

# Package: carsAlgo (via r-universe)

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**Title** Competitive Adaptive Reweighted Sampling (CARS) Algorithm

**Version** 0.5.0

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**Description** Implements Competitive Adaptive Reweighted Sampling (CARS) algorithm for variable selection from high-dimensional dataset using Partial Least Squares (PLS) regression models. CARS algorithm iteratively applies the Monte Carlo sub-sampling and exponential variable elimination techniques to identify/select the most informative variables/features subjected to minimal cross-validated RMSE score. The implementation of CARS algorithm is inspired from the work of Li et al. (2009) <doi:10.1016/j.aca.2009.06.046>. This algorithm is widely applied in near-infrared (NIR), mid-infrared (MIR), hyperspectral chemometrics areas, etc.

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**Depends** R (>= 4.1.0)

**Imports** ggplot2, pls, rlang, stats, utils

**URL** <https://github.com/mah-iasri/carsAlgo>

**BugReports** <https://github.com/mah-iasri/carsAlgo/issues>

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

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CARSAAlgorithm	<i>Create an object of the CARS algorithm</i>
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### Description

The `CARSAAlgorithm()` function creates a configuration object for the Competitive Adaptive Reweighted Sampling (CARS) algorithm. Pass this object to `fit.CARSAAlgorithm` to run variable selection on your high dimensional dataset.

### Usage

```
CARSAAlgorithm(max_iter = 100, N = 50, cv_folds = 5, random_state = 42)
```

### Arguments

<code>max_iter</code>	Maximum number of CARS iterations. Default 100.
<code>N</code>	Number of Monte Carlo sub-sampling runs per iteration. Default 50.
<code>cv_folds</code>	Number of folds for k-fold cross-validation. Default 5.
<code>random_state</code>	Integer seed for reproducibility. Default 42.

### Value

An object of class "CARSAAlgorithm" - a named list of hyperparameters to be passed to `fit.CARSAAlgorithm`.

### See Also

[fit.CARSAAlgorithm](#)

### Examples

```
cars_obj <- CARSAAlgorithm(max_iter = 20, N = 30, cv_folds = 5)
cars_obj
```

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fit	<i>Fit a Model Object to Data</i>
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**Description**

Generic function for fitting model objects to data. Methods are dispatched based on the class of `x`.

**Usage**

```
fit(cars_obj, ...)
```

**Arguments**

<code>cars_obj</code>	A model configuration object (e.g., a <code>CARSAlgorithm</code> object).
<code>...</code>	Additional arguments passed to the specific method.

**Value**

Depends on the method. See [fit.CARSAlgorithm](#).

**See Also**

[fit.CARSAlgorithm](#)

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fit.CARSAlgorithm	<i>Fits a CARS Object to any high dimensional dataset</i>
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**Description**

Applies the CARS algorithm to a high-dimensional data matrix  $X$  and response vector  $y$ , iteratively selecting the optimal variable subset via Monte Carlo enabled PLS regression and adaptive reweighted sampling techniques.

**Usage**

```
## S3 method for class 'CARSAlgorithm'
fit(cars_obj, X, y, max_components = 10L, plot = TRUE, plot_path = NULL, ...)
```

**Arguments**

<code>cars_obj</code>	A <code>CARSAlgorithm</code> object created by <a href="#">CARSAlgorithm</a> .
<code>X</code>	Numeric matrix of predictors ( <code>n_samples</code> x <code>n_features</code> ).
<code>y</code>	Numeric response vector of length <code>n_samples</code> .
<code>max_components</code>	Integer cap on PLS latent components. Default 10.
<code>plot</code>	Logical. Whether to display and save the RMSECV curve. Default TRUE.
<code>plot_path</code>	File path for saving the RMSECV plot. Default <code>"../carsAlgo_rmsecv_curve.jpg"</code> .
<code>...</code>	Currently unused.

## Details

This function iteratively:

1. Sub-samples the calibration set (Monte Carlo, N runs per iteration).
2. Fits a PLS model and extracts regression coefficients.
3. Selects variables by Adaptive Reweighted Sampling (ARS) proportional to absolute coefficient magnitude.
4. Evaluates the subset via k-fold cross-validation (RMSECV).
5. Retains the best subset and repeats with an exponentially shrinking variable set.

## Value

A named list with:

`best_features` Sorted 1-based column indices of selected features.

`best_rmsecv` Lowest RMSECV achieved across all iterations.

`rmsecv_history` Numeric vector of best RMSECV per iteration.

`num_features_history` Integer vector of feature count per iteration.

`plot` A ggplot2 object of the RMSECV curve.

## See Also

[CARSAAlgorithm](#)

## Examples

```
set.seed(1)
X <- matrix(rnorm(100 * 200), nrow = 100)
y <- X[, 5] * 2 + X[, 50] * -1.5 + rnorm(100, sd = 0.5)

cars_obj <- CARSAAlgorithm(max_iter = 15, N = 30, cv_folds = 5)
result <- fit(cars_obj, X, y, max_components = 8)

cat("Best RMSECV      :", result$best_rmsecv, "\n")
cat("Selected features:", result$best_features, "\n")
```

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`print.CARSAgorithm`    *Print method for CARSAgorithm objects*

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**Description**

Print method for CARSAgorithm objects

**Usage**

```
## S3 method for class 'CARSAgorithm'  
print(x, ...)
```

**Arguments**

<code>x</code>	A CARSAgorithm object.
<code>...</code>	Ignored.

**Value**

No return value, called for side effects

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