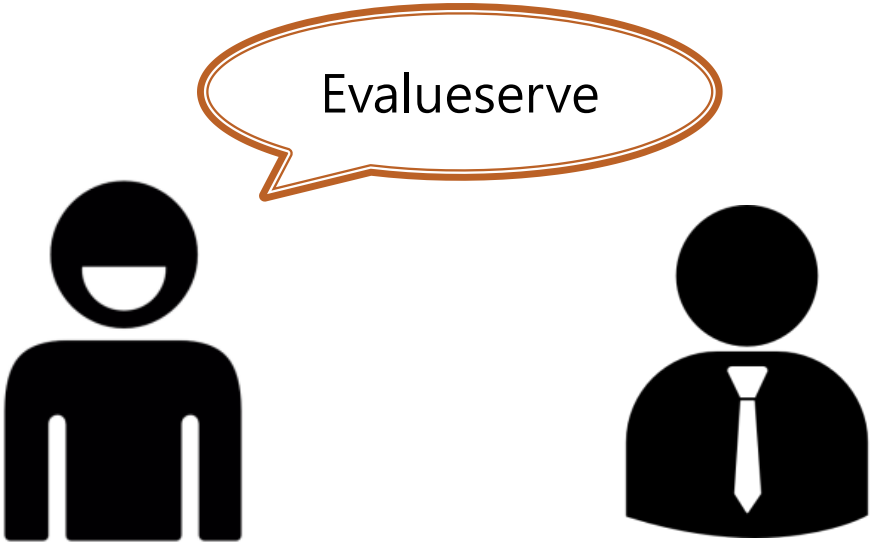
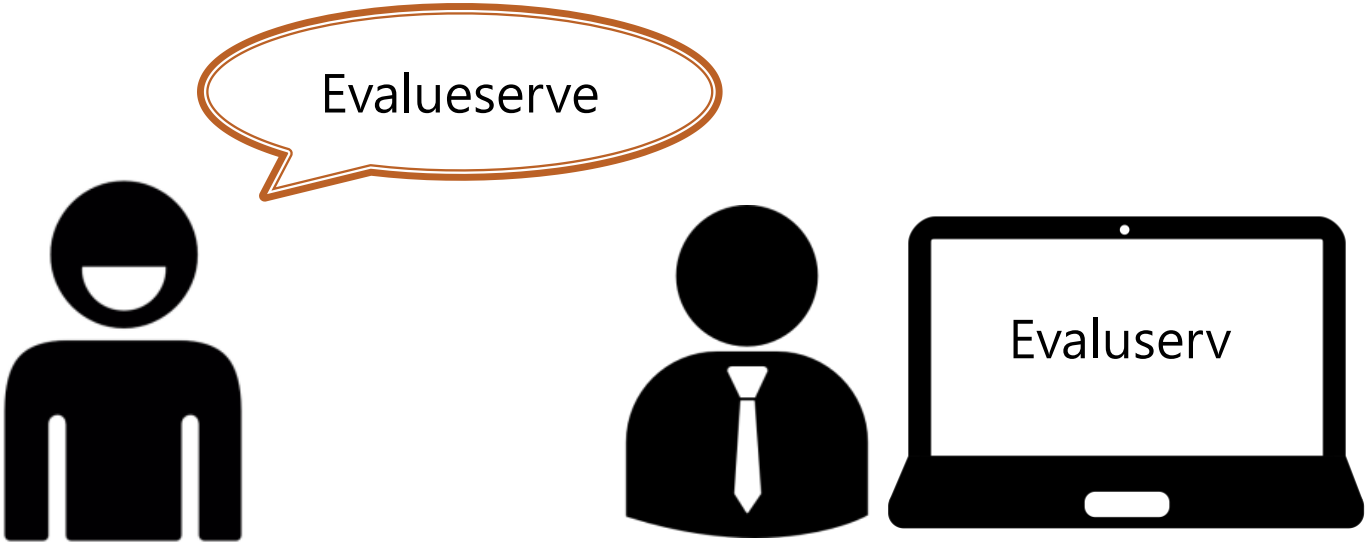
Fuzzy Merging
with Company Names

Richard Vogg

Sep 26th, 2019


Evalueserve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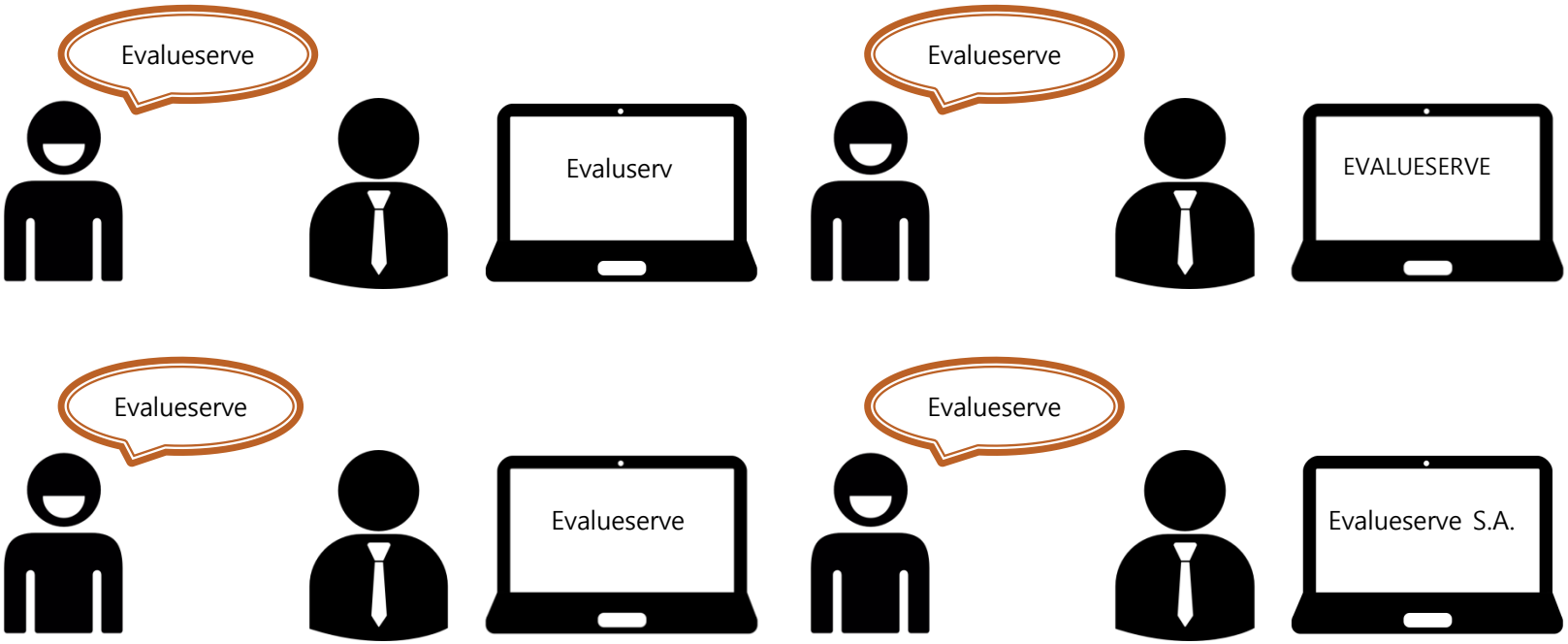
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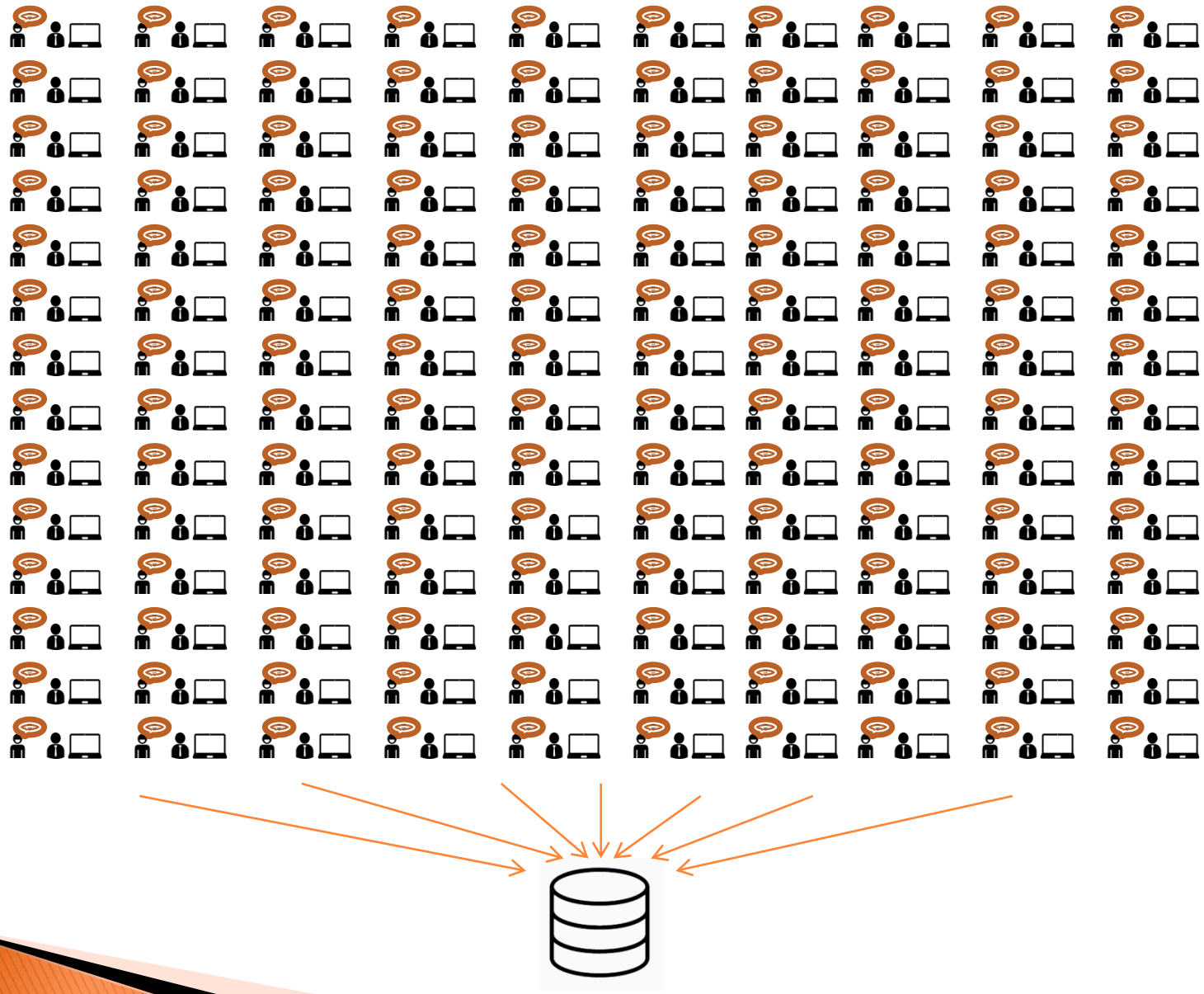

The input

The input

dirty_list
Haliburton
ExxonMobile
ABBOTT LABORATORIES
Marrriott
Self
Activision Blizzard
Quest dianotstics
Unemployed
MARRIOT

500,000 names

The input

dirty_list
Haliburton
ExxonMobile
ABBOTT LABORATORIES
Marrriott
Self
Activision Blizzard
Quest dianotstics
Unemployed
MARRIOT

500,000 names

clean_list
3M Company
Abbott Laboratories
AbbVie Inc.
ABIOMED Inc
Accenture plc
Activision Blizzard
Adobe Systems Inc
Advanced Micro Devices Inc
Advance Auto Parts
AES Corp

S&P500 list

The stringdist package

- Approximate matching and string distance calculations for R.
- Many distance functions: Hamming, Levenshtein, Longest common substring, qgram, **Jaro-Winkler**
- Computes in parallel when possible

van der Loo M (2014). "The stringdist package for approximate string matching." *The R Journal*, **6**, 111-122. https://CRAN.R-project.org/package=stringdist.

Jaro similarity

1	2	3	4	5	6	7	8	9
B	R	E	A	K	F	A	S	T

B	A	S	E	B	A	L	L
1	2	3	4	5	6	7	8

$$sim_j(s_1, s_2) = \begin{cases} 0, & if\ m = 0 \\ \frac{1}{3}\left(\frac{m}{|s_1|} + \frac{m}{|s_2|} + \frac{m-t}{m}\right), & else. \end{cases}$$

Jaro similarity

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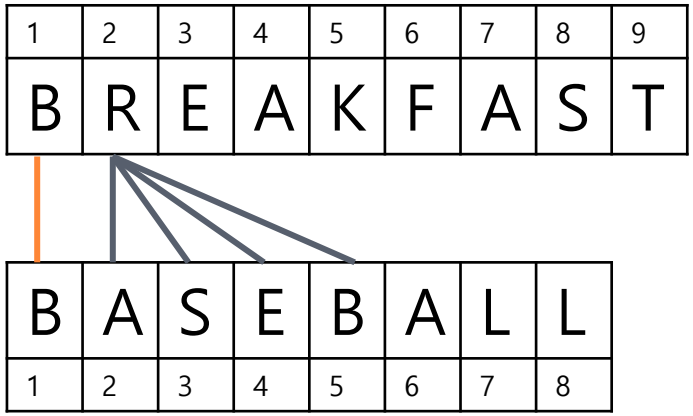

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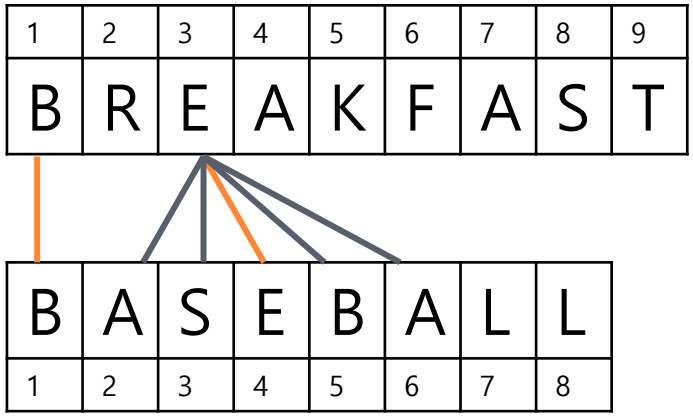
Jaro similarity



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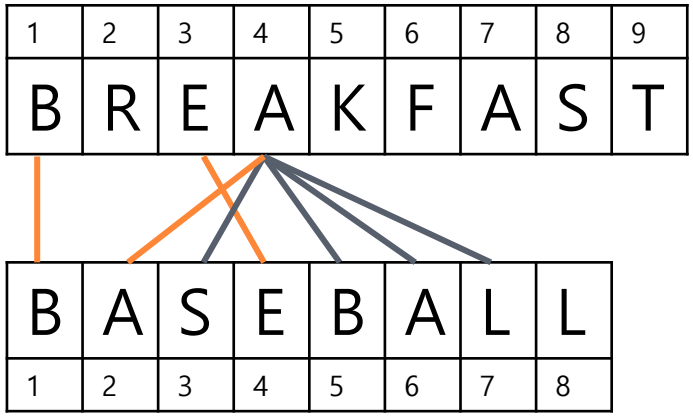
Jaro similarity



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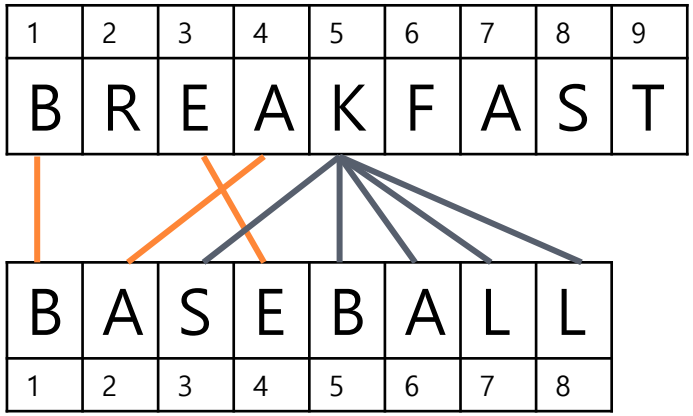
Jaro similarity



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Jaro similarity

1	2	3	4	5	6	7	8	9
B	R	E	A	K	F	A	S	T

B	A	S	E	B	A	L	L
1	2	3	4	5	6	7	8

$$sim_j(\text{"}breakfast\text{"},\text{"}baseball\text{"}) = \frac{1}{3}\left(\frac{4}{9}+\frac{4}{8}+\frac{4-1}{4}\right)$$

$$= 0.56$$

$$sim_j(s_1, s_2) = \begin{cases} 0, & if\ m = 0 \\ \frac{1}{3}\left(\frac{m}{|s_1|}+\frac{m}{|s_2|}+\frac{m-t}{m}\right), & else. \end{cases}$$

Jaro-Winkler similarity

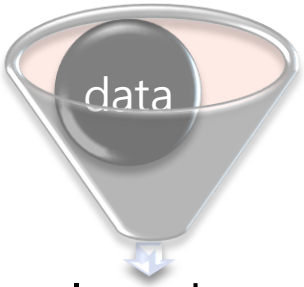
1	2	3	4	5	6	7	8	9
B	R	E	A	K	F	A	S	T

B	A	S	E	B	A	L	L
1	2	3	4	5	6	7	8

$$sim_{jw}(\text{"}breakfast\text{"},\text{"}baseball\text{"})$$
$$= 0.56 + 0.1(1 - 0.56) = 0.60$$

$$sim_{jw}(s_1, s_2) = sim_j + lp(1 - sim_j)$$

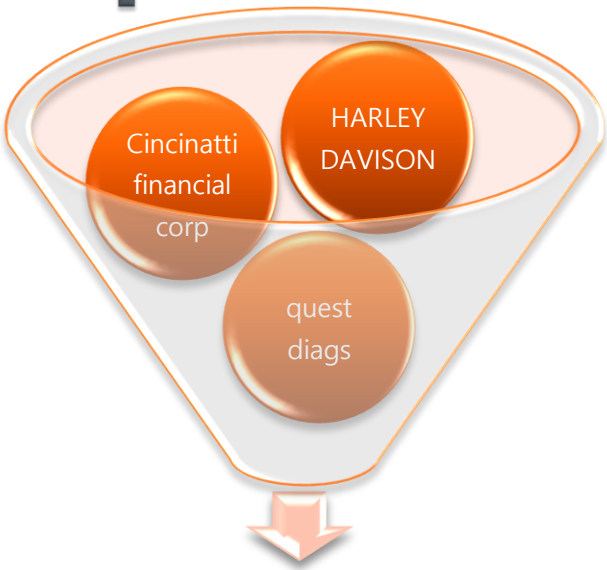
The process: cleaning



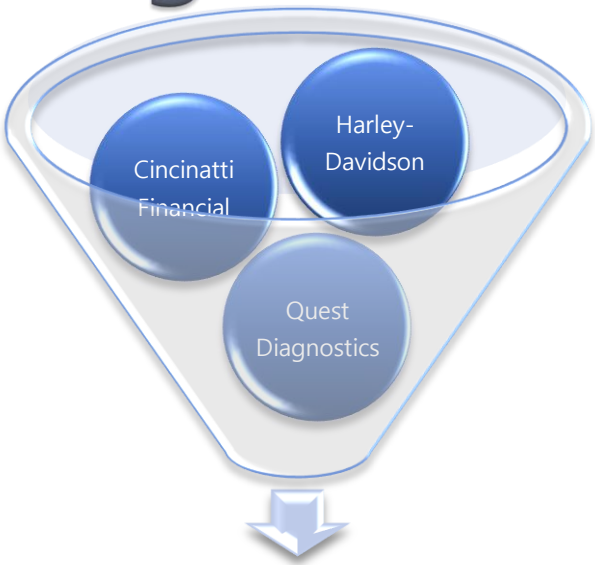
cleandata

```
cleaner <- function(data) {
  wordremove <- c(" and "," comp "," company","companies"," corp
  "," inc ","[.]com")
  data <- data %>% tolower() %>%
    {gsub(paste(wordremove,collapse='|'),"",.)} %>%
    {gsub("[[:punct:]]","",.)} %>%
    {gsub("[[:blank:]]","",.)}
  return(data)
}
```

The process: cleaning



cincinattifinancial
harleydavison
questdiags



cincinattifinancial
harleydavidson
questdiagnostics

```
clean_list_cl <- cleaner(clean_list)
dirty_list_cl <- cleaner(dirty_list)
```

The process: distance matrix

	cincinattifinancial	harleydavison	otherexample	questdiags
harleydavidson	0.67	0.01	0.54	0.51
cincinattifinancial	0	0.66	0.64	0.68
questdiagnostics	0.47	0.46	0.63	0.08

```
library(stringdist)
distmatrix <- stringdist::stringdistmatrix(clean_list_cl,
                        dirty_list_cl,method='jw‘,p=0.1)
```

The process: minima detection

	cincinattifinancial	harleydavison	otherexample	questdiags
harleydavidson	0.67	0.01	0.54	0.51
cincinattifinancial	0	0.66	0.64	0.68
questdiagnostics	0.47	0.46	0.63	0.08

```
output <- data.frame(original=dirty_list)
best_fit <- apply(distmatrix,2,which.min) %>% as.integer()
output$best_fit <- clean_list[best_fit]
output$distance <- apply(distmatrix,2,min)
```

The process: thresholding

	cincinattifinancial	harleydavison	otherexample	questdiags
harleydavidson	0.67	0.01	0.54	0.51
cincinattifinancial	0	0.66	0.64	0.68
questdiagnostics	0.47	0.46	0.63	0.08

```
output$final <- ifelse(control$distance<0.12,control$best_fit,NA)
```

The output

original	best_fit	distance	result
Self-employed	Teleflex	0.306	NA
Mohawk Ind	Mohawk Industries	0.088	Mohawk Industries
cincinnati financial	Cincinnati Financial	0.000	Cincinnati Financial
Illumin	Illumina Inc	0.073	Illumina Inc
HARLEY DAVIDSEN	Harley-Davidson	0.029	Harley-Davidson
Oracle	Oracle Corp.	0.080	Oracle Corp.
Harley Davidson	Harley-Davidson	0.000	Harley-Davidson
burger king	NRG Energy	0.300	NA
Haliburton	Halliburton Co.	0.054	Halliburton Co.
Self	Sealed Air	0.244	NA

The value of Fuzzy merging

Descriptive	Predictive	Combinations
• S&P 500 customer analysis • Regional opportunities	• Add value to predictive models • Churn analysis	• Identify customers in managing positions in S&P 500 companies

Other applications

Our approach:
Dirty list vs
clean list

Fuzzy search

Record linkage

De-duplication

Thank you!

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