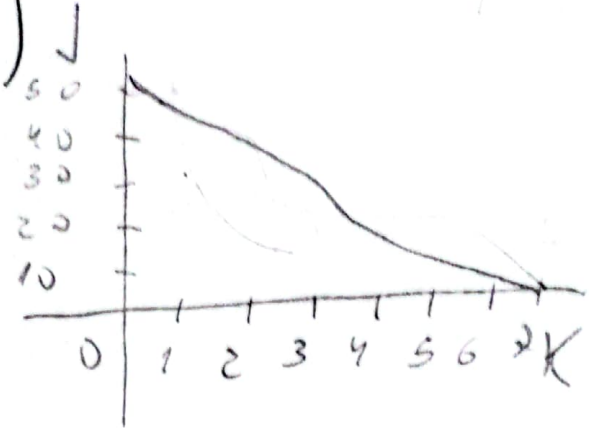
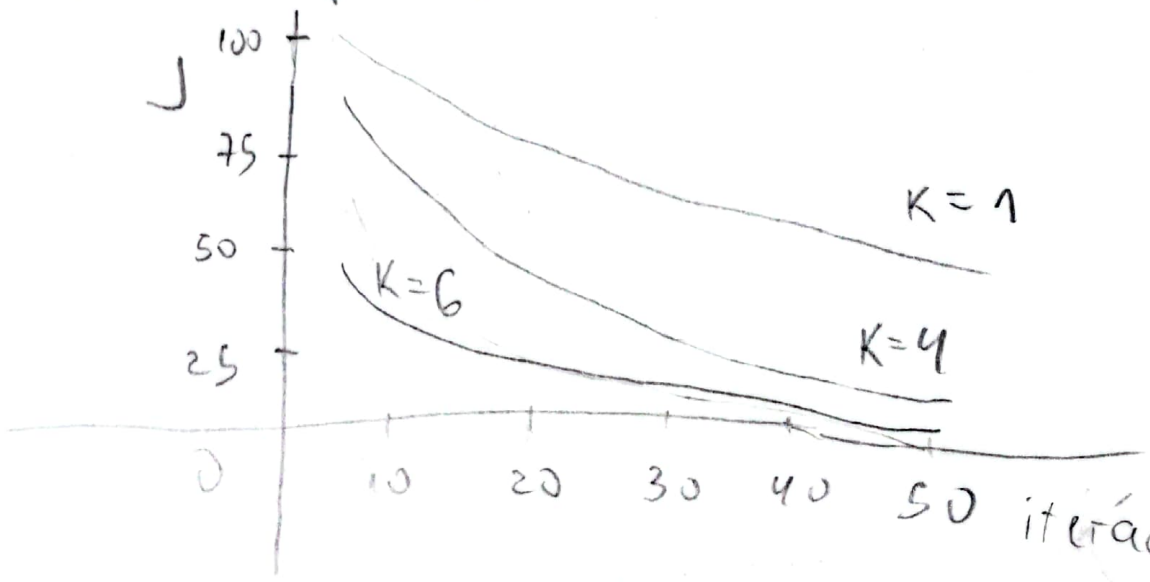
Ana Lukenda, 0036515803
V1g

1.1. a)

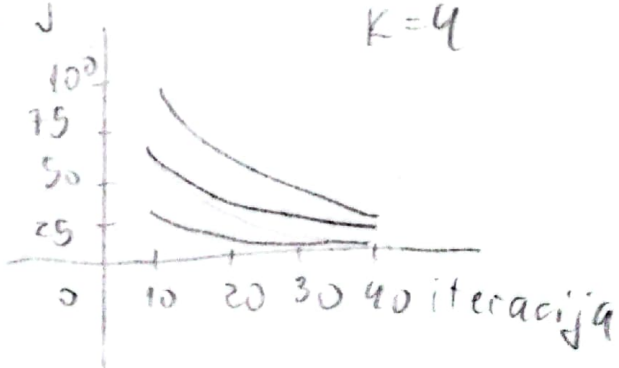


Minimalna vrijednost funkcije J je 0, zato što je moguće da K bude jednak broju primjera pa će greška biti jednaka 0, odnosno svaki primjer točno grupiran u vlastitu grupu. Iako to se ne koristi u praksi jer je besmisleno.

b)



c)



Izgledniji je da će biti izabrana krivulja s manjom greškom.

Ana Lukenda, 00365 15803

v1g

1.2.

$D = \{a=(5,2), b=(7,1), c=(1,4), d=(6,2), e=(2,8), f=(3,6), g=(0,4)\}$

a) $K=3$

$M_1 = b$

$M_2 = c$

$M_3 = e$

$x_1^{(1)} = a = (5,2)$

$\|a - M_1\| = \begin{bmatrix} -2 & 1 \end{bmatrix} \begin{bmatrix} -2 \\ 1 \end{bmatrix} = 5 \Rightarrow \min_j = 1$

$\|a - M_2\| = \begin{bmatrix} 4 & -2 \end{bmatrix} \begin{bmatrix} 4 \\ -2 \end{bmatrix} = 20$

$\|a - M_3\| = \begin{bmatrix} 3 & -6 \end{bmatrix} \begin{bmatrix} 3 \\ -6 \end{bmatrix} = 45$

$b_1^{(1)} = 1, \quad b_2^{(1)} = b_3^{(1)} = 0$

$x^{(2)} = b = (7,1)$

$\|b - M_1\| = 0 \Rightarrow \min_j = 1$

$\|b - M_2\| = \begin{bmatrix} 6 & -3 \end{bmatrix} \begin{bmatrix} 6 \\ -3 \end{bmatrix} = 45$

$\|b - M_3\| = \begin{bmatrix} 5 & -7 \end{bmatrix} \begin{bmatrix} 5 \\ -7 \end{bmatrix} = 74$

$b_1^{(2)} = 1, \quad b_2^{(2)} = b_2^{(3)} = 0$

$x^{(3)} = c = (1,4)$

$\|c - M_1\| = \begin{bmatrix} -6 & 3 \end{bmatrix} \begin{bmatrix} -6 \\ 3 \end{bmatrix} = 45$

$b_2^{(3)} = 1, \quad b_1^{(3)} = b_3^{(3)} = 0$

$\|c - M_2\| = 0 \Rightarrow \min_j = 2$

$\|c - M_3\| = \begin{bmatrix} -1, & -4 \end{bmatrix} \begin{bmatrix} -1 \\ -4 \end{bmatrix} = 17$

Ang Lukenda, 0036515803

V 19

1.2. a) nastavak

$x^{(4)} = d = (6,2)$

$\|d - M_1\| = \begin{bmatrix} -1 & 1 \end{bmatrix} \begin{bmatrix} -1 \\ 1 \end{bmatrix} = 2 \Rightarrow \min_d = 1$

$\|d - M_2\| = \begin{bmatrix} 5 & -2 \end{bmatrix} \begin{bmatrix} 5 \\ -2 \end{bmatrix} = 29$

$\|d - M_3\| = \begin{bmatrix} 4 & -6 \end{bmatrix} \begin{bmatrix} 4 \\ -6 \end{bmatrix} = 52$

$b_1^{(4)} = 1, \; b_2^{(4)} = b_3^{(4)} = 0$

$x^{(5)} = e = (2,8)$

$\|d - M_1\| = \begin{bmatrix} -5 & 7 \end{bmatrix} \begin{bmatrix} -5 \\ 7 \end{bmatrix} = 74$

$\|d - M_2\| = \begin{bmatrix} 1 & 4 \end{bmatrix} \begin{bmatrix} 9 \\ 4 \end{bmatrix} = 17$

$\|d - M_3\| = 0 \Rightarrow \min_d = 3$

$b_3^{(5)} = 1, \; b_1^{(5)} = b_2^{(5)} = 0$

$x^{(6)} = f = (3,6)$

$\|f - M_1\| = \begin{bmatrix} -4 & 5 \end{bmatrix} \begin{bmatrix} -4 \\ 5 \end{bmatrix} = 41$

$\|f - M_2\| = \begin{bmatrix} 2 & 2 \end{bmatrix} \begin{bmatrix} 2 \\ 2 \end{bmatrix} = 8$

$\|f - M_3\| = \begin{bmatrix} 1 & -2 \end{bmatrix} \begin{bmatrix} 1 \\ -2 \end{bmatrix} = 5 \Rightarrow \min_f = 3$

$b_3^{(6)} = 1, \; b_1^{(6)} = b_2^{(6)} = 0$

Ana Lukendg, 00365158/3

v1g

1.2. a) nastavak

$x^{(7)} = g = (0,4)$

$\|g - \mu_1\| = \begin{bmatrix} -7 & 3 \end{bmatrix} \begin{bmatrix} -7 \\ 3 \end{bmatrix} = 58$

$\|g - \mu_2\| = \begin{bmatrix} -1 & 0 \end{bmatrix} \begin{bmatrix} -1 \\ 0 \end{bmatrix} = 1 \Rightarrow \min j = 2$

$\|g - \mu_3\| = \begin{bmatrix} -2 & -4 \end{bmatrix} \begin{bmatrix} -2 \\ -4 \end{bmatrix} = 20$

$b_2^{(7)} = 1; \; b_1^{(7)} = b_3^{(7)} = 0$

$\mu_1 = \frac{a+b+d}{3 \cdot 1} = \frac{[5\ 2] + [7\ 1] + [6\ 2]}{3}$

$= (6, \frac{5}{3})$

$\mu_2 = \frac{c+g}{2 \cdot 1} = \frac{[1\ 4] + [0\ 4]}{2} = (\frac{1}{2}, 4)$

$\mu_3 = \frac{e+f}{2 \cdot 1} = \frac{[2\ 8] + [3\ 6]}{2} = (\frac{5}{2}, 7)$

Ana Lukenda, 00365158O3

vig

1.2. c) Složenost k-srednja $O(TnNK)$, pri čemu je T broj iteracija, n broj značajki, N broj primjera i K broj klasa. Složenost k-medoida $O(TK(N-K)^2)$, složenost je kvadratna te je veća od linearne složenost k-srednja.

d) Nedostatak je računalna složenost, a prednost što može raditi s primjerima koje je nemoguće vektorizirati, odnosno računati euklidsku udaljenost između njih.

vz1

1.1. $\{(y^{(i)}, h(x^{(i)}))\}_{i=1}^{11} = \{(1,1),(0,2),(2,2),(1,2),(1,1),$

$(0,0),(1,1),(2,1),(0,1),(2,0),(2,1)\}$

a) $Acc = \frac{1\{1=1\} + 1\{2=2\} + 1\{1=1\} + 1\{0=0\} + 1\{1=1\}}{11}$

$= \frac{5}{11} = 0.4545$

Ang Lukenda, 00365158e2

V2n1

1.1.5)

	$y_{true}=0$	$y_{true}=1$	$y_{true}=2$
$y_{pred}=0$	1	0	1
$y_{pred}=1$	1	3	2
$y_{pred}=2$	1	1	1

$$\begin{bmatrix} TP_d & FP_d \\ FN_d & TN_d \end{bmatrix} \Rightarrow \underset{y=0}{\begin{pmatrix} 1 & 1 \\ 2 & 7 \end{pmatrix}} \quad \underset{y=1}{\begin{pmatrix} 3 & 3 \\ 1 & 4 \end{pmatrix}} \quad \underset{y=2}{\begin{pmatrix} 1 & 2 \\ 3 & 5 \end{pmatrix}}$$

$P_0 = 0.5$ $\quad P_1 = 0.5$ $\quad P_2 = \frac{1}{3}$

$R_0 = \frac{1}{3}$ $\quad R_1 = 0.75$ $\quad R_2 = 0.25$

$F_{1,0} = 0.4$ $\quad F_{1,1} = 0.6$ $\quad F_{1,2} = \frac{2}{7}$

makro:

$$P^M = \frac{P_0+P_1+P_2}{3} = \frac{4}{9}, \quad R^M = \frac{P_1+P_2+P_3}{3} = \frac{4}{9}, \quad F_1^M = \frac{F_{1,0}+F_{1,1}+F_{1,2}}{3} = \frac{3}{7}$$

mikro:

$$\begin{pmatrix} 1 & 1 \\ 2 & 7 \end{pmatrix} + \begin{pmatrix} 3 & 3 \\ 1 & 4 \end{pmatrix} + \begin{pmatrix} 1 & 2 \\ 3 & 5 \end{pmatrix} = \begin{pmatrix} 5 & 6 \\ 6 & 16 \end{pmatrix}$$

$$P^M = \frac{5}{11}, \quad R^M = \frac{5}{11}, \quad F_1^M = \frac{5}{11}$$