

Package: arimasel (via r-universe)

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Title Cartesian Product-Based ARIMA Model Identification and Selection

Version 0.1.0

Description Provides an alternative algorithm for ARIMA model identification based on Cartesian products of user-supplied parameter sets. Rather than relying on ACF/PACF plots or stepwise search (as in `auto.arima`), the package exhaustively evaluates every ARIMA(p,d,q) triple in $P \times D \times Q$, ranks all converged models by AIC, AICc, BIC, and HQIC simultaneously, computes Akaike weights for model uncertainty quantification, produces ensemble forecasts, and provides publication-quality diagnostic plots. The algorithm is flexible, transparent, and widely applicable for quick, reproducible ARIMA model selection. Applications are demonstrated with Nigerian macroeconomic time series data.

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Suggests tseries, forecast, testthat ($\geq 3.0.0$), knitr, rmarkdown

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URL <https://github.com/Olawaleawe/arimasel>

BugReports <https://github.com/Olawaleawe/arimasel/issues>

NeedsCompilation no

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arimase1-package	<i>arimase1: Cartesian Product-Based ARIMA Model Identification and Selection</i>
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Description

Provides an alternative algorithm for ARIMA model identification based on Cartesian products of user-supplied parameter sets. The package exhaustively evaluates every ARIMA(p,d,q) triple in P x D x Q, ranks models by four information criteria, computes Akaike weights, and supports ensemble forecasting.

Details

Key functions: [cart_arima](#), [arima_forecast](#), [arima_diagnose](#), [compare_arima](#), [stationarity_test](#), [suggest_d](#), [cp_sets](#), [hqic](#), [arima_weights](#).

Author(s)

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References

Awe, O. O. (2026). *arimasel: Cartesian Product-Based ARIMA Model Identification and Selection*. R package version 0.1.0.

arima_diagnose	<i>Residual Diagnostics for a cartARIMA Object</i>
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Description

Six-panel residual diagnostic plot for the best ARIMA model: residuals over time, ACF, PACF, histogram with Normal density, Q-Q plot, and Ljung-Box p-values by lag.

Usage

```
arima_diagnose(object, lags = NULL, ...)
```

Arguments

- object An object of class "cartARIMA".
- lags Maximum lag for Ljung-Box and ACF/PACF. Default: `min(20, floor(n / 5))`.
- ... Additional graphical parameters.

Value

Invisibly returns a list with `ljung_box` (data.frame) and `shapiro_wilk`.

See Also

[cart_arima](#)

Examples

```
set.seed(3)
x <- arima.sim(list(ar = 0.5), n = 80)
res <- cart_arima(x, p_set = 0:2, d_set = 0:1, q_set = 0:2)
arima_diagnose(res, lags = 15)
```

arima_fanplot

Forecast Fan Chart for cartARIMA Objects

Description

Produces a publication-quality gradient fan chart showing point forecasts and multiple simultaneous prediction intervals shaded with progressively lighter fills.

Usage

```
arima_fanplot(x, h = 12L, levels = c(0.50, 0.80, 0.95),
             history = 36L, ...)
```

Arguments

x	An object of class "cartARIMA".
h	Integer; forecast horizon. Default: 12.
levels	Numeric vector of coverage probabilities for the fan bands. Default: c(0.50, 0.80, 0.95).
history	Integer; number of in-sample observations to display before the forecast origin. Default: 36. Use NULL to show the full series.
...	Additional graphical parameters passed to plot.

Value

Invisibly returns a named list with elements mean (numeric vector of point forecasts), lower, and upper (each a matrix with one column per level in levels).

See Also

[cart_arima](#), [arima_forecast](#), [plot.cartARIMA](#)

Examples

```
set.seed(42)
x <- arima.sim(list(ar = 0.7, ma = 0.3), n = 120)
res <- cart_arima(x, p_set = 0:2, d_set = 0:1, q_set = 0:2)
arima_fanplot(res, h = 12)
```

arima_forecast	<i>Forecast from a Cartesian Product ARIMA Result</i>
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Description

Produces h-step-ahead point forecasts and prediction intervals from the best model or an Akaike-weighted ensemble of the top-k models.

Usage

```
arima_forecast(object, h = 10L, ensemble = FALSE, top_k = NULL,  
               level = c(80, 95), plot = TRUE, ...)
```

Arguments

object	An object of class "cartARIMA".
h	Positive integer forecast horizon. Default 10L.
ensemble	Logical; compute Akaike-weighted ensemble? Default FALSE.
top_k	Number of ensemble members. Default min(5, n_converged).
level	Confidence levels for prediction intervals. Default c(80, 95).
plot	Logical; produce plot? Default TRUE.
...	Additional graphical parameters.

Value

A list (invisibly) with mean, lower, upper, ensemble_mean, level, model, and top_k.

See Also

[cart_arima](#)

Examples

```
set.seed(7)  
x <- arima.sim(list(ar = 0.6), n = 80)  
res <- cart_arima(x, p_set = 0:2, d_set = 0:1, q_set = 0:2)  
arima_forecast(res, h = 8, ensemble = TRUE, top_k = 3)
```

arima_table

Format and Re-rank the ARIMA Model Comparison Table

Description

Extracts and optionally re-ranks the model comparison table from a "cartARIMA" object, with Akaike weights recomputed for the chosen criterion.

Usage

```
arima_table(object, criterion = NULL, top_n = NULL)
```

Arguments

object	An object of class "cartARIMA".
criterion	Ranking criterion. One of "AIC", "AICc", "BIC", "HQIC". NULL (default) retains the original.
top_n	Number of rows to return. NULL returns all models.

Value

A data.frame with columns Model, p, d, q, LogLik, AIC, AICc, BIC, HQIC, Rank, Delta, Weight.

See Also

[cart_arima](#)

Examples

```
set.seed(1)
x <- arima.sim(list(ar = 0.5), n = 80)
res <- cart_arima(x, p_set = 0:2, d_set = 0:1, q_set = 0:2)
arima_table(res, criterion = "BIC", top_n = 5)
```

arima_weights

Akaike Weights and Evidence Ratios

Description

Given a numeric vector of information criterion values (lower = better), computes Akaike weights and evidence ratios relative to the best model.

Usage

```
arima_weights(criteria_values, names_vec = NULL)
```

Arguments

- criteria_values
A numeric vector of IC values, length ≥ 2 .
- names_vec
Optional character vector of model names.

Value

A data.frame with columns Model, IC_value, Delta, Weight, EvidenceRatio, sorted by ascending Delta.

See Also

[cart_arima](#)

Examples

```
ic_vals <- c(ARIMA_110 = 200.1, ARIMA_011 = 198.4, ARIMA_210 = 201.7)
arima_weights(ic_vals)
```

cart_arima	<i>Cartesian Product ARIMA Model Identification and Selection</i>
------------	---

Description

Exhaustively fits every ARIMA(p,d,q) model in the Cartesian product $P \times D \times Q$, ranks all converged models by AIC, AICc, BIC, and HQIC simultaneously, computes Akaike weights, and returns the best model together with a full comparison table.

Usage

```
cart_arima(x, p_set = 0:2, d_set = 0:1, q_set = 0:2,
           criterion = c("AIC", "AICc", "BIC", "HQIC"),
           top_n = 10L, ...)
```

Arguments

- x
A numeric vector or ts object (minimum 10 observations).
- p_set
Integer vector of AR orders $p \geq 0$. Default 0:2.
- d_set
Integer vector of differencing orders $d \geq 0$. Default 0:1.
- q_set
Integer vector of MA orders $q \geq 0$. Default 0:2.
- criterion
Primary ranking criterion: "AIC" (default), "AICc", "BIC", or "HQIC".
- top_n
Maximum rows in the abbreviated table (obj\$table). Default 10L.
- ...
Additional arguments to [arima](#), e.g. method = "ML".

Value

An object of class "cartARIMA" with components:

`best_model` Fitted Arima object for the top-ranked model.

`best_model_str` Character string, e.g. "ARIMA(1,1,1)".

`criterion` Primary ranking criterion used.

`table` Top `top_n` models (data.frame).

`full_table` All converged models (data.frame).

`vote_table` Criterion-vote counts per model.

`failed_models` Character vector of models that failed.

`n_total` Total candidates attempted.

`n_converged` Models that converged.

`p_set, d_set, q_set` Index sets used.

`data` Original series (ts).

`n_obs` Length of the original series.

`call` Matched call.

References

Box, G. E. P., Jenkins, G. M., Reinsel, G. C., and Ljung, G. M. (2015). *Time Series Analysis: Forecasting and Control* (5th ed.). John Wiley & Sons.

Akaike, H. (1974). A new look at the statistical model identification. *IEEE Transactions on Automatic Control*, **19**(6), 716–723.

Awe, O. O. (2026). *arimasel: Cartesian Product-Based ARIMA Model Identification and Selection*. R package version 0.1.0.

See Also

[arima_table](#), [arima_forecast](#), [arima_diagnose](#), [compare_arima](#), [cp_sets](#)

Examples

```
set.seed(42)
x <- arima.sim(list(ar = 0.7, ma = -0.3), n = 100)
result <- cart_arima(x, p_set = 0:2, d_set = 0:1, q_set = 0:2)
print(result)
summary(result)
```

Description

Standard S3 methods for objects of class "cartARIMA" returned by [cart_arima](#).

Usage

```
## S3 method for class 'cartARIMA'
print(x, ...)
## S3 method for class 'cartARIMA'
summary(object, ...)
## S3 method for class 'cartARIMA'
plot(x,
      type = c("criteria", "lollipop", "weights",
               "bubble", "surface", "fitted", "dashboard"),
      criterion = NULL, top_n = 10L, ...)
```

S3 method for class 'cartARIMA'

```
coef(object, ...)
## S3 method for class 'cartARIMA'
residuals(object, ...)
## S3 method for class 'cartARIMA'
fitted(object, ...)
## S3 method for class 'cartARIMA'
AIC(object, ..., k = 2)
## S3 method for class 'cartARIMA'
BIC(object, ...)
## S3 method for class 'cartARIMA'
logLik(object, ...)
```

Arguments

x, object	An object of class "cartARIMA".
type	Character; one of: "criteria" Horizontal bar chart of IC values. "lollipop" Cleveland lollipop chart of IC values (modern bar alternative). "weights" Bar chart of Akaike model weights. "bubble" Bubble chart: rank vs IC value, bubble area = Akaike weight. "surface" Criterion heat map over the p x q grid. "fitted" Observed vs fitted overlay with residual shading. "dashboard" Six-panel comprehensive summary dashboard.
criterion	IC criterion to display: "AIC", "AICc", "BIC", or "HQIC". Defaults to the criterion used in <code>cart_arima()</code> .
top_n	Integer; how many top models to include in plots. Default: 10.

`k` Numeric penalty per parameter for AIC (default: 2).
`...` Further arguments passed to underlying plot functions.

Value

`print` and `plot` return `x` invisibly. `summary` returns object invisibly. `coef`, `residuals`, `fitted`, `AIC`, `BIC`, and `logLik` return the corresponding quantities from the best model.

See Also

[cart_arima](#), [arima_fanplot](#)

Examples

```
set.seed(1)
x <- arima.sim(list(ar = 0.6), n = 100)
res <- cart_arima(x, p_set = 0:2, d_set = 0:1, q_set = 0:2)

print(res)
summary(res)

## individual plot types
plot(res, type = "lollipop")
plot(res, type = "weights")
plot(res, type = "bubble")
plot(res, type = "fitted")
plot(res, type = "dashboard")
```

compare_arima

Compare cart_arima with auto.arima

Description

Fits a Cartesian product model and, if **forecast** is installed, compares it with `auto.arima` on in-sample information criteria and optionally on out-of-sample forecast accuracy.

Usage

```
compare_arima(x, p_set = 0:2, d_set = 0:1, q_set = 0:2,
              criterion = "AIC", holdout = 0L, ...)
```

Arguments

`x` A numeric vector or ts object.
`p_set, d_set, q_set` Index sets passed to [cart_arima](#).
`criterion` Primary criterion for `cart_arima`. Default "AIC".
`holdout` Test set size. 0L disables holdout. Default 0L.
`...` Additional arguments passed to `cart_arima`.

Value

A list with `cart_arima_result`, `comparison_table`, `auto_arima_model`, and `winner`.

See Also

[cart_arima](#)

Examples

```
set.seed(11)
x <- arima.sim(list(ar = 0.6), n = 80)
compare_arima(x, p_set = 0:2, d_set = 0:1, q_set = 0:2)
```

cp_sets

Cartesian Product of ARIMA Parameter Sets

Description

Displays and returns the Cartesian product of user-supplied AR, differencing, and MA index sets, listing all candidate ARIMA(p,d,q) models.

Usage

```
cp_sets(p_set = 0:2, d_set = 0:1, q_set = 0:2)
## S3 method for class 'cartProduct'
print(x, ...)
```

Arguments

p_set	Non-negative integer vector of AR orders. Default 0:2.
d_set	Non-negative integer vector of differencing orders. Default 0:1.
q_set	Non-negative integer vector of MA orders. Default 0:2.
x	A cartProduct object (for the print method).
...	Currently unused.

Value

An object of class "cartProduct" (invisibly) containing `p_set`, `d_set`, `q_set`, `product`, `n_models`, and `model_strings`.

See Also

[cart_arima](#)

Examples

```
cp_sets(0:1, 0:1, 0:1)
cp_sets(p_set = c(0,1,2), d_set = 1, q_set = c(0,1))
```

exchange_ng

Monthly USD/NGN Exchange Rate – Nigeria, 2010-2023

Description

Monthly US dollar to Nigerian Naira exchange rate from January 2010 to December 2023, including structural breaks from major CBN policy shifts.

Usage

```
data(exchange_ng)
```

Format

A ts object of length 168 with frequency = 12.

Examples

```
data(exchange_ng)
plot(exchange_ng, main = "USD/NGN Exchange Rate")
```

gdp_ng

Annual GDP Growth Rate – Nigeria, 1990-2023

Description

Annual time series of Nigeria's GDP growth rate (percent) from 1990 to 2023.

Usage

```
data(gdp_ng)
```

Format

A ts object of length 34 with frequency = 1.

Examples

```
data(gdp_ng)
plot(gdp_ng, main = "Nigeria Annual GDP Growth Rate (%)")
```

hqic	<i>Hannan-Quinn Information Criterion</i>
------	---

Description

Computes the Hannan-Quinn Information Criterion (HQIC) for a fitted ARIMA model: $HQIC = -2\hat{\ell} + 2k \ln(\ln n)$.

Usage

```
hqic(object, k = 2)
```

Arguments

object	A fitted model of class "Arima" (from arima).
k	Penalty multiplier. Default 2.

Value

A single numeric value.

References

Hannan, E. J. and Quinn, B. G. (1979). The determination of the order of an autoregression. *Journal of the Royal Statistical Society, Series B*, **41**(2), 190–195.

Examples

```
x <- cumsum(rnorm(80))
fit <- arima(x, order = c(1, 1, 0))
hqic(fit)
```

inflation_ng	<i>Monthly CPI Inflation Rate – Nigeria, 2000-2023</i>
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Description

Monthly CPI year-on-year inflation rate (percent) for Nigeria from January 2000 to December 2023.

Usage

```
data(inflation_ng)
```

Format

A ts object of length 288 with frequency = 12.

Examples

```
data(inflation_ng)
plot(inflation_ng, main = "Nigeria Monthly CPI Inflation (%)")
```

stationarity_test	<i>Battery of Stationarity Tests</i>
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Description

Runs the Augmented Dickey-Fuller (ADF) test and, if the **tseries** package is installed, the Phillips-Perron (PP) and KPSS tests. Returns a tidy summary with a consensus conclusion.

Usage

```
stationarity_test(x, lags = NULL, alpha = 0.05)
```

Arguments

x	A numeric vector or ts object (minimum 10 observations).
lags	ADF lag order. NULL uses $\lfloor (n - 1)^{1/3} \rfloor$.
alpha	Significance level. Default 0.05.

Value

A data.frame with columns Test, Statistic, p_value, Conclusion, and attributes consensus and suggested_d.

See Also

[suggest_d](#), [cart_arima](#)

Examples

```
set.seed(5)
x <- cumsum(rnorm(80))
stationarity_test(x)
```

suggest_d	<i>Recommend a Differencing Order</i>
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Description

Applies ADF tests iteratively to the original and differenced series to recommend the differencing order d .

Usage

```
suggest_d(x, max_d = 2L, alpha = 0.05, verbose = FALSE)
```

Arguments

<code>x</code>	A numeric vector or ts object.
<code>max_d</code>	Maximum differencing order. Default 2L.
<code>alpha</code>	Significance level. Default 0.05.
<code>verbose</code>	Logical; print test results. Default FALSE.

Value

A single non-negative integer.

See Also

[stationarity_test](#)

Examples

```
set.seed(9)
x <- cumsum(rnorm(80))
suggest_d(x, verbose = TRUE)
```

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