

Package ‘rhythm.metrics’

September 2, 2026

Title Analyse and Visualise Speech Rhythm and Timing Metrics

Version 1.1.0

Description Calculates and visualises speech rhythm and timing metrics. The 'rhythm.metrics' package provides a standardised workflow to compute common metrics including Delta C, Delta V, VarcoC, VarcoV, the percentage of vocalic intervals (%V), and both raw and normalised Pairwise Variability Indices (rPVI, nPVI). It includes functions for calculating and visualising these measures to facilitate cross-linguistic and developmental rhythm research. Delta C, Delta V, and %V measures are based on Ramus et al. (1999) [doi:10.1016/S0010-0277\(99\)00058-X](https://doi.org/10.1016/S0010-0277(99)00058-X); VarcoC and VarcoV measures are based on Dellwo (2006, ISBN: 9783631554777); and rPVI-C and nPVI-V are based on Grabe & Low (2002) [doi:10.1515/9783110197105.2.515](https://doi.org/10.1515/9783110197105.2.515).

License GPL (>= 3)

Depends R (>= 4.5.0)

Imports dplyr, ggplot2, ggsci, magrittr, rlang

Suggests knitr, rmarkdown, testthat (>= 3.0.0)

VignetteBuilder knitr

Encoding UTF-8

Config/roxygen2/version 8.0.0

NeedsCompilation no

Author Cong Zhang [aut, cre] (ORCID: <https://orcid.org/0000-0002-2561-2113>)

Maintainer Cong Zhang <cong.zhang@newcastle.ac.uk>

Repository CRAN

Date/Publication 2026-09-02 11:50:02 UTC

Contents

delta_cv	2
npvi_v	3
percentage_v	4

2

delta_cv

plot_delta_cv

5

plot_npvi

6

plot_percentage_v

7

plot_rpvi

8

plot_varco_cv

10

rpvi_c

11

varco_cv

12

Index

14

delta_cv	<i>Delta C & Delta V</i>
----------	------------------------------

Description

This function loads a dataframe as input and returns a dataframe containing the mean values and mean standard deviations of Delta C and Delta V.

Usage

```
delta_cv(df, cv_label, utterance_id, cv_duration)
```

Arguments

- df

a data frame containing cv_labels, utterance_id, and cv_duration values.
- cv_label

the column name for whether a segment is a C(onsonant) or a V(owel)
- utterance_id

the column name where each unique utterance has a unique id
- cv_duration

the column name for the duration of C or V

Details

Delta C and Delta V are rhythm metrics based on Ramus, F., Nespor, M., & Mehler, J. (1999). Correlates of linguistic rhythm in the speech signal. Cognition, 73(3), 265-292.
Delta C: SD of total C duration
Delta V: SD of total V duration

Value

a data frame containing the results of Delta C and Delta V values

Author(s)

Cong Zhang, <cong.zhang@newcastle.ac.uk>

Examples

```
df_test <- data.frame(cv_label = c("c", "v", "c", "v", "c", "v", "c", "v"),
  utterance_id = c("utt_1", "utt_1", "utt_2", "utt_2",
    "utt_1", "utt_1", "utt_2", "utt_2"),
  cv_duration = c(0.1, 0.8, 0.2, 0.5, 0.3, 0.3, 0.4, 0.7))

delta_cv(df_test, cv_label, utterance_id, cv_duration)
```

npvi_v

*nPVI V***Description**

This function loads a dataframe as input and returns a dataframe containing the mean values of nPVI of vowels.

Usage

```
npvi_v(df, cv_label, label_name, utterance_id, cv_duration)
```

Arguments

df a data frame containing cv_labels, utterance_id, and cv_duration values.

cv_label column name for the segment labels (e.g., cv_label).

label_name a string to filter the vowels, e.g. label_name = 'vowel'.

utterance_id column name for unique utterance IDs.

cv_duration column name for the duration of C or V.

Value

a data frame containing the mean nPVI for vowels.

Author(s)

Cong Zhang, <cong.zhang@newcastle.ac.uk>

Examples

```
df_test <- data.frame(cv_label = rep(c("consonant", "vowel"), 8),
  utterance_id = rep(c("utt_1", "utt_2", "utt_3", "utt_4"), each = 4),
  cv_duration = c(0.1, 0.8, 0.2, 0.5, 0.3, 0.3, 0.4, 0.7,
    0.3, 0.88, 0.5, 0.9, 0.3, 0.57, 0.4, 0.97))

npvi_v(df_test, cv_label = cv_label, label_name = "vowel",
  utterance_id = utterance_id, cv_duration = cv_duration)
```

percentage_v	<i>Percentage V</i>
--------------	---------------------

Description

This function loads a dataframe as input and returns a dataframe containing the mean values and mean standard deviations of %V.

Usage

```
percentage_v(df, v_label, utterance_id, cv_duration, utterance_duration)
```

Arguments

df	a data frame containing cv_labels, utterance_id, cv_duration, and utterance_duration values.
v_label	a string to filter the vowels, e.g. v_label = 'vowel'
utterance_id	column name for unique utterance IDs
cv_duration	column name for the duration of C or V
utterance_duration	column name for the duration of entire utterances

Details

%V is a rhythm metrics based on Ramus, F., Nespor, M., & Mehler, J. (1999). Correlates of linguistic rhythm in the speech signal. *Cognition*, 73(3), 265-292. It calculates the percentage of an utterance occupied by vocalic material.

$\%V: (\text{total V duration} / \text{total utterance duration}) * 100$

Value

a data frame containing the mean values and standard deviation of %V

Author(s)

Cong Zhang, <cong.zhang@newcastle.ac.uk>

Examples

```
df_test <- data.frame(cv_label = c("consonant", "vowel", "consonant", "vowel"),
                     utterance_id = c("utt_1", "utt_1", "utt_2", "utt_2"),
                     cv_duration = c(0.1, 0.8, 0.2, 0.5),
                     utterance_duration = c(2.4, 2.4, 2.7, 2.7))

percentage_v(df_test, v_label="vowel", utterance_id, cv_duration, utterance_duration)
```

plot_delta_cv	<i>Plot Delta C & Delta V</i>
---------------	-----------------------------------

Description

This function loads a dataframe as input and returns a box plot for Delta C and Delta V values.

Usage

```
plot_delta_cv(
  df,
  cv_label,
  utterance_id,
  cv_duration,
  save_fig = FALSE,
  fig_path = NULL
)
```

Arguments

df	a data frame containing cv_labels, utterance_id, and cv_duration values.
cv_label	column name for segment type (C or V).
utterance_id	column name for unique utterance IDs.
cv_duration	column name for the duration of C or V.
save_fig	default is FALSE. Change to TRUE to save the plot.
fig_path	default is NULL. Required if save_fig = TRUE.

Value

A boxplot for Delta C and Delta V values.

Author(s)

Cong Zhang, <cong.zhang@newcastle.ac.uk>

Examples

```
df_test <- data.frame(
  cv_label = rep(c("consonant", "vowel"), 8),
  utterance_id = rep(paste0("utt_", 1:4), each = 4),
  cv_duration = c(
    0.10, 0.80, 0.20, 0.50,
    0.30, 0.30, 0.40, 0.70,
    0.30, 0.88, 0.50, 0.90,
    0.30, 0.57, 0.40, 0.97
  )
)
```

```

plot_delta_cv(
    df_test, cv_label, utterance_id, cv_duration, save_fig = FALSE
)

```

plot_npvi

Plot nPVI V

Description

This function loads a dataframe as input and returns a box plot for nPVI V values.

Usage

```

plot_npvi(
  df,
  cv_label,
  label_name,
  utterance_id,
  cv_duration,
  save_fig = FALSE,
  fig_path = NULL
)

```

Arguments

df	a data frame containing cv_labels, utterance_id, and cv_duration values.
cv_label	column name for the segment labels (e.g., cv_label).
label_name	a string to filter the vowels, e.g. label_name = 'vowel'.
utterance_id	column name for unique utterance IDs.
cv_duration	column name for the duration of C or V.
save_fig	default is FALSE. Change to TRUE to save the plot.
fig_path	default is NULL. Required if save_fig = TRUE.

Value

A boxplot for nPVI V values.

Author(s)

Cong Zhang, <cong.zhang@newcastle.ac.uk>

Examples

```
df_test <- data.frame(
  cv_label = rep(c("consonant", "vowel"), 8),
  utterance_id = rep(paste0("utt_", 1:4), each = 4),
  cv_duration = c(
    0.10, 0.80, 0.20, 0.50,
    0.30, 0.30, 0.40, 0.70,
    0.30, 0.88, 0.50, 0.90,
    0.30, 0.57, 0.40, 0.97
  )
)

plot_npvi(
  df_test,
  cv_label = cv_label,
  label_name = "vowel",
  utterance_id = utterance_id,
  cv_duration = cv_duration
)
```

plot_percentage_v	<i>Plot Percentage V</i>
-------------------	--------------------------

Description

This function loads a dataframe as input and returns a box plot for %V values.

Usage

```
plot_percentage_v(
  df,
  cv_label,
  label_name,
  utterance_id,
  cv_duration,
  utterance_duration,
  save_fig = FALSE,
  fig_path = NULL
)
```

Arguments

df	a data frame containing cv_labels, utterance_id, cv_duration, and utterance_duration values.
cv_label	column name for the segment labels (e.g., cv_label).
label_name	a string to filter the vowels, e.g. label_name = 'vowel'.

utterance_id column name for unique utterance IDs.
cv_duration column name for the duration of C or V.
utterance_duration
 column name for the duration of entire utterances.
save_fig default is FALSE. Change to TRUE to save the plot.
fig_path default is NULL. Required if save_fig = TRUE.

Value

A boxplot for %V values.

Author(s)

Cong Zhang, <cong.zhang@newcastle.ac.uk>

Examples

```
df_test <- data.frame(  
  cv_label = rep(c("consonant", "vowel"), 8),  
  utterance_id = rep(paste0("utt_", 1:4), each = 4),  
  cv_duration = c(  
    0.10, 0.80, 0.20, 0.50,  
    0.30, 0.30, 0.40, 0.70,  
    0.30, 0.88, 0.50, 0.90,  
    0.30, 0.57, 0.40, 0.97  
  ),  
  utterance_duration = rep(c(2.4, 2.7, 3.4, 1.8), each = 4)  
)  
  
plot_percentage_v(  
  df_test,  
  cv_label = cv_label,  
  label_name = "vowel",  
  utterance_id = utterance_id,  
  cv_duration = cv_duration,  
  utterance_duration = utterance_duration  
)
```

plot_rpvi	<i>Plot rPVI C</i>
-----------	--------------------

Description

This function loads a dataframe as input and returns a box plot for rPVI C values.

Usage

```
plot_rpvi(  
  df,  
  cv_label,  
  label_name,  
  utterance_id,  
  cv_duration,  
  save_fig = FALSE,  
  fig_path = NULL  
)
```

Arguments

df	a data frame containing cv_labels, utterance_id, and cv_duration values.
cv_label	column name for the segment labels (e.g., cv_label).
label_name	a string to filter the segments, e.g. label_name = 'consonant'.
utterance_id	column name for unique utterance IDs.
cv_duration	column name for the duration of C or V.
save_fig	default is FALSE. Change to TRUE to save the plot.
fig_path	default is NULL. Required if save_fig = TRUE.

Value

A boxplot for rPVI values.

Author(s)

Cong Zhang, <cong.zhang@newcastle.ac.uk>

Examples

```
df_test <- data.frame(  
  cv_label = rep(c("consonant", "vowel"), 8),  
  utterance_id = rep(paste0("utt_", 1:4), each = 4),  
  cv_duration = c(  
    0.10, 0.80, 0.20, 0.50,  
    0.30, 0.30, 0.40, 0.70,  
    0.30, 0.88, 0.50, 0.90,  
    0.30, 0.57, 0.40, 0.97  
  )  
)  
  
plot_rpvi(  
  df_test,  
  cv_label = cv_label,  
  label_name = "consonant",  
  utterance_id = utterance_id,  
  cv_duration = cv_duration
```

)

plot_varco_cv

Plot Varco C & Varco V

Description

This function loads a dataframe as input and returns a box plot for Varco C and Varco V values.

Usage

```
plot_varco_cv(
  df,
  cv_label,
  utterance_id,
  cv_duration,
  save_fig = FALSE,
  fig_path = NULL
)
```

Arguments

df	a data frame containing cv_labels, utterance_id, and cv_duration values.
cv_label	column name for segment type (C or V).
utterance_id	column name for unique utterance IDs.
cv_duration	column name for the duration of C or V.
save_fig	default is FALSE. Change to TRUE to save the plot.
fig_path	default is NULL. Required if save_fig = TRUE.

Value

A boxplot for Varco C and Varco V values.

Author(s)

Cong Zhang, <cong.zhang@newcastle.ac.uk>

Examples

```
df_test <- data.frame(
  cv_label = rep(c("consonant", "vowel"), 8),
  utterance_id = rep(paste0("utt_", 1:4), each = 4),
  cv_duration = c(
    0.10, 0.80, 0.20, 0.50,
    0.30, 0.30, 0.40, 0.70,
    0.30, 0.88, 0.50, 0.90,
```

```

        0.30, 0.57, 0.40, 0.97
    )
)

plot_varco_cv(
  df_test, cv_label, utterance_id, cv_duration, save_fig = FALSE
)

```

rpvi_c

rPVI C

Description

This function loads a dataframe as input and returns a dataframe containing the mean values of rPVI of consonants.

Usage

```
rpvi_c(df, cv_label, utterance_id, cv_duration, label_name = "consonant")
```

Arguments

df	a data frame containing cv_labels, utterance_id, and cv_duration values.
cv_label	the column name that contains the labels (consonant/vowel).
utterance_id	column name for unique utterance IDs
cv_duration	column name for the duration of C or V
label_name	a string to filter the consonants, e.g. 'consonant'

Details

rPVI C is a rhythm metrics based on Grabe, E., & Low, E. L. (2002). Durational variability in speech and the rhythm class hypothesis. In *Laboratory phonology 7* (pp. 515-546). De Gruyter Mouton. It calculates the sum of the absolute differences between pairs of consecutive consonantal intervals divided by the number of pairs in the speech sample.

Value

a data frame containing the mean rPVI for consonants

Author(s)

Cong Zhang, <cong.zhang@newcastle.ac.uk>

Examples

```
df_test <- data.frame(cv_label = rep(c("consonant", "vowel"), 4),
                     utterance_id = rep(c("utt_1", "utt_2"), each = 4),
                     cv_duration = c(0.1, 0.8, 0.2, 0.5, 0.3, 0.3, 0.4, 0.7))

rpvi_c(
  df_test,
  cv_label = cv_label,
  utterance_id = utterance_id,
  cv_duration = cv_duration,
  label_name = "consonant"
)
```

varco_cv

Varco C & Varco V

Description

This function loads a dataframe as input and returns a dataframe containing the mean values of Varco C and Varco V.

Usage

```
varco_cv(df, cv_label, utterance_id, cv_duration)
```

Arguments

df	a data frame containing cv_labels, utterance_id, and cv_duration values.
cv_label	column name indicating whether a segment is a C(onsonant) or a V(owel).
utterance_id	column name for unique utterance IDs.
cv_duration	column name for the duration of C or V.

Details

Varco C and Varco V are rhythm metrics based on Dellwo, Volker (2006). Rhythm and Speech Rate: A Variation Coefficient for deltaC. In: Karnowski, P; Szigeti, I. Language and language-processing. Frankfurt/Main: Peter Lang, 231-241.

Varco C: $\Delta C / \text{mean}(C \text{ duration}) * 100$ Varco V: $\Delta V / \text{mean}(V \text{ duration}) * 100$

Value

a data frame containing the results of Varco C and Varco V values.

Author(s)

Cong Zhang, <cong.zhang@newcastle.ac.uk>

Examples

```
df_test <- data.frame(cv_label = c("c", "v", "c", "v", "c", "v", "c", "v"),
                      utterance_id = c("utt_1", "utt_1", "utt_2", "utt_2",
                                       "utt_3", "utt_3", "utt_4", "utt_4"),
                      cv_duration = c(0.1, 0.8, 0.2, 0.5, 0.3, 0.3, 0.4, 0.7))

varco_cv(df_test, cv_label, utterance_id, cv_duration)
```

Index

delta_cv, [2](#)

npvi_v, [3](#)

percentage_v, [4](#)

plot_delta_cv, [5](#)

plot_npvi, [6](#)

plot_percentage_v, [7](#)

plot_rpvi, [8](#)

plot_varco_cv, [10](#)

rpvi_c, [11](#)

varco_cv, [12](#)