# Package 'fozziejoin'

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**Title** Utilities for Joining Dataframes with Inexact Matching

**Version** 0.0.16

**Description** Provides functions for joining data frames based on inexact criteria, including string distance, Manhattan distance, Euclidean distance, and interval overlap. This API is designed as a modern, performance-oriented alternative to the 'fuzzyjoin' package (Robinson 2026) <doi:10.32614/CRAN.package.fuzzyjoin>. String distance functions utilizing 'q-grams' are adapted with permission from the 'textdistance' 'Rust' crate (Orsinium 2024) <https://docs.rs/textdistance/latest/textdistance/>. Other string distance calculations rely on the 'rapidfuzz' 'Rust' crate (Bachmann 2023) <https://docs.rs/rapidfuzz/0.5.0/rapidfuzz/>. Interval joins are backed by a Adelson-Velsky and Landis tree as implemented by the 'interavl' 'Rust' crate <https://docs.rs/interavl/0.5.0/interavl/>.

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**BugReports** https://github.com/fozzieverse/fozziejoin/issues

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**Author** Jon Downs [aut, cre],
The authors of the dependency Rust crates [ctb, cph] (see inst/AUTHORS file for details)

**Maintainer** Jon Downs <jon@jondowns.net>

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`fozzie_difference_join_family` *Perform a fuzzy join between two data frames using numeric difference matching.*

---

## Description

`fozzie_difference_join()` and its directional variants (`fozzie_difference_inner_join()`, `fozzie_difference_left_join()`, `fozzie_difference_right_join()`, `fozzie_difference_anti_join()`, `fozzie_difference_full_join()`) enable approximate matching of numeric fields in two data frames based on absolute difference thresholds. These joins are analogous to `fuzzyjoin::difference_join`, but implemented in Rust for performance.

## Usage

```
fozzie_difference_join(
  df1,
  df2,
  by = NULL,
  how = "inner",
  max_distance = 1,
  distance_col = NULL,
  nthread = getOption("fozzie.nthread", NULL)
)
```

```
fozzie_difference_inner_join(
  df1,
  df2,
  by = NULL,
  max_distance = 1,
  distance_col = NULL,
  nthread = getOption("fozzie.nthread", NULL)
)

fozzie_difference_left_join(
  df1,
  df2,
  by = NULL,
  max_distance = 1,
  distance_col = NULL,
  nthread = getOption("fozzie.nthread", NULL)
)

fozzie_difference_right_join(
  df1,
  df2,
  by = NULL,
  max_distance = 1,
  distance_col = NULL,
  nthread = getOption("fozzie.nthread", NULL)
)

fozzie_difference_anti_join(
  df1,
  df2,
  by = NULL,
  max_distance = 1,
  distance_col = NULL,
  nthread = getOption("fozzie.nthread", NULL)
)

fozzie_difference_full_join(
  df1,
  df2,
  by = NULL,
  max_distance = 1,
  distance_col = NULL,
  nthread = getOption("fozzie.nthread", NULL)
)

fozzie_difference_semi_join(
  df1,
```

```
  df2,
  by = NULL,
  max_distance = 1,
  distance_col = NULL,
  nthread = getOption("fozzie.nthread", NULL)
)
```

## Arguments

| | |
|---|---|
| df1 | A data frame to join from (left table). |
| df2 | A data frame to join to (right table). |
| by | A named list or character vector indicating the matching columns. Can be a character vector of length 2, e.g. `c("col1", "col2")`, or a named list like `list(col1 = "col2")`. |
| how | A string specifying the join mode. One of:<br>• `"inner"`: matched pairs only.<br>• `"left"`: all rows from `df1`, unmatched rows filled with NAs.<br>• `"right"`: all rows from `df2`, unmatched rows filled with NAs.<br>• `"full"`: all rows from both `df1` and `df2`.<br>• `"anti"`: rows from `df1` not matched in `df2`.<br>• `"semi"`: rows from `df1` that matched with one or more matches in `df2`. |
| max_distance | A numeric threshold for allowable absolute difference between values (lower is stricter). |
| distance_col | Optional name of column to store computed differences. |
| nthread | Optional integer specifying the number of threads to use for parallelization. If not provided, the value is determined by `options("fozzie.nthread")`. The package default is inherited from Rayon, the multithreading library used throughout the package. |

## Value

A data frame with approximately matched rows depending on the join type. See individual functions like `fozzie_difference_inner_join()` for examples. If `distance_col` is specified, an additional numeric column is included.

## Examples

```
df1 <- data.frame(x = c(1.0, 2.0, 3.0))
df2 <- data.frame(x = c(1.05, 2.1, 2.95))

fozzie_difference_inner_join(df1, df2, by = c("x"), max_distance = 0.1)
fozzie_difference_left_join(df1, df2, by = c("x"), max_distance = 0.2)
fozzie_difference_right_join(df1, df2, by = c("x"), max_distance = 0.05)
```

`fozzie_distance_join_family` *Perform a fuzzy join between two data frames using vector distance matching.*

## Description

`fozzie_distance_join()` and its directional variants (`fozzie_distance_inner_join()`, `fozzie_distance_left_join(`
`fozzie_distance_right_join()`, `fozzie_distance_anti_join()`, `fozzie_distance_full_join()`)
enable approximate matching of numeric fields in two data frames based on vector distance thresholds. These joins are analogous to `fuzzyjoin::distance_join`, but implemented in Rust for performance.

## Usage

```
fozzie_distance_join(
  df1,
  df2,
  by = NULL,
  how = "inner",
  max_distance = 1,
  method = "manhattan",
  distance_col = NULL,
  nthread = getOption("fozzie.nthread", NULL)
)

fozzie_distance_inner_join(
  df1,
  df2,
  by = NULL,
  max_distance = 1,
  method = "manhattan",
  distance_col = NULL,
  nthread = getOption("fozzie.nthread", NULL)
)

fozzie_distance_left_join(
  df1,
  df2,
  by = NULL,
  max_distance = 1,
  method = "manhattan",
  distance_col = NULL,
  nthread = getOption("fozzie.nthread", NULL)
)

fozzie_distance_right_join(
```

```
  df1,
  df2,
  by = NULL,
  max_distance = 1,
  method = "manhattan",
  distance_col = NULL,
  nthread = getOption("fozzie.nthread", NULL)
)

fozzie_distance_full_join(
  df1,
  df2,
  by = NULL,
  max_distance = 1,
  method = "manhattan",
  distance_col = NULL,
  nthread = getOption("fozzie.nthread", NULL)
)

fozzie_distance_anti_join(
  df1,
  df2,
  by = NULL,
  max_distance = 1,
  method = "manhattan",
  distance_col = NULL,
  nthread = getOption("fozzie.nthread", NULL)
)

fozzie_distance_semi_join(
  df1,
  df2,
  by = NULL,
  max_distance = 1,
  method = "manhattan",
  distance_col = NULL,
  nthread = getOption("fozzie.nthread", NULL)
)
```

## Arguments

| | |
|---|---|
| df1 | A data frame to join from (left table). |
| df2 | A data frame to join to (right table). |
| by | A character vector of column names to match on. These columns must be numeric and present in both data frames. |
| how | A string specifying the join mode. One of:<br>• "inner": matched pairs only.<br>• "left": all rows from df1, unmatched rows filled with NAs. |

- "right": all rows from df2, unmatched rows filled with NAs.
- "full": all rows from both df1 and df2.
- "anti": rows from df1 not matched in df2.
- "semi": rows from df1 that matched with one or more matches in df2.

max_distance — A numeric threshold for allowable vector distance between rows.

method — A string specifying the distance metric. One of:

- "manhattan": sum of absolute differences.
- "euclidean": square root of sum of squared differences.

distance_col — Optional name of column to store computed distances.

nthread — Optional integer specifying the number of threads to use for parallelization. If not provided, the value is determined by options("fozzie.nthread"). The package default is inherited from Rayon, the multithreading library used throughout the package.

## Value

A data frame with approximately matched rows depending on the join type. If distance_col is specified, an additional numeric column is included.

## Examples

```
df1 <- data.frame(x = c(1.0, 2.0), y = c(3.0, 4.0))
df2 <- data.frame(x = c(1.1, 2.1), y = c(3.1, 4.1))

fozzie_distance_inner_join(df1, df2, by = c("x", "y"), max_distance = 0.3, method = "euclidean")
```

---

# fozzie_interval_join_family

*Perform a fuzzy join between two data frames using interval overlap matching.*

---

## Description

fozzie_interval_join() and its directional variants (fozzie_interval_inner_join(), fozzie_interval_left_join( etc.) enable approximate matching of interval columns in two data frames based on overlap logic.
These joins are conceptually similar to data.table::foverlaps() and Bioconductor's IRanges::findOverlaps(), supporting both continuous and discrete interval semantics.

## Usage

```
fozzie_interval_join(
  df1,
  df2,
  by = NULL,
  how = "inner",
```

```
  overlap_type = "any",
  maxgap = 0,
  minoverlap = 0,
  interval_mode = c("auto", "real", "integer"),
  nthread = getOption("fozzie.nthread", NULL)
)

fozzie_interval_inner_join(
  df1,
  df2,
  by = NULL,
  overlap_type = "any",
  maxgap = 0,
  minoverlap = 0,
  interval_mode = "auto",
  nthread = getOption("fozzie.nthread", NULL)
)

fozzie_interval_left_join(
  df1,
  df2,
  by = NULL,
  overlap_type = "any",
  maxgap = 0,
  minoverlap = 0,
  interval_mode = "auto",
  nthread = getOption("fozzie.nthread", NULL)
)

fozzie_interval_right_join(
  df1,
  df2,
  by = NULL,
  overlap_type = "any",
  maxgap = 0,
  minoverlap = 0,
  interval_mode = "auto",
  nthread = getOption("fozzie.nthread", NULL)
)

fozzie_interval_full_join(
  df1,
  df2,
  by = NULL,
  overlap_type = "any",
  maxgap = 0,
  minoverlap = 0,
  interval_mode = "auto",
```

```
  nthread = getOption("fozzie.nthread", NULL)
)

fozzie_interval_anti_join(
  df1,
  df2,
  by = NULL,
  overlap_type = "any",
  maxgap = 0,
  minoverlap = 0,
  interval_mode = "auto",
  nthread = getOption("fozzie.nthread", NULL)
)

fozzie_interval_semi_join(
  df1,
  df2,
  by = NULL,
  overlap_type = "any",
  maxgap = 0,
  minoverlap = 0,
  interval_mode = "auto",
  nthread = getOption("fozzie.nthread", NULL)
)
```

## Arguments

| | |
|---|---|
| df1 | A data frame to join from (left table). |
| df2 | A data frame to join to (right table). |
| by | A named list mapping left and right interval columns. Must contain two entries: start and end. |
| how | A string specifying the join mode. One of:<br>• "inner": matched pairs only.<br>• "left": all rows from df1, unmatched rows filled with NAs.<br>• "right": all rows from df2, unmatched rows filled with NAs.<br>• "full": all rows from both df1 and df2.<br>• "anti": rows from df1 not matched in df2.<br>• "semi": rows from df1 that matched with one or more matches in df2. |
| overlap_type | A string specifying the overlap logic. One of:<br>• "any": any overlap.<br>• "within": left interval fully within right.<br>• "start": left start within right.<br>• "end": left end within right. |
| maxgap | Maximum allowed gap between intervals (non-negative). |
| minoverlap | Minimum required overlap length (non-negative). |

`interval_mode` A string specifying how interval boundaries should be interpreted. One of:

- `"auto"`: automatically infer mode based on column types.
- `"real"`: treat interval boundaries as continuous numeric values (e.g., `double`). Overlaps are computed using strict inequality and floating-point arithmetic.
- `"integer"`: treat interval boundaries as discrete integer ranges. This mode behaves similarly to Bioconductor's `IRanges` — intervals are inclusive and defined over integer coordinates, so `[start, end]` includes both endpoints. This affects how overlaps, gaps, and minimum overlap lengths are calculated, especially when `maxgap` or `minoverlap` are used.

`nthread` Optional integer specifying the number of threads to use for parallelization. If not provided, the value is determined by `options("fozzie.nthread")`. The package default is inherited from Rayon, the multithreading library used throughout the package.

## Value

A data frame with approximately matched rows depending on the join type.

## Note

When `interval_mode = "real"`, interval boundaries are treated as continuous values and matched using floating-point arithmetic. Due to precision limitations, a small threshold (typically around `1e-6`) is internally added to the query range to ensure adjacent or near-touching intervals are considered for matching. This is especially relevant for timestamp-based joins, where intervals like `[14:00:00, 14:00:01]` and `[13:00:00, 14:00:00]` may fail to match unless a sufficient `maxgap` or internal epsilon is applied.

## Examples

```
df1 <- data.frame(start = c(1, 5), end = c(3, 7))
df2 <- data.frame(start = c(2, 6), end = c(4, 8))

fozzie_interval_inner_join(df1, df2, by = c(start = "start", end = "end"), overlap_type = "any")
```

---

# fozzie_regex_join_family

*Perform a fuzzy join between two data frames using regex pattern matching.*

---

## Description

`fozzie_regex_join()` and its directional variants (`fozzie_regex_inner_join()`, `fozzie_regex_left_join()`, `fozzie_regex_right_join()`, `fozzie_regex_anti_join()`, `fozzie_regex_full_join()`, `fozzie_regex_semi_join()`) enable approximate matching of string fields in two data frames using regular expressions. These joins are analogous to `fuzzyjoin::regex_join`, but implemented in Rust for performance.

## Usage

```
fozzie_regex_join(
  df1,
  df2,
  by = NULL,
  how = "inner",
  ignore_case = FALSE,
  nthread = getOption("fozzie.nthread", NULL)
)

fozzie_regex_inner_join(
  df1,
  df2,
  by = NULL,
  ignore_case = FALSE,
  nthread = getOption("fozzie.nthread", NULL)
)

fozzie_regex_left_join(
  df1,
  df2,
  by = NULL,
  ignore_case = FALSE,
  nthread = getOption("fozzie.nthread", NULL)
)

fozzie_regex_right_join(
  df1,
  df2,
  by = NULL,
  ignore_case = FALSE,
  nthread = getOption("fozzie.nthread", NULL)
)

fozzie_regex_anti_join(
  df1,
  df2,
  by = NULL,
  ignore_case = FALSE,
  nthread = getOption("fozzie.nthread", NULL)
)

fozzie_regex_full_join(
  df1,
  df2,
  by = NULL,
  ignore_case = FALSE,
  nthread = getOption("fozzie.nthread", NULL)
```

```
)

fozzie_regex_semi_join(
  df1,
  df2,
  by = NULL,
  ignore_case = FALSE,
  nthread = getOption("fozzie.nthread", NULL)
)
```

## Arguments

| | |
|---|---|
| df1 | A data frame to join from (left table). |
| df2 | A data frame to join to (right table). |
| by | A named list or character vector indicating the matching columns. Can be a character vector of length 2, e.g. `c("col1", "col2")`, or a named list like `list(col1 = "col2")`. |
| how | A string specifying the join mode. One of:<br>• `"inner"`: matched pairs only.<br>• `"left"`: all rows from `df1`, unmatched rows filled with NAs.<br>• `"right"`: all rows from `df2`, unmatched rows filled with NAs.<br>• `"full"`: all rows from both `df1` and `df2`.<br>• `"anti"`: rows from `df1` not matched in `df2`.<br>• `"semi"`: rows from `df1` that matched with one or more matches in `df2`. |
| ignore_case | Should be case insensitive. Default is FALSE. |
| nthread | Optional integer specifying the number of threads to use for parallelization. If not provided, the value is determined by `options("fozzie.nthread")`. The package default is inherited from Rayon, the multithreading library used throughout the package. |

## Details

The right-hand column (from `df2`) is treated as a vector of regex patterns, and each value in the left-hand column (from `df1`) is matched against those patterns.

## Value

A data frame with approximately matched rows depending on the join type. See individual functions like `fozzie_regex_inner_join()` for examples.

## Examples

```
df1 <- data.frame(name = c("apple", "banana", "cherry"))
df2 <- data.frame(pattern = c("^a", "an", "rry$"))

fozzie_regex_inner_join(df1, df2, by = c("name" = "pattern"))
fozzie_regex_left_join(df1, df2, by = c("name" =  "pattern"))
```

fozzie_string_join_family *Perform a fuzzy join between two data frames using approximate string matching.*

## Description

fozzie_string_join() and its directional variants (fozzie_string_inner_join(), fozzie_string_left_join(), fozzie_string_right_join(), fozzie_string_anti_join(), fozzie_string_full_join()) enable approximate matching of string fields in two data frames. These joins support multiple string distance and similarity algorithms including Levenshtein, Jaro-Winkler, q-gram similarity, and others.

## Usage

```
fozzie_string_join(
  df1,
  df2,
  by = NULL,
  method = "levenshtein",
  how = "inner",
  max_distance = 1,
  distance_col = NULL,
  q = NULL,
  max_prefix = 0,
  prefix_weight = 0,
  nthread = getOption("fozzie.nthread", NULL)
)

fozzie_string_inner_join(
  df1,
  df2,
  by = NULL,
  method = "levenshtein",
  max_distance = 1,
  distance_col = NULL,
  q = NULL,
  max_prefix = 0,
  prefix_weight = 0,
  nthread = getOption("fozzie.nthread", NULL)
)

fozzie_string_left_join(
  df1,
  df2,
  by = NULL,
  method = "levenshtein",
```

```
  max_distance = 1,
  distance_col = NULL,
  q = NULL,
  max_prefix = 0,
  prefix_weight = 0,
  nthread = getOption("fozzie.nthread", NULL)
)

fozzie_string_right_join(
  df1,
  df2,
  by = NULL,
  method = "levenshtein",
  max_distance = 1,
  distance_col = NULL,
  q = NULL,
  max_prefix = 0,
  prefix_weight = 0,
  nthread = getOption("fozzie.nthread", NULL)
)

fozzie_string_anti_join(
  df1,
  df2,
  by = NULL,
  method = "levenshtein",
  max_distance = 1,
  distance_col = NULL,
  q = NULL,
  max_prefix = 0,
  prefix_weight = 0,
  nthread = getOption("fozzie.nthread", NULL)
)

fozzie_string_full_join(
  df1,
  df2,
  by = NULL,
  method = "levenshtein",
  max_distance = 1,
  distance_col = NULL,
  q = NULL,
  max_prefix = 0,
  prefix_weight = 0,
  nthread = getOption("fozzie.nthread", NULL)
)

fozzie_string_semi_join(
```

```
  df1,
  df2,
  by = NULL,
  method = "levenshtein",
  max_distance = 1,
  distance_col = NULL,
  q = NULL,
  max_prefix = 0,
  prefix_weight = 0,
  nthread = getOption("fozzie.nthread", NULL)
)
```

## Arguments

| | |
|---|---|
| df1 | A data frame to join from (left table). |
| df2 | A data frame to join to (right table). |
| by | A named list or character vector indicating the matching columns. Can be a character vector of length 2, e.g. `c("col1", "col2")`, or a named list like `list(col1 = "col2")`. |
| method | A string indicating the fuzzy matching method. Supported methods:<br>• `"levenshtein"`: Levenshtein edit distance (default).<br>• `"osa"`: Optimal string alignment.<br>• `"damerau_levenshtein"` or `"dl"`: Damerau-Levenshtein distance.<br>• `"hamming"`: Hamming distance (equal-length strings only).<br>• `"lcs"`: Longest common subsequence.<br>• `"qgram"`: Q-gram similarity (requires `q`).<br>• `"cosine"`: Cosine similarity (requires `q`).<br>• `"jaccard"`: Jaccard similarity (requires `q`).<br>• `"jaro"`: Jaro similarity.<br>• `"jaro_winkler"` or `"jw"`: Jaro-Winkler similarity.<br>• `"soundex"`: Soundex codes based on the National Archives standard. |
| how | A string specifying the join mode. One of:<br>• `"inner"`: matched pairs only.<br>• `"left"`: all rows from `df1`, unmatched rows filled with NAs.<br>• `"right"`: all rows from `df2`, unmatched rows filled with NAs.<br>• `"full"`: all rows from both `df1` and `df2`.<br>• `"anti"`: rows from `df1` not matched in `df2`.<br>• `"semi"`: rows from `df1` that matched with one or more matches in `df2`. |
| max_distance | A numeric threshold for allowable string distance or dissimilarity (lower is stricter). |
| distance_col | Optional name of column to store computed string distances. |
| q | Integer. Size of q-grams for `"qgram"`, `"cosine"`, or `"jaccard"` methods. |
| max_prefix | Integer (for Jaro-Winkler) specifying the prefix length influencing similarity boost. |

| | |
|---|---|
| prefix_weight | Numeric (for Jaro-Winkler) specifying the prefix weighting factor. |
| nthread | Optional integer specifying the number of threads to use for parallelization. If not provided, the value is determined by `options("fozzie.nthread")`. The package default is inherited from Rayon, the multithreading library used throughout the package. |

## Value

A data frame with fuzzy-matched rows depending on the join type. See individual functions like `fozzie_string_inner_join()` for examples. If `distance_col` is specified, an additional numeric column is included.

## Examples

```
df1 <- data.frame(name = c("Alice", "Bob", "Charlie"))
df2 <- data.frame(name = c("Alicia", "Robert", "Charles"))

fozzie_string_inner_join(
  df1, df2, by = c("name"), method = "levenshtein", max_distance = 2
)
fozzie_string_left_join(
  df1, df2, by = c("name"), method = "jw", max_distance = 0.2
)
fozzie_string_right_join(
  df1, df2, by = c("name"), method = "cosine", q = 2, max_distance = 0.1
 )
```

---

# fozzie_temporal_interval_join_family

*Perform a fuzzy join between two data frames using time-based interval overlap matching.*

---

## Description

`fozzie_temporal_interval_join()` and its directional variants (`fozzie_temporal_interval_inner_join()`, `fozzie_temporal_interval_left_join()`, etc.) enable approximate matching of time-based intervals in two data frames using continuous overlap logic.

## Usage

```
fozzie_temporal_interval_join(
  df1,
  df2,
  by = NULL,
  how = "inner",
  overlap_type = "any",
  maxgap = 0,
```

```
  minoverlap = 0,
  unit = c("days", "hours", "minutes", "seconds", "ms", "us", "ns"),
  nthread = getOption("fozzie.nthread", NULL)
)

fozzie_temporal_interval_inner_join(
  df1,
  df2,
  by = NULL,
  overlap_type = "any",
  maxgap = 0,
  minoverlap = 0,
  unit = c("days", "hours", "minutes", "seconds", "ms", "us", "ns"),
  nthread = getOption("fozzie.nthread", NULL)
)

fozzie_temporal_interval_left_join(
  df1,
  df2,
  by = NULL,
  overlap_type = "any",
  maxgap = 0,
  minoverlap = 0,
  unit = c("days", "hours", "minutes", "seconds", "ms", "us", "ns"),
  nthread = getOption("fozzie.nthread", NULL)
)

fozzie_temporal_interval_right_join(
  df1,
  df2,
  by = NULL,
  overlap_type = "any",
  maxgap = 0,
  minoverlap = 0,
  unit = c("days", "hours", "minutes", "seconds", "ms", "us", "ns"),
  nthread = getOption("fozzie.nthread", NULL)
)

fozzie_temporal_interval_full_join(
  df1,
  df2,
  by = NULL,
  overlap_type = "any",
  maxgap = 0,
  minoverlap = 0,
  unit = c("days", "hours", "minutes", "seconds", "ms", "us", "ns"),
  nthread = getOption("fozzie.nthread", NULL)
)
```

```
fozzie_temporal_interval_anti_join(
  df1,
  df2,
  by = NULL,
  overlap_type = "any",
  maxgap = 0,
  minoverlap = 0,
  unit = c("days", "hours", "minutes", "seconds", "ms", "us", "ns"),
  nthread = getOption("fozzie.nthread", NULL)
)

fozzie_temporal_interval_semi_join(
  df1,
  df2,
  by = NULL,
  overlap_type = "any",
  maxgap = 0,
  minoverlap = 0,
  unit = c("days", "hours", "minutes", "seconds", "ms", "us", "ns"),
  nthread = getOption("fozzie.nthread", NULL)
)
```

## Arguments

| | |
|---|---|
| df1 | A data frame to join from (left table). |
| df2 | A data frame to join to (right table). |
| by | A named list mapping left and right interval columns. Must contain two entries: start and end. |
| how | A string specifying the join mode. One of:<br>• "inner": matched pairs only.<br>• "left": all rows from df1, unmatched rows filled with NAs.<br>• "right": all rows from df2, unmatched rows filled with NAs.<br>• "full": all rows from both df1 and df2.<br>• "anti": rows from df1 not matched in df2.<br>• "semi": rows from df1 that matched with one or more matches in df2. |
| overlap_type | A string specifying the overlap logic. One of:<br>• "any": any overlap.<br>• "within": left interval fully within right.<br>• "start": left start within right.<br>• "end": left end within right. |
| maxgap | Maximum allowed gap between intervals, expressed in the specified time unit. |
| minoverlap | Minimum required overlap length, expressed in the specified time unit. |
| unit | A string specifying the time unit for maxgap and minoverlap. One of: "days", "hours", "minutes", "seconds", "ms", "us", "ns". |

nthread — Optional integer specifying the number of threads to use for parallelization. If not provided, the value is determined by `options("fozzie.nthread")`. The package default is inherited from Rayon, the multithreading library used throughout the package.

## Details

All interval columns must be of the same type — either `Date` or `POSIXct` — across both data frames. Mixed types are not supported. Overlaps are computed using real-valued time semantics, allowing for fractional gaps and overlaps. This is useful for calendar intervals (`Date`) as well as precise timestamp ranges (`POSIXct`).

## Value

A data frame with approximately matched rows depending on the join type.

## Examples

```
df1 <- data.frame(
  start = as.Date(c("2023-01-01", "2023-01-05")),
  end = as.Date(c("2023-01-03", "2023-01-07"))
)
df2 <- data.frame(
  start = as.Date(c("2023-01-02", "2023-01-06")),
  end = as.Date(c("2023-01-04", "2023-01-08"))
)

fozzie_temporal_interval_inner_join(
  df1, df2,
  by = list(start = "start", end = "end"),
  overlap_type = "any",
  maxgap = 0.5,
  unit = "days"
)
```

---

# fozzie_temporal_join_family

*Perform a fuzzy join between two data frames using temporal difference matching.*

---

## Description

`fozzie_temporal_join()` and its directional variants (`fozzie_temporal_inner_join()`, `fozzie_temporal_left_join(` etc.) enable approximate matching of temporal columns in two data frames based on absolute time difference thresholds. These joins are conceptually similar to `fozzie_difference_join()`, but specialized for temporal data types (`Date` and `POSIXct`).

## Usage

```
fozzie_temporal_join(
  df1,
  df2,
  by = NULL,
  how = "inner",
  max_distance = 1,
  unit = c("days", "hours", "minutes", "seconds", "ms", "us", "ns"),
  distance_col = NULL,
  nthread = getOption("fozzie.nthread", NULL)
)

fozzie_temporal_inner_join(
  df1,
  df2,
  by = NULL,
  max_distance = 1,
  unit = c("days", "hours", "minutes", "seconds", "ms", "us", "ns"),
  distance_col = NULL,
  nthread = getOption("fozzie.nthread", NULL)
)

fozzie_temporal_left_join(
  df1,
  df2,
  by = NULL,
  max_distance = 1,
  unit = c("days", "hours", "minutes", "seconds", "ms", "us", "ns"),
  distance_col = NULL,
  nthread = getOption("fozzie.nthread", NULL)
)

fozzie_temporal_right_join(
  df1,
  df2,
  by = NULL,
  max_distance = 1,
  unit = c("days", "hours", "minutes", "seconds", "ms", "us", "ns"),
  distance_col = NULL,
  nthread = getOption("fozzie.nthread", NULL)
)

fozzie_temporal_full_join(
  df1,
  df2,
  by = NULL,
  max_distance = 1,
  unit = c("days", "hours", "minutes", "seconds", "ms", "us", "ns"),
```

```
  distance_col = NULL,
  nthread = getOption("fozzie.nthread", NULL)
)

fozzie_temporal_anti_join(
  df1,
  df2,
  by = NULL,
  max_distance = 1,
  unit = c("days", "hours", "minutes", "seconds", "ms", "us", "ns"),
  distance_col = NULL,
  nthread = getOption("fozzie.nthread", NULL)
)

fozzie_temporal_semi_join(
  df1,
  df2,
  by = NULL,
  max_distance = 1,
  unit = c("days", "hours", "minutes", "seconds", "ms", "us", "ns"),
  distance_col = NULL,
  nthread = getOption("fozzie.nthread", NULL)
)
```

## Arguments

| | |
|---|---|
| df1 | A data frame to join from (left table). |
| df2 | A data frame to join to (right table). |
| by | A named list indicating the matching temporal columns, e.g. `list(time1 = "time2")`. |
| how | A string specifying the join mode. One of:<br>• `"inner"`: matched pairs only.<br>• `"left"`: all rows from `df1`, unmatched rows filled with NAs.<br>• `"right"`: all rows from `df2`, unmatched rows filled with NAs.<br>• `"full"`: all rows from both `df1` and `df2`.<br>• `"anti"`: rows from `df1` not matched in `df2`.<br>• `"semi"`: rows from `df1` that matched with one or more matches in `df2`. |
| max_distance | Maximum allowed time difference between values. |
| unit | A string specifying the time unit for `max_distance`. One of: `"days"`, `"hours"`, `"minutes"`, `"seconds"`, `"ms"`, `"us"`, `"ns"`. If joining on `Date` columns, only `"days"` is allowed. |
| distance_col | Optional name of column to store computed time differences (in seconds or days). |
| nthread | Optional integer specifying the number of threads to use for parallelization. If not provided, the value is determined by `options("fozzie.nthread")`. The package default is inherited from Rayon, the multithreading library used throughout the package. |

## Details

All join columns must be either `Date` or `POSIXct`, and must be consistent across both data frames. Mixed types (e.g., `Date` in one and `POSIXct` in the other) are not allowed.

## Value

A data frame with approximately matched rows depending on the join type. If `distance_col` is specified, an additional numeric column is included.

## Examples

```
df1 <- data.frame(time = as.POSIXct(c("2023-01-01 12:00:00", "2023-01-01 13:00:00")))
df2 <- data.frame(time = as.POSIXct(c("2023-01-01 12:00:05", "2023-01-01 14:00:00")))

fozzie_temporal_inner_join(df1, df2, by = list(time = "time"), max_distance = 10, unit = "seconds")

df1 <- data.frame(date = as.Date(c("2023-01-01", "2023-01-03")))
df2 <- data.frame(date = as.Date(c("2023-01-02", "2023-01-04")))

fozzie_temporal_inner_join(df1, df2, by = list(date = "date"), max_distance = 1, unit = "days")
```

---

# `get_nthread_default` *Get Number of Threads in the Global Thread Pool*

---

## Description

This function retrieves the current number of threads allocated by the Rayon thread pool. Understanding this value can be useful for optimizing the parallelization capacity of your computations.

## Usage

```
get_nthread_default()
```

## Value

A single numeric value indicating the number of threads in the global thread pool.

## normalize_by *Normalize Join Columns*

### Description

Join columns expect a named list, where names are left-hand columns to join on, and values are right-hand columns to join on. This function ensures a fuzzy-like syntax to the user while producing the correct output for the Rust join utilities.

### Usage

```
normalize_by(df1, df2, by)
```

### Arguments

| | |
|---|---|
| df1 | A data frame representing the left-hand side of the join. |
| df2 | A data frame representing the right-hand side of the join. |
| by | A named list or character vector specifying join columns. If NULL, shared column names between df1 and df2 are used. |

### Value

A named list mapping left-hand columns to right-hand columns.

## test_df *Baby Names Dataset*

### Description

A small example dataset containing fictional baby names and various column types for testing joins, type handling, and metadata preservation.

### Usage

```
test_df
```

### Format

A data frame with 10 rows and 8 columns:

**Name** Character. Baby name.

**int_col** Integer. Some missing values.

**real_col** Numeric. Some missing values.

**logical_col** Logical. TRUE/FALSE with NA.

**date_col** Date. Sequential from 2020-01-01.

**posixct_col** POSIXct. Hourly timestamps.

**posixlt_col** POSIXlt. Same as above, different class.

**factor_col** Factor. Five levels: A–E.

## Source

Created manually for testing purposes.

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