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Ex07

Task 1)

(a) Hamming Distance: $d(x, x') = |x \setminus x' \cup x' \setminus x|$

x_n	y_n	$H_D(\{a,d,b\})$	$H_D(\{f\})$
$\{a,b,d,e\}$	3	$\lvert\{e\}\rvert = 1$	$\lvert\{f,a,b,d,e\}\rvert = 5$
$\{c,d\}$	1	$\lvert\{a,b,c\}\rvert = 3$	$\lvert\{c,d,f\}\rvert = 3$
$\{a\}$	2	$\lvert\{d,b\}\rvert = 2$	$\lvert\{a,f\}\rvert = 2$
$\{a,f,g\}$	3	$\lvert\{d,b,f,g\}\rvert = 4$	$\lvert\{a,g\}\rvert = ?$
$\{e,f\}$	4	$\lvert\{e,f,a,d,b\}\rvert = 5$	$\lvert\{e\}\rvert = 1$

Sorted Nearest Neighbours:

$\{3, 2, 1, 3, 4\}$ $\quad$ $\{4, 3, 2, 1, 3\}$

$k=1$: $\bar{y} = 3$ ∴ $\quad$ $\bar{y} = 4$ ∴

$k=2$: $\bar{y} = \frac{1}{2}(3+2) = 2.5$ $\quad$ $\bar{y} = \frac{1}{2}(4+3) = 3.5$ ∴

$k=3$: $\bar{y} = \frac{1}{3}(3+2+1) = 2$ ✓ $\quad$ $\bar{y} = \frac{1}{3}(4+3+2) = 3$ ✓

$\Rightarrow k=3$ was obtained

(b) Jaccard Similarity: $S(x,x') = \frac{|x \cap x'|}{|x \cup x'|}$

x_n	D_n	$J_D(\{a,b,d\})$	$J_D(\{f\})$
	3	$\frac{3}{4}$	$\frac{0}{5}$
$\{a,b,d,e\}$	1	$\frac{1}{4}$	$\frac{0}{5}$
$\{c,d\}$		$\frac{1}{3}$	$\frac{0}{2}$
$\{a\}$	2	$\frac{1}{5}$	$\frac{1}{3}$
$\{a,c,f,g\}$	3	$\frac{0}{5}$	$\frac{1}{2}$
$\{e,f\}$	4		

Sorted Nearest Neighbours:

$\{3,2,1,3,4\}$

$\{3,4,2,1,3\}$

$k=1 \rightarrow \bar{y}=3$ (X)

$\bar{y}=3$ (X)

$k=2 \rightarrow \bar{y}=\frac{1}{2}(3+2)=2.5$ (✓)

$\bar{y}=\frac{1}{2}(3+4)=3.5$ (✓)

$\Rightarrow k=2$ was obtained

Task 3) The algorithm:

i) first we initialize $D(0,j)=j$ and $D(i,0)=i$

ii) Recursively for $D(i,j)$: $\begin{cases} D(i-1,j-1) & \text{if } x_i=y_j \\ 1+\min\{D(i-1,j), D(i,j-1), D(i-1,j-1)\} & \text{if } x_i \neq y_j \end{cases}$

we do two inner loops $i=1$ to L, $j=1$ to k

iii) For the answer we select the bottom right element

		e	x	e	c	u	t	i	o	n
	0	1	2	3	4	5	6	7	8	9
i	1	1	2	3	4	5	6	6	7	8
n	2	2	2	3	4	5	6	7	7	7
t	3	3	3	3	4	5	5	6	7	8
e	4	3	4	3	4	5	6	6	7	8
n	5	4	4	4	4	5	6	7	7	7
t	6	5	5	5	5	5	5	6	7	8
i	7	6	6	6	6	6	6	5	6	7
o	8	7	7	7	7	7	7	6	5	6
n	9	8	8	8	8	8	8	7	6	5

The final distance is 5

The distance between "intent" and "exe" is 5

The distance between "execut" and "int" is 5

Task 2 The code given below: