph` function in survey. The multipleNCC package fits Cox models using a weighted partial likelihood for nested case-control studies. The intcox package implements the Cox model for interval-censored data using the ICM-algorithm. The MIICD package implements Pan's (2000) multiple imputation approach to Cox models for interval censored data. The ICsurv package fits Cox models for interval-censored data through an EM algorithm. The dynsurv package fits time-varying coefficient models for interval censored and right censored survival data using a Bayesian Cox model, a spline based Cox model or a transformation model. The CPHshape package computes the Cox proportional hazards model with shape constrained hazard functions. The OrdFacReg package implements the Cox model using an active set algorithm for dummy variables of ordered factors. The survivalMPL package fits Cox models using maximum penalised likelihood and provide a non parametric smooth estimate of the baseline hazard function.
  The `cumres` function in gof computes goodness-of-fit methods for the Cox proportional hazards model. The proportionality assumption can be checked using the `cox.zph` function in survival. The CPE package calculates concordance probability estimate for the Cox model, as does the

`coxphCPE` function in clinfun. The `coxphQuantile` in the latter package draws a quantile curve of the survival distribution as a function of covariates. The multcomp package computes simultaneous tests and confidence intervals for the Cox model and other parametric survival models. The lsmeans package permits to obtain least-squares means (and contrasts thereof) from linear models. In particular, it provides support for the `coxph`, `survreg` and `coxme` functions. The multtest package on Bioconductor proposes a resampling based multiple hypothesis testing that can be applied to the Cox model. Testing coefficients of Cox regression models using a Wald test with a sandwich estimator of variance can be done using the saws package. The rankhazard package permits to plot visualisation of the relative importance of covariates in a proportional hazards model. The smoothHR package provides hazard ratio curves that allows for nonlinear relationship between predictor and survival. The paf package permits to compute the unadjusted/adjusted attributable fraction function from a Cox proportional hazards model. The PHeval package proposes tools to check the proportional hazards assumption using a standardised score process.

- ***Parametric Proportional Hazards Model:*** `survreg` (from survival) fits a parametric proportional hazards model. The eha and mixPHM packages implement a proportional hazards model with a parametric baseline hazard. The `pphsm` in rms translates an AFT model to a proportional hazards form. The polspline package includes the `hare` function that fits a hazard regression model, using splines to model the baseline hazard. Hazards can be, but not necessarily, proportional. The flexsurv package implements the model of Royston and Parmar (2002). The model uses natural cubic splines for the baseline survival function, and proportional hazards, proportional odds or probit functions for regression.
- ***Accelerated Failure Time (AFT) Models:*** The `survreg` function in package survival can fit an accelerated failure time model. A modified version of `survreg` is implemented in the rms package (`psm` function). It permits to use some of the rms functionalities. The eha package also proposes an implementation of the AFT model (function `aftreg`). An AFT model with an error distribution assumed to be a mixture of G-splines is implemented in the smoothSurv package. The NADA package proposes the front end of the `survreg` function for left-censored data. A least-square principled implementation of the AFT model can be found in the lss package. The simexaft package implements the Simulation-Extrapolation algorithm for the AFT model, that can be used when covariates are subject to measurement error. A robust version of the accelerated failure time model can be found in RobustAFT. The coarseDataTools package fits AFT models for interval censored data. The aftgee package implements both rank-based estimates and least square estimates (via generalised estimating equations) to the AFT model.
- ***Additive Models:*** Both survival and timereg fit the additive hazards model of Aalen in functions `aareg` and `aalen`, respectively. timereg also proposes an implementation of the Cox-Aalen model (that can also be used to perform the Lin, Wei and Ying (1994) goodness-of-fit for Cox regression models) and the partly parametric additive risk model of McKeague and Sasieni. A version of the Cox-Aalen model for interval censored data is available in the coxinterval package.
- ***Buckley-James Models:*** The `bj` function in rms and `BJnoint` in emplik compute the Buckley-James model, though the latter does it without an intercept term. The bujar package fits the Buckley-James model with high-dimensional covariates (L2 boosting, regression trees and boosted MARS, elastic net).
- ***Other models:*** Functions like `survreg` can fit other types of models depending on the chosen distribution, *e.g.* , a tobit model. The AER package provides the `tobit` function, which is a wrapper of `survreg` to fit the tobit model. An implementation of the tobit model for cross-sectional data and panel data can be found in the censReg package. The timereg package provides implementation of the proportional odds model and of the proportional excess hazards model. The invGauss package fits the inverse Gaussian distribution to survival data. The model is based on describing time to event as the barrier hitting time of a Wiener process, where drift towards the barrier has been randomized with a Gaussian distribution. The pseudo package computes the pseudo-observation for modelling the survival function based on the Kaplan-Meier estimator and the restricted mean. flexsurv fits parametric time-to-event models, in which

any parametric distribution can be used to model the survival probability, and where one of the parameters is a linear function of covariates. The `Icens` function in package Epi provides a multiplicative relative risk and an additive excess risk model for interval-censored data. The VGAM package can fit vector generalised linear and additive models for censored data. The gamlss.cens package implements the generalised additive model for location, scale and shape that can be fitted to censored data. The `locfit.censor` function in locfit produces local regression estimates. The `crq` function included in the quantreg package implements a conditional quantile regression model for censored data. The JM package fits shared parameter models for the joint modelling of a longitudinal response and event times. The temporal process regression model is implemented in the tpr package. Aster models, which combine aspects of generalized linear models and Cox models, are implemented in the aster and aster2 packages. The concreg package implements conditional logistic regression for survival data as an alternative to the Cox model when hazards are non-proportional. lava.tobit, an extension of the **lava** package, fits latent variable models for censored outcomes via a probit link formulation. The BGPhazard package implements Markov beta and gamma processes for modelling the hazard ratio for discrete failure time data. The surv2sampleComp packages proposes some model-free contrast comparison measures such as difference/ratio of cumulative hazards, quantiles and restricted mean.

Multistate Models

- ***General Multistate Models:*** The `coxph` function from package survival can be fitted for any transition of a multistate model. It can also be used for comparing two transition hazards, using correspondence between multistate models and time-dependent covariates. Besides, all the regression methods presented above can be used for multistate models as long as they allow for left-truncation.
  The mvna package provides convenient functions for estimating and plotting the cumulative transition hazards in any multistate model, possibly subject to right-censoring and left-truncation. The etm package estimates and plots transition probabilities for any multistate models. It can also estimate the variance of the Aalen-Johansen estimator, and handles left-truncated data. The msSurv package provides non-parametric estimation for multistate models subject to right-censoring (possibly state-dependent) and left-truncation. The mstate package permits to estimate hazards and probabilities, possibly depending on covariates, and to obtain prediction probabilities in the context of competing risks and multistate models. The msm package contains functions for fitting general continuous-time Markov and hidden Markov multistate models to longitudinal data. Transition rates and output processes can be modelled in terms of covariates. The SemiMarkov package can be used to fit semi-Markov multistate models in continuous time. The distribution of the waiting times can be chosen between the exponential, the Weibull and exponentiated Weibull distributions. Non-parametric estimates in illness-death models and other three state models can be obtained with package p3state.msm. The TPmsm package permits to estimate transition probabilities of an illness-death model or three-state progressive model. The gamboostMSM package extends the mboost package to estimation in the mulstistate model framework, while the penMSM package proposes L1 penalised estimation. The coxinterval package permits to fit Cox models to the progressive illness-death model observed under right-censored survival times and interval- or right-censored progression times. The SmoothHazard package fits proportional hazards models for the illness-death model with possibly interval-censored data for transition toward the transient state. Left-truncated and right-censored data are also allowed. The model is either parametric (Weibull) or semi-parametric with M-splines approximation of the baseline intensities.
  The Epi package implements Lexis objects as a way to represent, manipulate and summarise data from multistate models. The TraMineR package is intended for analysing state or event sequences that describe life courses. asbio computes the expected numbers of individuals in specified age classes or life stages given survivorship probabilities from a transition matrix.
- ***Competing risks:*** The package cmprsk estimates the cumulative incidence functions, but they

can be compared in more than two samples. The package also implements the Fine and Gray model for regressing the subdistribution hazard of a competing risk. crrSC extends the cmprsk package to stratified and clustered data. The kmi package performs a Kaplan-Meier multiple imputation to recover missing potential censoring information from competing risks events, permitting to use standard right-censored methods to analyse cumulative incidence functions. The crrstep package implements stepwise covariate selection for the Fine and Gray model. Package pseudo computes pseudo observations for modelling competing risks based on the cumulative incidence functions. timereg does flexible regression modelling for competing risks data based on the on the inverse-probability-censoring-weights and direct binomial regression approach. riskRegression implements risk regression for competing risks data, along with other extensions of existing packages useful for survival analysis and competing risks data. The Cprob package estimates the conditional probability of a competing event, aka., the conditional cumulative incidence. It also implements a proportional-odds model using either the temporal process regression or the pseudo-value approaches. Packages survival (via `survfit`) and prodlim can also be used to estimate the cumulative incidence function. The compeir package estimates event-specific incidence rates, rate ratios, event-specific incidence proportions and cumulative incidence functions. The NPMLEcmprsk package implements the semi-parametric mixture model for competing risks data. The wtcrsk package implements a proportional subdistribution hazards model with adjustment for covariate-dependent censoring. The MIICD package implements Pan's (2000) multiple imputation approach to the Fine and Gray model for interval censored data.

- ***Recurrent event data:*** `coxph` from the survival package can be used to analyse recurrent event data. The `cph` function of the rms package fits the Anderson-Gill model for recurrent events, model that can also be fitted with the frailtypack package. The latter also permits to fit joint frailty models for joint modelling of recurrent events and a terminal event. The survrec package proposes implementations of several models for recurrent events data, such as the Peña-Strawderman-Hollander, Wang-Chang estimators, and MLE estimation under a Gamma Frailty model. The condGEE package implements the conditional GEE for recurrent event gap times. The TestSurvRec package implements weighted logrank type tests for recurrent events.

Relative Survival

- The relsurv package proposes several functions to deal with relative survival data. For example, `rs.surv` computes a relative survival curve. `rs.add` fits an additive model and `rsmul` fits the Cox model of Andersen et al. for relative survival, while `rstrans` fits a Cox model in transformed time.
- The timereg package permits to fit relative survival models like the proportional excess and additive excess models.
- The JPSurv package implements methods for population-based survival analysis, like the proportional hazard relative survival model and the join point relative survival model.
- The survexp.fr package computes relative survival, absolute excess risk and standardized mortality ratio based on French death rates.
- The MRsurv package permits to fit multiplicative regression models for relative survival.
- The ROCt package implements time-dependent ROC curves and extensions to relative survival.

Random Effect Models

- ***Frailties:*** Frailty terms can be added in `coxph` and `survreg` functions in package survival. A mixed-effects Cox model is implemented in the coxme package. The `two.stage` function in the timereg package fits the Clayton-Oakes-Glidden model. The parfm package fits fully parametric frailty models via maximisation of the marginal likelihood. The frailtypack package fits proportional hazards models with a shared Gamma frailty to right-censored and/or left-truncated data using a penalised likelihood on the hazard function. The package also fits additive and nested frailty models that can be used for, e.g., meta-analysis and for hierarchically

clustered data (with 2 levels of clustering), respectively. A proportional hazards model with mixed effects can be fitted using the phmm package. The lmec package fits a linear mixed-effects model for left-censored data. The Cox model using h-likelihood estimation for the frailty terms can be fitted using the frailtyHL package. The tlmec package implements a linear mixed effects model for censored data with Student-t or normal distributions.

- ***Joint modelling of time-to-event and longitudinal data:*** The joineR package allows the analysis of repeated measurements and time-to-event data via joint random effects models.

Multivariate Survival

Multivariate survival refers to the analysis of unit, e.g., the survival of twins or a family. To analyse such data, we can estimate the joint distribution of the survival times

- ***Joint modelling:*** Both Icens and MLEcens can estimate bivariate survival data subject to interval censoring.
- The mets package implements various statistical models for multivariate event history data, e.g., multivariate cumulative incidence models, bivariate random effects probit models, Clayton-Oakes model.
- The MST package constructs trees for multivariate survival data using marginal and frailty models.

Bayesian Models

- The bayesSurv package proposes an implementation of a bivariate AFT model.
- The package BMA computes a Bayesian model averaging for Cox proportional hazards models.
- The `DPsurvint` function in DPpackage fits a Bayesian semi-parametric AFT model. `LDDPsurvival` in the same package fits a Linear Dependent Dirichlet Process Mixture of survival models.
- `NMixMCMC` in mixAK performs an MCMC estimation of normal mixtures for censored data.
- A MCMC for Gaussian linear regression with left-, right- or interval-censored data can be fitted using the `MCMCtobit` in MCMCpack.
- The BayHaz package estimates the hazard function from censored data in a Bayesian framework.
- The `weibullregpost` function in LearnBayes computes the log posterior density for a Weibull proportional-odds regression model.
- The MCMCglmm fits generalised linear mixed models using MCMC to right-, left- and interval censored data.
- The BaSTA package aims at drawing inference on age-specific mortality from capture-recapture/recovery data when some or all records have missing information on times of birth and death. Covariates can also be included in the model.
- The JMbayes package performs joint modelling of longitudinal and time-to-event data under a bayesian approach.
- Bayesian parametric and semi-parametric estimation for semi-competing risks data is available via the SemiCompRisks package.
- The psbcGroup package implements penalized semi-parametric Bayesian Cox models with elastic net, fused lasso and group lasso priors.
- The spatsurv package fits a Bayesian parametric proportional hazards model for which events have been geo-located.
- The PReMiuM package implements Bayesian clustering using a Dirichlet process mixture model to censored responses.
- The spBayesSurv package provides Bayesian model fitting for several survival models including spatial copula, linear dependent Dirichlet process mixture model, anova Dirichlet process mixture model, proportional hazards model and marginal spatial proportional hazards model.

- The IDPSurvival package implements non-parametric survival analysis techniques using a prior near-ignorant Dirichlet Process.

High-Dimensional Data

- ***Recursive partitioning:*** rpart implements CART-like trees that can be used with censored outcomes. The party package implements recursive partitioning for survival data. LogicReg can perform logic regression. kaps implements K-adaptive partitioning and recursive partitioning algorithms for censored survival data. The DStree package implements trees and bagged trees for discrete-times survival data.
- ***Random forest:*** Package ipred implements bagging for survival data. The randomForestSRC package fits random forest to survival data, while a variant of the random forest is implemented in party.
- ***Regularised and shrinkage methods:*** The glmpath package implements a L1 regularised Cox proportional hazards model. An L1 and L2 penalised Cox models are available in penalized. The pamr package computes a nearest shrunken centroid for survival gene expression data. A high dimensional Cox model using univariate shrinkage is available in uniCox. The lpc package implements the lassoed principal components method. The ahaz package implements the LASSO and elastic net estimator for the additive risk model. The fastcox package implements the Lasso and elastic-net penalized Cox's regression using the cockail algorithm. The SGL package permits to fit Cox models with a combination of lasso and group lasso regularisation. CoxRidge fits Cox models with penalized ridge-type (ridge, dynamic and weighted dynamic) partial likelihood.
- ***Boosting:*** Gradient boosting for the Cox model is implemented in the gbm package. The mboost package includes a generic gradient boosting algorithm for the construction of prognostic and diagnostic models for right-censored data. globalboosttest implements permutation-based testing procedure to test the additional predictive value of high-dimensional data. It is based on mboost. CoxBoost provides routines for fitting the Cox proportional hazards model and the Fine and Gray model by likelihood based boosting.
- ***Other:*** The superpc package implements the supervised principal components for survival data. The AIM package can construct index models for survival outcomes, that is, construct scores based on a training dataset. The compound.Cox package fits Cox proportional hazards model using the compound covariate method. plsRcox provides partial least squares regression and various techniques for fitting Cox models in high dimensionnal settings. The rsig package implements feature selection algorithms based on subsampling and averaging linear models obtained from the Lasso algorithm for predicting survival risk.

Predictions and Prediction Performance

- The pec package provides utilities to plot prediction error curves for several survival models
- peperr implements prediction error techniques which can be computed in a parallelised way. Useful for high-dimensional data.
- The timeROC package permits to estimate time-dependent ROC curves and time-dependent AUC with censored data, possibly with competing risks.
- survivalROC computes time-dependent ROC curves and time-dependent AUC from censored data using Kaplan-Meier or Akritas's nearest neighbour estimation method (Cumulative sensitivity and dynamic specificity).
- risksetROC implements time-dependent ROC curves, AUC and integrated AUC of Heagerty and Zheng (Biometrics, 2005).
- Various time-dependent true/false positive rates and Cumulative/Dynamic AUC are implemented in the survAUC package.
- The survcomp package provides several functions to assess and compare the performance of survival models.
- C-statistics for risk prediction models with censored survival data can be computed via the

survC1 package.
- The survIDINRI package implements the integrated discrimination improvement index and the category-less net reclassification index for comparing competing risks prediction models.
- The survAccuracyMeasures package provides functions for estimating the AUC, TPR(c), FPR(c), PPV(c), and NPV(c) for survival data.

Power Analysis

- The CR package proposes power calculation for weighted Log-Rank tests in cure rate models.
- The NPHMC permits to calculate sample size based on proportional hazards mixture cure models.
- The powerSurvEpi package provides power and sample size calculation for survival analysis (with a focus towards epidemiological studies).
- Power analysis and sample size calculation for SNP association studies with time-to-event outcomes can be done using the survSNP package.

Simulation

- The genSurv package permits to generate data wih one binary time-dependent covariate and data stemming from a progressive illness-death model.
- The PermAlgo package permits the user to simulate complex survival data, in which event and censoring times could be conditional on an user-specified list of (possibly time-dependent) covariates.
- The prodlim package proposes some functions for simulating complex event history data.
- The gems package also permits to simulate and analyse multistate models. The package allows for a general specification of the transition hazard functions, for non-Markov models and for dependencies on the history.
- The simMSM package provides functions for simulating complex multistate models data with possibly nonlinear baseline hazards and nonlinear covariate effects.
- The simPH package implements tools for simulating and plotting quantities of interest estimated from proportional hazards models.
- The survsim package permits to simulate simple and complex survival data such as recurrent event data and competing risks.
- The MicSim package provides routines for performing continuous-time microsimulation for population projection. The basis for the microsimulation are a multistate model, Markov or non-Markov, for which the transition intensities are specified, as well as an initial cohort.

Graphics

This section tries to list some specialised plot functions that might be useful in the context of event history analysis.

- The survMisc and rms packages both propose functions for plotting survival curves with the at risk table aligned to the x axis. prodlim extends this to the competing risks model.
- The `plot.Hist` function in prodlim permits to draw the states and transitions that characterize a multistate model.
- The Epi package provides many plot functions for representing multistate data, in particular Lexis diagrams.
- The compeir package provide multistate-type graphics for competing risks, in which the thickness of the transition arrows from the initial event to each competing event describes the particular amount of every incidence rate.

Miscellaneous

- dynpred is the companion package to "Dynamic Prediction in Clinical Survival Analysis".
- Package boot proposes the `censboot` function that implements several types of bootstrap techniques for right-censored data.
- The currentSurvival package estimates the current cumulative incidence and the current leukaemia free survival function.
- The survJamda package provides functions for performing meta-analyses of gene expression data and to predict patients' survival and risk assessment.
- ipdmeta provides tools for individual patient data meta-analysis, mixed-level meta-analysis with patient level data and mulivariate survival estimates for aggregate studies.
- The KMsurv package includes the data sets from Klein and Moeschberger (1997). Some supplementary data sets and functions can be found in the OIsurv package. The package SMIR that accompanies Aitkin et al. (2009), SMPracticals that accompanies Davidson (2003) and DAAG that accompanies Maindonald, J.H. and Braun, W.J. (2003, 2007) also contain survival data sets.
- The SvyNom package permits to construct, validate and calibrate nomograms stemming from complex right-censored survey data.
- The logconcens package compute the MLE of a density (log-concave) possibly for interval censored data.
- The TBSSurvival package fits parametric Transform-both-sides models used in reliability analysis
- The OutlierDC package implements algorithms to detect outliers based on quantile regression for censored data.
- The survMisc package proposes miscellaneous functions that extends the survival package, e.g., additional logrank type tests, goodness of fit plots.
- The coarseDataTools package implements an EM algorithm to estimate the relative case fatality ratio between two groups.

CRAN packages:

- AER
- aftgee
- ahaz
- AIM
- asbio
- aster
- aster2
- BaSTA
- bayesSurv
- BayHaz
- BGPhazard
- BMA
- boot
- bpcp
- bshazard
- bujar
- censReg
- clinfun
- cmprsk (core)
- coarseDataTools
- coin
- compeir
- compound.Cox
- concreg
- condGEE

- CoxBoost
- coxinterval
- coxme
- coxphf
- coxphw
- CoxRidge
- coxrobust
- CPE
- CPHshape
- Cprob
- CR
- crrSC
- crrstep
- currentSurvival
- DAAG
- dblcens
- DPpackage
- DStree
- DTDA
- dynpred
- dynsurv
- eha (core)
- emplik
- Epi
- epiR
- etm
- exactRankTests
- fastcox
- FHtest
- fitdistrplus
- flexsurv
- frailtyHL
- frailtypack
- gamboostMSM
- gamlss.cens
- gbm
- gems
- genSurv
- glmpath
- globalboosttest
- glrt
- gof
- gss
- ICE
- ICsurv
- IDPSurvival
- intcox
- interval
- invGauss
- ipdmeta
- ipred
- JM
- JMbayes
- joineR

- JPSurv
- kaps
- km.ci
- kmc
- kmconfband
- kmi
- KMsurv
- lava.tobit
- lbiassurv
- LearnBayes
- lmec
- locfit
- logconcens
- LogicReg
- LogrankA
- logspline
- lpc
- lsmeans
- lss
- MAMSE
- maxstat
- mboost
- MCMCglmm
- MCMCpack
- mets
- mfp
- MicSim
- MIICD
- mixAK
- mixPHM
- MLEcens
- MRsurv
- msm
- msSurv
- MST
- mstate (core)
- muhaz (core)
- multcomp
- multipleNCC
- mvna
- NADA
- NestedCohort
- NPHMC
- NPMLEcmprsk
- OIsurv
- OrdFacReg
- OutlierDC
- p3state.msm
- paf
- pamr
- parfm
- party
- pec
- penalized

- penMSM
- peperr
- PermAlgo
- PHeval
- phmm
- plsRcox
- polspline
- powerSurvEpi
- PReMiuM
- prodlim
- psbcGroup
- pseudo
- quantreg
- randomForestSRC
- rankhazard
- relsurv
- rhosp
- riskRegression
- risksetROC
- rms (core)
- RobustAFT
- ROCt
- rpart
- rsig
- saws
- SemiCompRisks
- SemiMarkov
- SGL
- simexaft
- simMSM
- simPH
- SMIR
- SmoothHazard
- smoothHR
- smoothSurv
- SMPracticals
- spatstat
- spatsurv
- spBayesSurv
- superpc
- surv2sampleComp
- survAccuracyMeasures
- survAUC
- survC1
- survexp.fr
- survey
- Survgini
- survIDINRI
- survival (core)
- survivalMPL
- survivalROC
- survJamda
- survMisc
- survPresmooth

- survrec
- survsim
- survSNP
- SvyNom
- TBSSurvival
- TestSurvRec
- timereg (core)
- timeROC
- tlmec
- TPmsm
- tpr
- TraMineR
- TSHRC
- uniCox
- VGAM
- vitality
- wtcrsk
- YPmodel

Related links:

- CRAN Task View: ClinicalTrials
- CRAN Task View: SocialSciences
- CRAN Task View: Bayesian
- CRAN Task View: MachineLearning
- Bioconductor Package: Icens
- Bioconductor Package: multtest
- Bioconductor Package: survcomp
- Competing Risks and Multistate Models with R
- Dynamic prediction in clinical survival analysis
- Regression modelling strategy
- GAMLSS
- Tutorial in competing risks and multistate models
- Associated functions from the tutorial
- Proportional-Hazards Regression for Survival Data. Appendix to An R and S-PLUS Companion to Applied Regression.
- Journal of Statistical Software. Special Volume: Competing Risks and Multi-State Models