Working With Text

Pittsburgh useR Group - 04/24/2018

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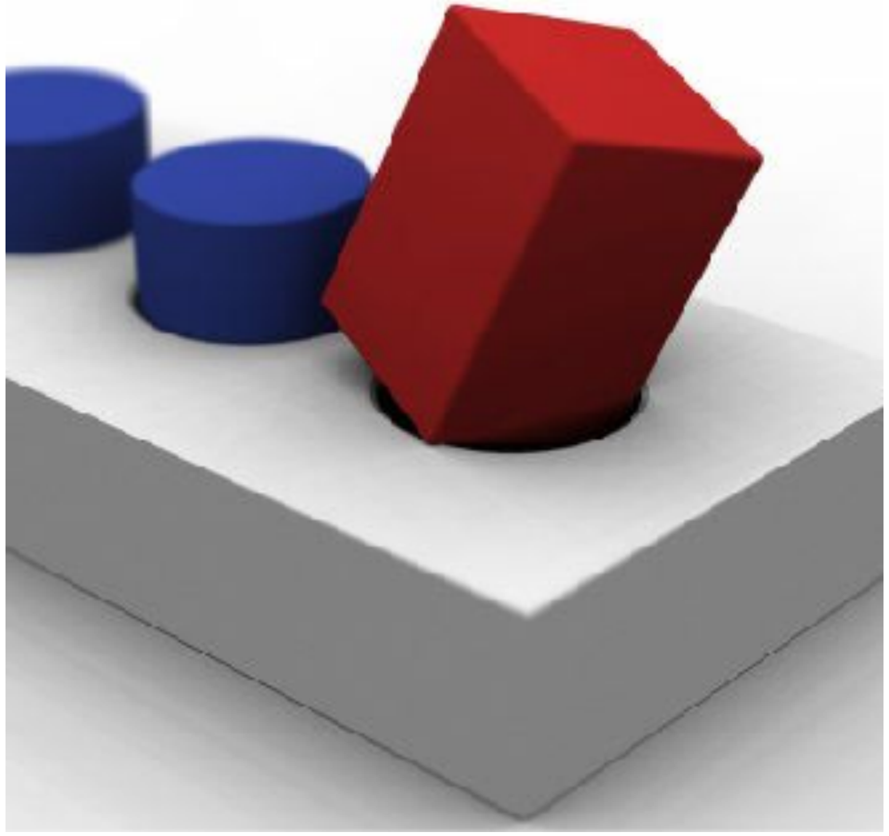
AvenueFour Analytics

Avenue 4 Analytics

Challenges

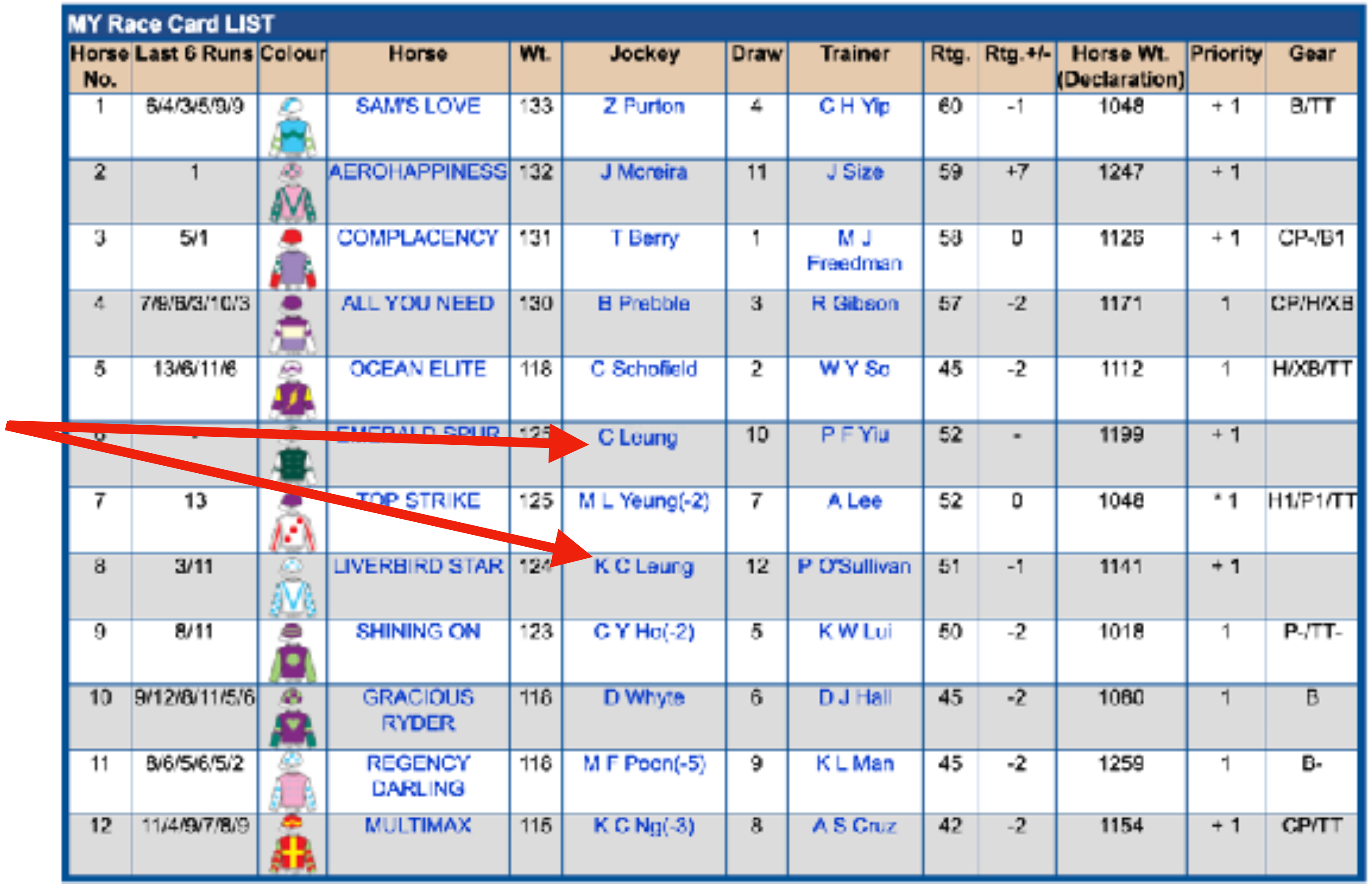
Text Is dirty!

Incompatible with most statistical models.



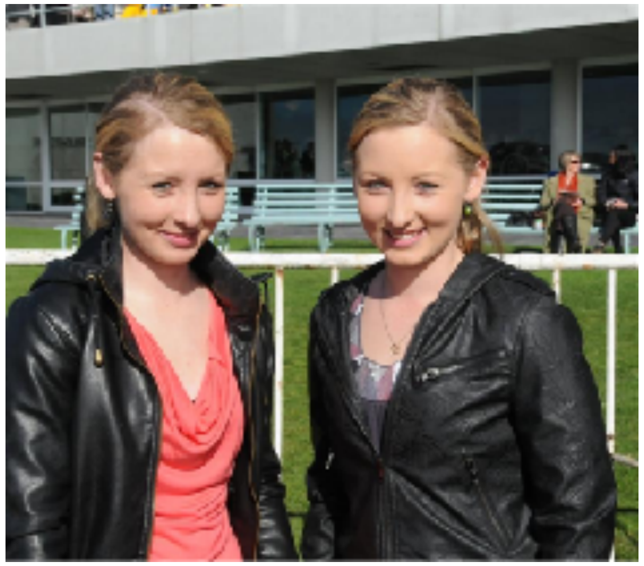
Correctly Identifying Entities

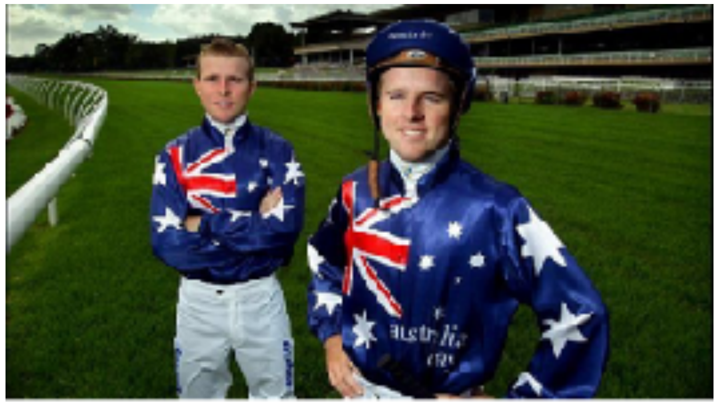
???



MY Race Card LIST

Horse No.	Last 6 Runs	Colour	Horse	Wt.	Jockey	Draw	Trainer	Rtg.	Rtg.+/-	Horse Wt. (Declaration)	Priority	Gear
1	6/4/3/5/9/9		SAM'S LOVE	133	Z Purton	4	C H Yip	60	-1	1048	+ 1	B/TT
2	1		AEROHAPPINESS	132	J Moreira	11	J Size	59	+7	1247	+ 1	
3	5/1		COMPLACENCY	131	T Berry	1	M J Freedman	58	0	1126	+ 1	CP-/B1
4	7/8/8/3/10/3		ALL YOU NEED	130	B Prebble	3	R Gibson	57	-2	1171	1	CP/H/XB
5	13/6/11/6		OCEAN ELITE	118	C Schofield	2	W Y So	45	-2	1112	1	H/XB/TT
6	[illegible]		EMERALD SPUR	125	C Leung	10	P F Yiu	52	-	1199	+ 1	
7	13		TOP STRIKE	125	M L Yeung(-2)	7	A Lee	52	0	1048	* 1	H1/P1/TT
8	3/11		LIVERBIRD STAR	124	K C Leung	12	P O'Sullivan	51	-1	1141	+ 1	
9	8/11		SHINING ON	123	C Y Ho(-2)	5	K W Lui	50	-2	1018	1	P-/TT-
10	9/12/8/11/5/6		GRACIOUS RYDER	116	D Whyte	6	D J Hall	45	-2	1080	1	B
11	8/6/5/6/5/2		REGENCY DARLING	116	M F Poon(-5)	9	K L Man	45	-2	1259	1	B-
12	11/4/9/7/8/9		MULTIMAX	115	K C Ng(-3)	8	A S Cruz	42	-2	1154	+ 1	CP/TT





Similarity Algorithms

Levenshtein Distance

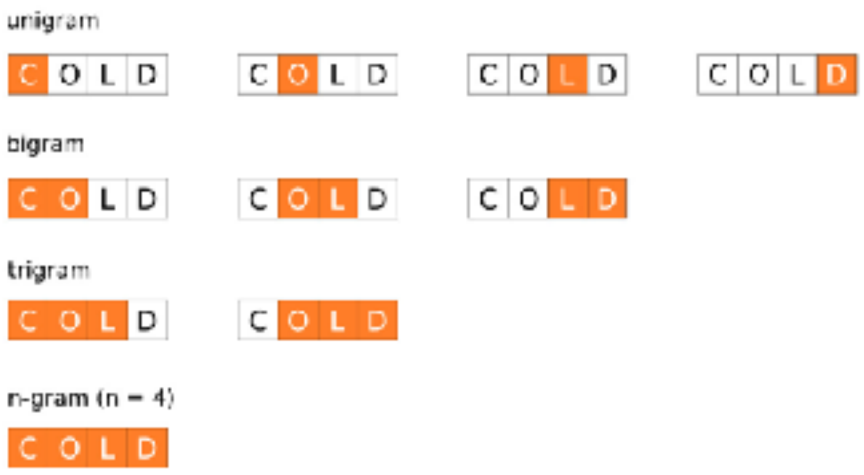
- minimum number of edits necessary to change one string into another

$$\mathrm{lev}_{a,b}(i,j) = \begin{cases} \max(i,j) & \text{if} \min(i,j)=0, \\ \min \begin{cases} \mathrm{lev}_{a,b}(i-1,j)+1 \\ \mathrm{lev}_{a,b}(i,j-1)+1 \\ \mathrm{lev}_{a,b}(i-1,j-1)+1_{(a_i \neq b_j)} \end{cases} & \text{otherwise.} \end{cases}$$

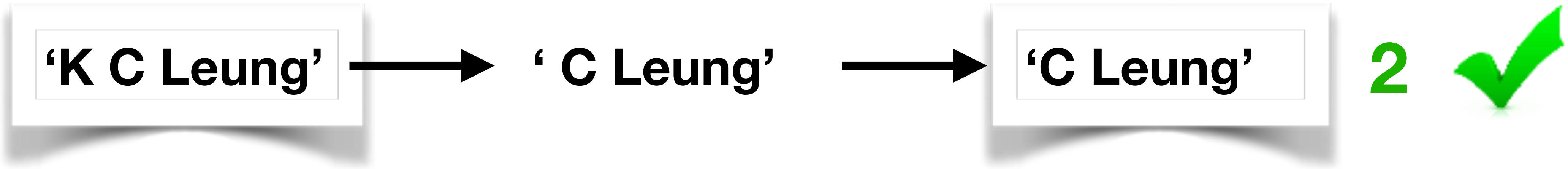
Jaccard Index (using ngrams)

- count of the intersection of ngrams divided by count of the union of ngrams

$$J(A,B) = \frac{|A \cap B|}{|A \cup B|}$$

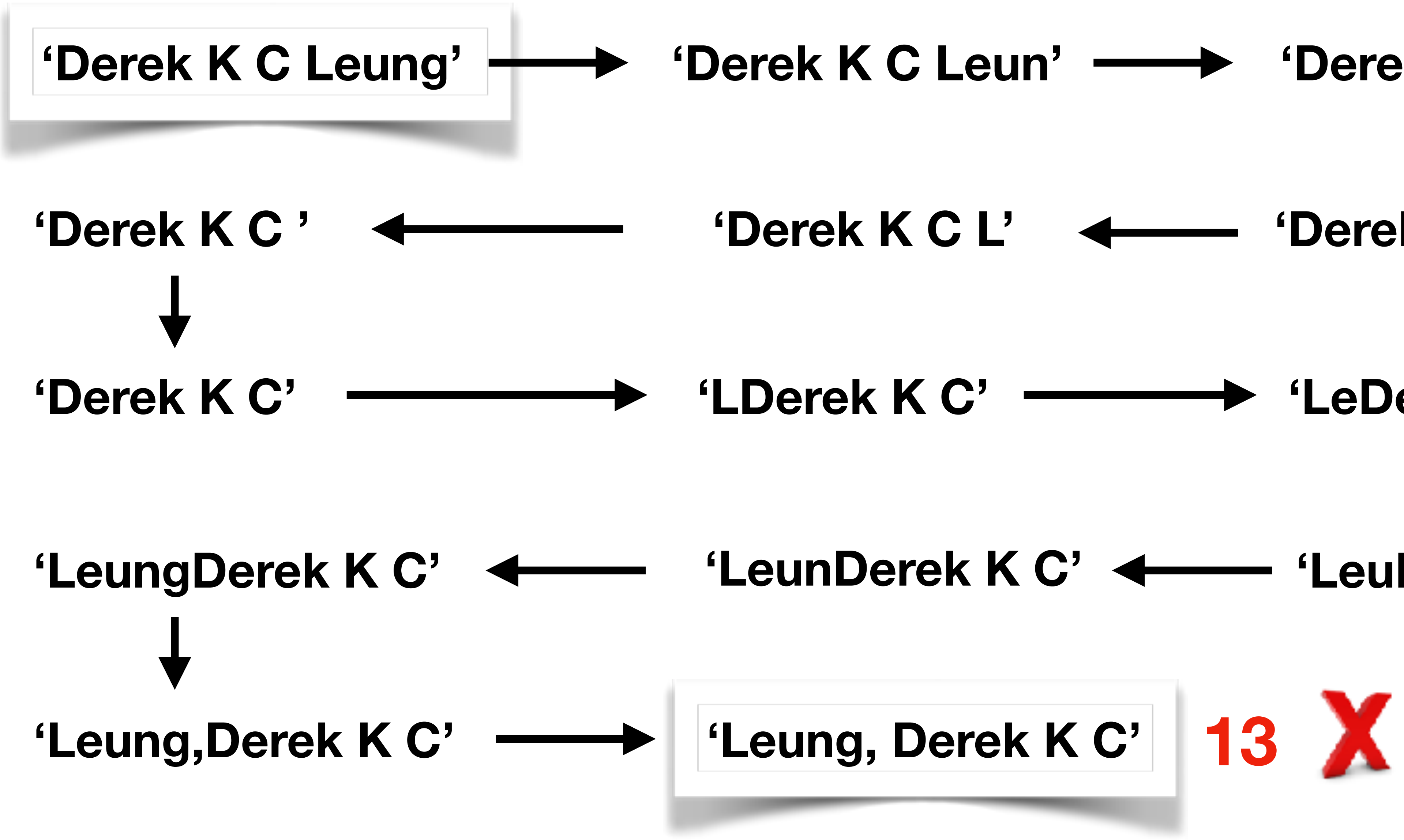


Levenshtein Distance



‘K C Leung’ → ‘ C Leung’ → ‘C Leung’ 2 ✓

Levenshtein Distance



‘Derek K C Leung’

‘Derek K C Leun’

‘Derek K C Leu’

‘Derek K C Le’

‘Derek K C L’

‘Derek K C ’

‘Derek K C’

‘LDerek K C’

‘LeDerek K C’

‘LeuDerek K C’

‘LeunDerek K C’

‘LeungDerek K C’

‘Leung,Derek K C’

‘Leung, Derek K C’

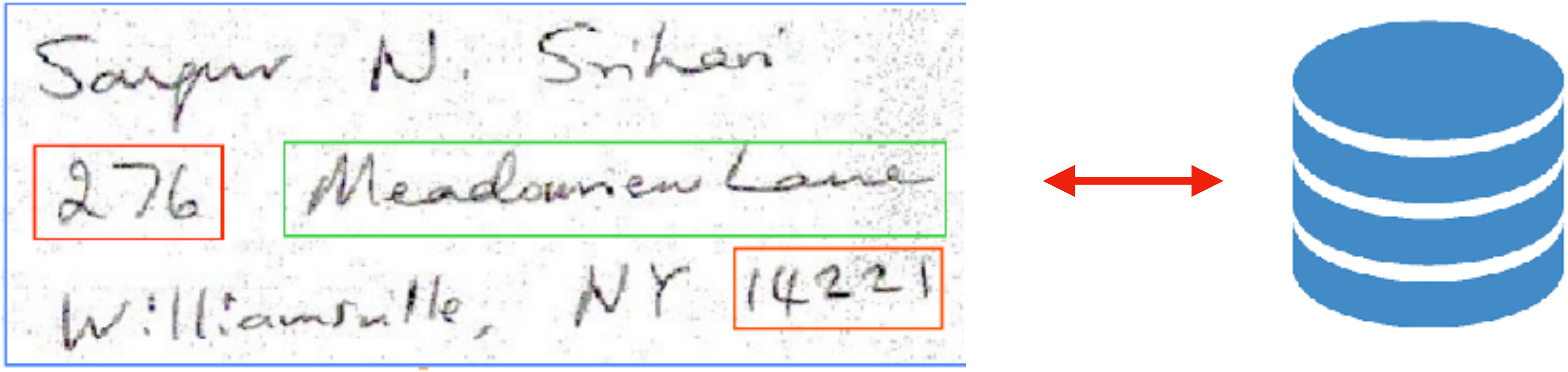
13 ✗

Jaccard Index (using ngrams)

‘K C Leung’	‘K ‘, ‘ C’, ‘C ‘, ‘ L’, ‘Le’, ‘eu’, ‘un’,’ng’	Intersection: ‘C ‘, ‘ L’, ‘Le’, ‘eu’, ‘un’,’ng’ Union: ’K ‘, ‘ C’, ‘C ‘, ‘ L’, ‘Le’, ‘eu’, ‘un’,’ng’ Score: 6 / 8 = 0.75
‘C Leung’	‘C ‘, ‘ L’, ‘Le’, ‘eu’, ‘un’,’ng’	
‘Derek K C Leung’	‘De’, ‘er’, ‘re’, ‘ek’, ‘k ‘, ‘ K’, ’K ‘, ‘ C’, ‘C ‘, ‘ L’, ‘Le’, ‘eu’, ‘un’,’ng’	Intersection: ‘De’, ‘er’, ‘re’, ‘ek’, ‘k ‘, ‘ K’, ’K ‘, ‘ C’, ‘Le’, ‘eu’, ‘un’,’ng’ Union: ‘De’, ‘er’, ‘re’, ‘ek’, ‘k ‘, ‘ K’, ’K ‘, ‘ C’, ‘C ‘, ‘ L’, ‘Le’, ‘eu’, ‘un’,’ng’, ‘g,’, ‘, ’, ‘ D’ Score: 12 / 17 = 0.71
‘Leung, Derek K C’	‘Le’, ‘eu’, ‘un’,’ng’, ‘g,’, ‘, ’, ‘ D’, ‘De’, ‘er’, ‘re’, ‘ek’, ‘k ‘, ‘ K’, ’K ‘, ‘ C’	

Leverage Domain Knowledge and Other Data Elements

Case Study: USPS



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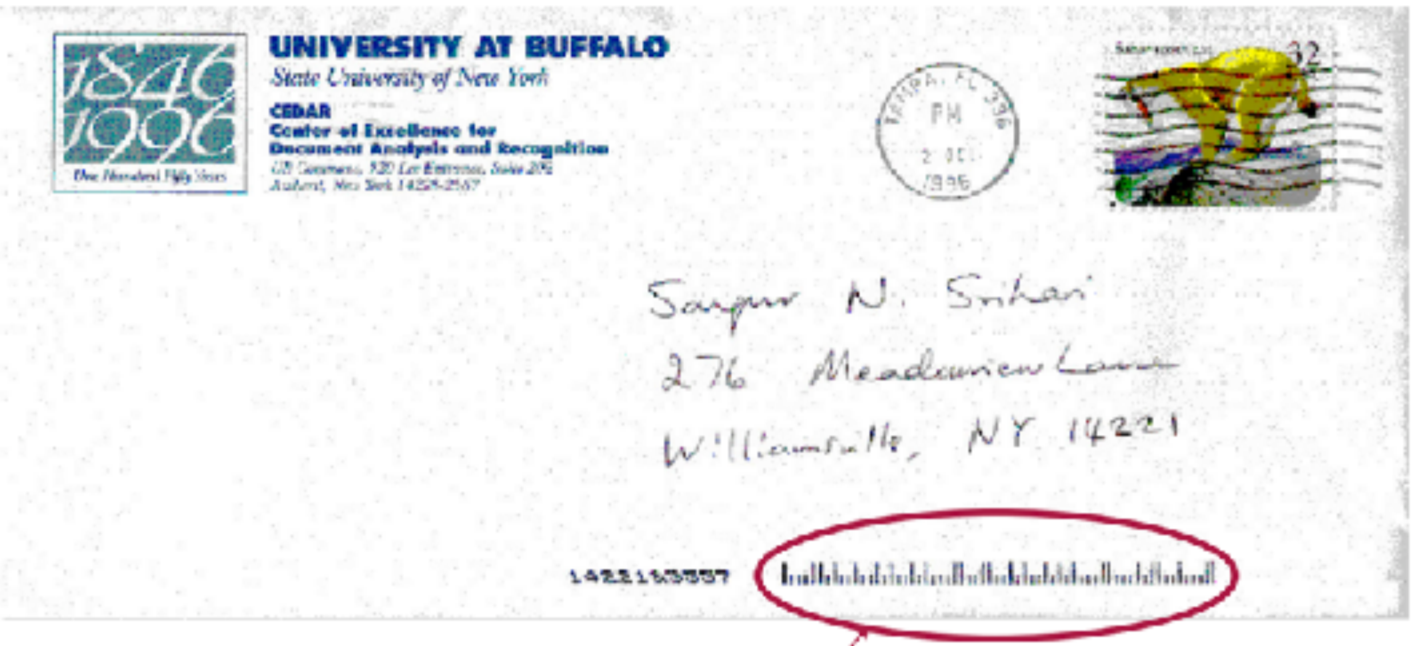

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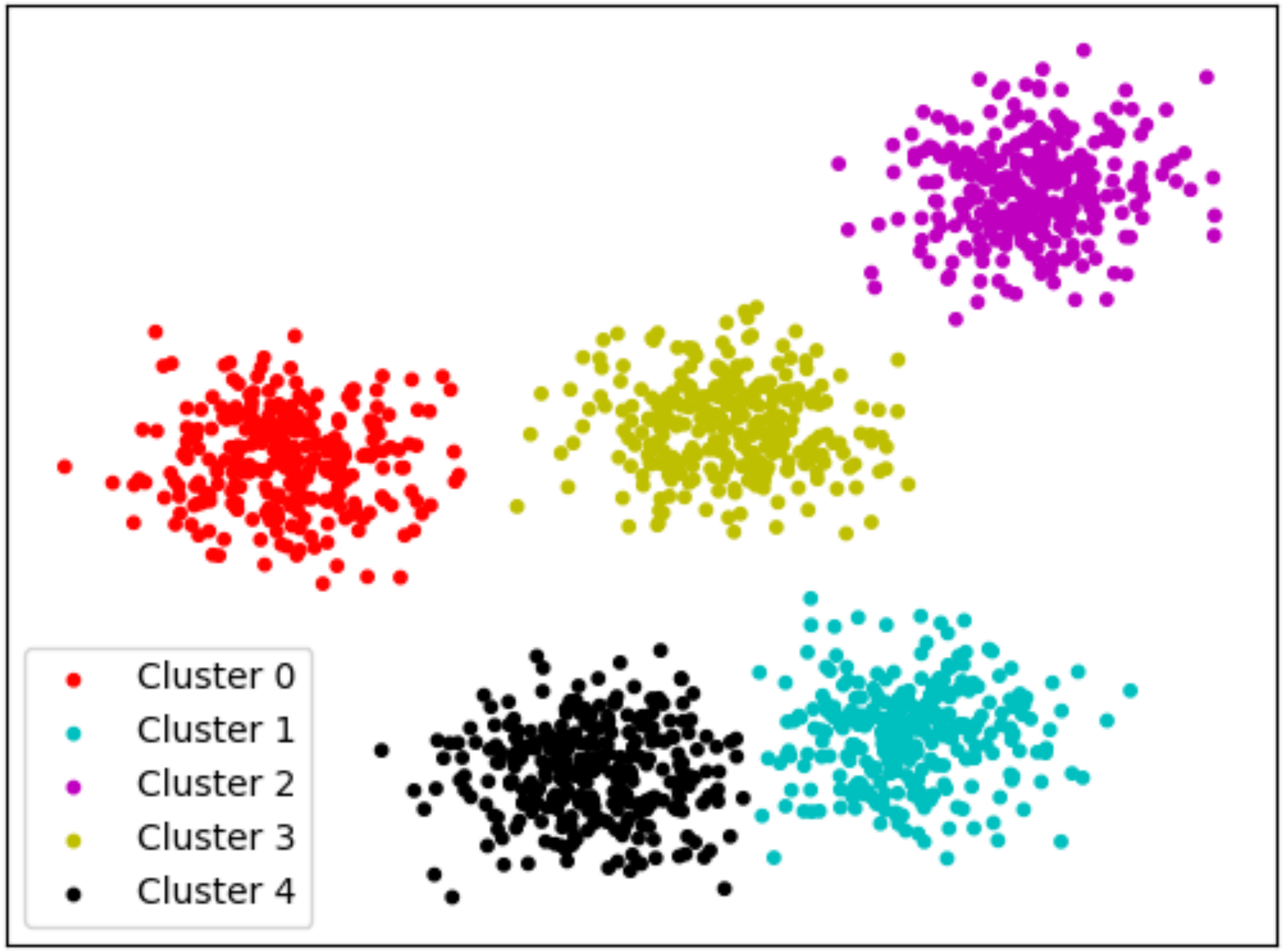
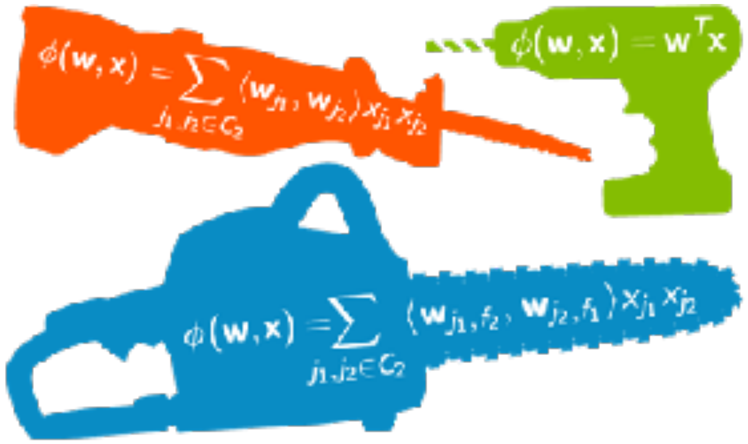
Postnet Bar Code representing Delivery Point

Feature Engineering - Clustering

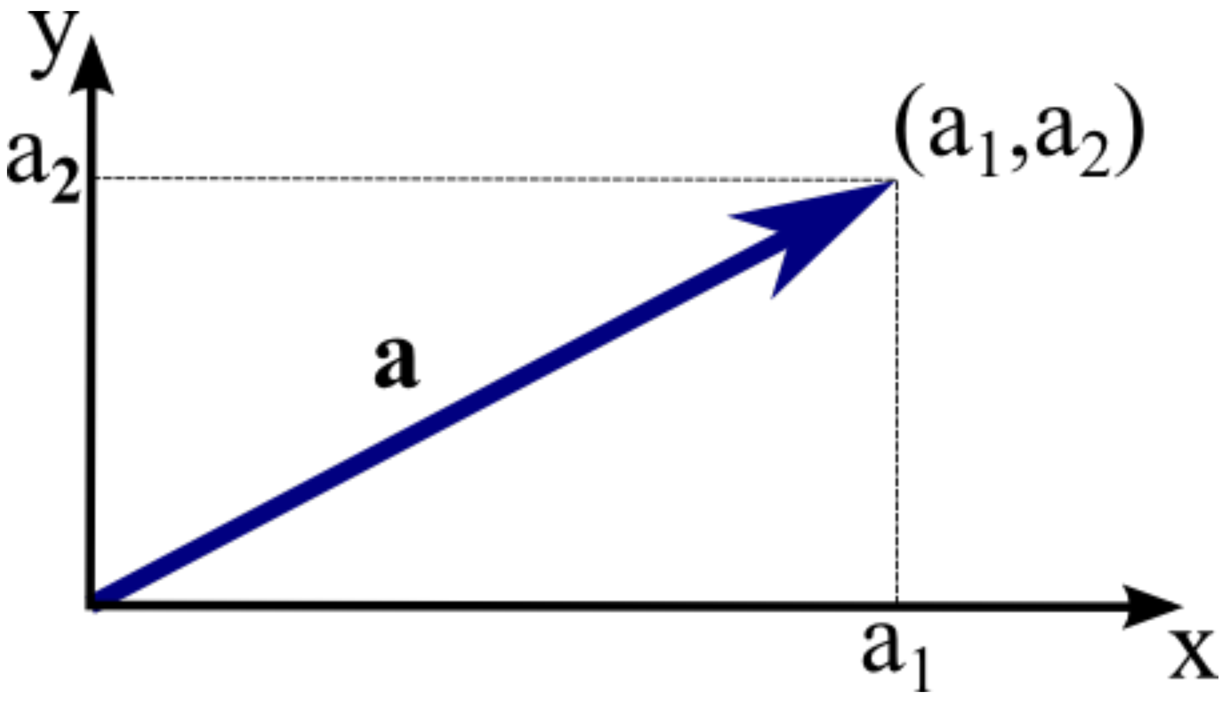



$\phi(\mathbf{w},\mathbf{x}) = \sum_{j_1,j_2 \in C_2} (\mathbf{w}_{j_1}, \mathbf{w}_{j_2}) x_{j_1} x_{j_2}$
$\phi(\mathbf{w},\mathbf{x}) = \mathbf{w}^T\mathbf{x}$
$\phi(\mathbf{w},\mathbf{x}) = \sum_{j_1,j_2 \in C_2} (\mathbf{w}_{j_1,f_2}, \mathbf{w}_{j_2,f_1}) x_{j_1} x_{j_2}$

Text to Vector

$$w_{i,j} = tf_{i,j} \times \log\left(\frac{N}{df_i}\right)$$

$tf_{i,j}$ = number of occurrences of i in j
df_i = number of documents containing i
N = total number of documents



Example: Greyhound Comments

Thank You Questions?

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