

# Example session for Weight-based deduplication

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This document shows an example session using the package *RecordLinkage*. A single data set is deduplicated using an EM algorithm for weight calculation. Conducting linkage of two data sets differs only in the step of generating record pairs.

## 1 Generating record pairs

The data to be deduplicated is expected to reside in a data frame or matrix, each row containing one record. Example data sets of 500 and 10000 records are included in the package as `RLData500` and `RLData10000`.

```
> data(RLdata500)
> RLdata500[1:5,]
```

|   | fname_c1 | fname_c2 | lname_c1 | lname_c2 | by   | bm | bd |
|---|----------|----------|----------|----------|------|----|----|
| 1 | CARSTEN  | <NA>     | MEIER    | <NA>     | 1949 | 7  | 22 |
| 2 | GERD     | <NA>     | BAUER    | <NA>     | 1968 | 7  | 27 |
| 3 | ROBERT   | <NA>     | HARTMANN | <NA>     | 1930 | 4  | 30 |
| 4 | STEFAN   | <NA>     | WOLFF    | <NA>     | 1957 | 9  | 2  |
| 5 | RALF     | <NA>     | KRUEGER  | <NA>     | 1966 | 1  | 13 |

For deduplication, `compare.dedup` is to be used. In this example, `blocking` is set to return only record pairs which agree in at least two components of the subdivided date of birth, resulting in 810 pairs. The argument `identity` preserves the true matching status for later evaluation.

```
> pairs=compare.dedup(RLdata500,identity=identity.RLdata500,blockfld=list(c(5,6),c(6,7),c(
> summary(pairs)
```

Deduplication Data Set

500 records

571 record pairs

49 matches

522 non-matches

0 pairs with unknown status

## 2 Weight calculation

Weights are calculated by means of an EM algorithm. This step is computationally intensive and might take a while. The histogram shows the resulting weight distribution.

```
> pairs=emWeights(pairs)

> hist(pairs$Wdata, plot=FALSE)

$breaks
 [1] -15 -10 -5  0  5 10 15 20 25 30 35
[12] 40 45

$counts
 [1] 352 13  0  0  5 26 42 123  9  0  0
[12]  1

$density
 [1] 0.1232924694 0.0045534151 0.0000000000
 [4] 0.0000000000 0.0017513135 0.0091068301
 [7] 0.0147110333 0.0430823117 0.0031523643
[10] 0.0000000000 0.0000000000 0.0003502627

$mids
 [1] -12.5 -7.5 -2.5  2.5  7.5 12.5 17.5
 [8] 22.5 27.5 32.5 37.5 42.5

$xname
 [1] "pairs$Wdata"

$equidist
 [1] TRUE

attr("class")
 [1] "histogram"
```

## 3 Classification

For determining thresholds, record pairs within a given range of weights can be printed using `getPairs`<sup>1</sup>. In this case, 24 is set as upper and -7 as lower threshold, dividing links, possible links and non-links. The summary shows the resulting contingency table and error measures.

```
> getPairs(pairs, 30, 20)
```

---

<sup>1</sup>The output of `getPairs` is shortened in this document.

```

      id fname_c1 fname_c2 lname_c1 lname_c2  by
23 457  URSULA  BIRGIT  MUELLER  <NA> 1940
24
25 467  ULRIKE  NICOLE  BECKRR  <NA> 1982
26 472  ULRIKE  NICOLE  BECKER  <NA> 1982
27
28 183  ULRICH  <NA>  MUELLER  <NA> 1962
29 444  SILKE  <NA>  MUELLER  <NA> 1962
30
31 25  MATTHIAS  <NA>  HAAS  <NA> 1955
32 107 MATTHIAS  <NA>  HAAS  <NA> 1955
33
34 106  ANDRE  <NA>  MUELLER  <NA> 1976
35 175  ANDRE  <NA>  MUELLER  <NA> 1976
36

```

```

      bm bd  Weight
23 6 15 25.14137
24
25 8 4
26 8 4 25.14137
27
28 6 19
29 6 14 24.20333
30
31 7 8
32 8 8 24.11923
33
34 2 25
35 1 25 24.11923
36

```

```

> pairs=emClassify(pairs, threshold.upper=24, threshold.lower=-7)
> summary(pairs)

```

Deduplication Data Set

500 records

571 record pairs

49 matches

522 non-matches

0 pairs with unknown status

Weight distribution:

|           |          |         |         |         |
|-----------|----------|---------|---------|---------|
| [-15,-10] | (-10,-5] | (-5,0]  | (0,5]   | (5,10]  |
| 352       | 13       | 0       | 0       | 5       |
| (10,15]   | (15,20]  | (20,25] | (25,30] | (30,35] |
| 26        | 42       | 123     | 9       | 0       |

```
(35,40] (40,45]
      0      1
```

```
15 links detected
198 possible links detected
358 non-links detected
```

```
alpha error: 0.000000
beta error: 0.002786
accuracy: 0.997319
```

Classification table:

```
      classification
true status  N  P  L
      FALSE 358 163  1
      TRUE   0  35 14
```

Review of the record pairs denoted as possible links is facilitated by `getPairs`, which can be forced to show only possible links via argument `show`. A list with the ids of linked pairs can be extracted from the output of `getPairs` with argument `single.rows` set to `TRUE`.

```
> possibles <- getPairs(pairs, show="possible")
> possibles[1:6,]

  id  fname_c1  fname_c2  lname_c1  lname_c2  by
1  17 ALEXANDER  <NA>  MUELLER  <NA> 1974
2 193 CHRISTIAN  <NA>  MUELLER  <NA> 1974
3
4  61      ANDRE  <NA>  FISCHER  <NA> 1943
5 254 STEFANIE  <NA>  FISCHER  <NA> 1943
6
  bm bd  Weight
1  9  9
2  8  9 21.691086
3
4  6 25
5 11 25 21.691086
6

> links=getPairs(pairs,show="links", single.rows=TRUE)
> link_ids <- links[, c("id1", "id2")]
> link_ids

  id1 id2
290 290 466
50  50 234
87  87 117
145 145 240
```

286 286 383  
289 289 399  
297 297 388  
357 357 414  
313 313 457  
467 467 472  
183 183 444  
25 25 107  
106 106 175  
370 370 478  
127 127 142

>