

# Package: palmtree (via r-universe)

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**Title** Partially Additive (Generalized) Linear Model Trees

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**Version** 1.0-0

**Description** This is an implementation of model-based trees with global model parameters (PALM trees). The PALM tree algorithm is an extension to the MOB algorithm (implemented in the 'partykit' package), where some parameters are fixed across all groups. Details about the method can be found in Seibold, Hothorn, Zeileis (2019) <[doi:10.1007/s11634-018-0342-1](https://doi.org/10.1007/s11634-018-0342-1)>. The package offers `coef()`, `logLik()`, `plot()`, and `predict()` functions for PALM trees.

**Depends** R (>= 3.1.0), partykit

**Imports** Formula (>= 1.2-1)

**Suggests** mvtnorm, psychotools

**License** GPL-2 | GPL-3

**Repository** <https://zeileis.r-universe.dev>

**RemoteUrl** <https://github.com/r-forge/partykit>

**RemoteRef** HEAD

**RemoteSha** 575ca9f0bcd61c6c5ff75c8952766d96dad34a6

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**Description**

Model-based recursive partitioning based on (generalized) linear models with some local (i.e., leaf-specific) and some global (i.e., constant throughout the tree) regression coefficients.

**Usage**

```
palmtree(formula, data, weights = NULL, family = NULL,
  lmstart = NULL, abstol = 0.001, maxit = 100,
  dfsplit = TRUE, verbose = FALSE, plot = FALSE, ...)
```

**Arguments**

formula	formula specifying the response variable and a three-part right-hand-side describing the local (i.e., leaf-specific) regressors, the global regressors (i.e., with constant coefficients throughout the tree), and partitioning variables, respectively. For details see below.
data	data.frame to be used for estimating the model tree.
weights	numeric. An optional numeric vector of weights. (Note that this is passed with standard evaluation, i.e., it is not enough to pass the name of a column in data.)
family	either NULL so that <code>lm</code> / <code>lmtree</code> are used or family specification for <code>glm</code> / <code>glmtree</code> . See <a href="#">glm</a> documentation for families.
lmstart	numeric. A vector of length <code>nrow(data)</code> , to be used as an offset in estimation of the first tree. NULL by default, which results in an initialization with the global model.
abstol	numeric. The convergence criterion used for estimation of the model. When the difference in log-likelihoods of the model from two consecutive iterations is smaller than <code>abstol</code> , estimation of the model tree has converged.
maxit	numeric. The maximum number of iterations to be performed in estimation of the model tree.
dfsplit	logical or numeric. <code>as.integer(dfsplit)</code> is the degrees of freedom per selected split employed when extracting the log-likelihood.
verbose	Should the log-likelihood value of the estimated model be printed for every iteration of the estimation?
plot	Should the tree be plotted at every iteration of the estimation? Note that selecting this option slows down execution of the function.
...	Additional arguments to be passed to <code>lmtree()</code> or <code>glmtree()</code> . See <a href="#">mob_control</a> documentation for details.

## Details

Partially additive (generalized) linear model (PALM) trees learn a tree where each terminal node is associated with different regression coefficients while adjusting for additional global regression effects. This allows for detection of subgroup-specific coefficients with respect to selected covariates, while keeping the remaining regression coefficients constant throughout the tree. The estimation algorithm iterates between (1) estimation of the tree given an offset of the global effects, and (2) estimation of the global regression effects given the tree structure. See Seibold, Hothorn, and Zeileis (2019, *Advances in Data Analysis and Classification*) for further details.

To specify all variables in the model a formula such as  $y \sim x_1 + x_2 \mid x_3 \mid z_1 + z_2 + z_3$  is used, where  $y$  is the response,  $x_1$  and  $x_2$  are the regressors in every node of the tree,  $x_3$  has a global regression coefficients, and  $z_1$  to  $z_3$  are the partitioning variables considered for growing the tree.

## Value

The function returns a list with the following objects:

formula	The formula as specified with the formula argument.
call	the matched call.
tree	The final lmtree/glmtree.
palm	The final lm/glm model.
data	The dataset specified with the data argument including added auxiliary variables .lm and .tree from the last iteration.
nobs	Number of observations.
loglik	The log-likelihood value of the last iteration.
df	Degrees of freedom.
dfsplitt	degrees of freedom per selected split as specified with the dfsplitt argument.
iterations	The number of iterations used to estimate the palmtree.
maxit	The maximum number of iterations specified with the maxit argument.
lmstart	Offset in estimation of the first tree as specified in the lmstart argument.
abstol	The prespecified value for the change in log-likelihood to evaluate convergence, as specified with the abstol argument.
intercept	Logical specifying if an intercept was computed.
family	The family object used.
mob.control	A list containing control parameters passed to lmtree(), as specified with ....

## References

- Seibold H, Hothorn T, Zeileis A (2019). Generalised Linear Model Trees with Global Additive Effects. *Advances in Data Analysis and Classification*, **13**(3), 703-725. doi:10.1007/s11634018-03421
- Sies A, Van Mechelen I (2017). Comparing Four Methods for Estimating Tree-Based Treatment Regimes. *The International Journal of Biostatistics*, **13**(1), 20160068. doi:10.1515/ijb20160068

**See Also**

[lm](#), [glm](#), [lmtree](#), [glmmtree](#)

**Examples**

```
## illustration: DGP (1) from Sies and Van Mechelen (2017)
dgp <- function(nobs = 1000, nreg = 5, creg = 0.4, ptreat = 0.5, sd = 1,
  coef = c(1, 0.25, 0.25, 0, 0, -0.25), eff = 1)
{
  d <- mvtnorm::rmvnorm(nobs,
    mean = rep(0, nreg),
    sigma = diag(1 - creg, nreg) + creg)
  colnames(d) <- paste0("x", 1:nreg)
  d <- as.data.frame(d)
  d$a <- rbinom(nobs, size = 1, prob = ptreat)
  d$err <- rnorm(nobs, mean = 0, sd = sd)

  gopt <- function(d) {
    as.numeric(d$x1 > -0.545) * as.numeric(d$x2 < 0.545)
  }
  d$y <- coef[1] + drop(as.matrix(d[, paste0("x", 1:5)]) %*% coef[-1]) -
    eff * (d$a - gopt(d))^2 + d$err
  d$a <- factor(d$a)
  return(d)
}
set.seed(1)
d <- dgp()

## estimate PALM tree with correctly specified global (partially
## additive) regressors and all variables considered for partitioning
palm <- palmtree(y ~ a | x1 + x2 + x5 | x1 + x2 + x3 + x4 + x5, data = d)
print(palm)
plot(palm)

## query coefficients
coef(palm, model = "tree")
coef(palm, model = "palm")
coef(palm, model = "all")
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