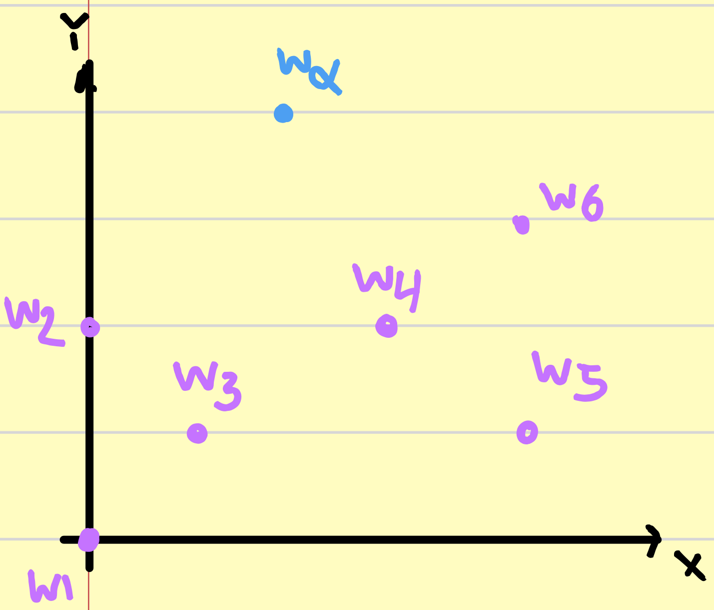


Übung. Gegeben ist die Position von 6 Werke mit (X,Y) Koordinaten. 1) Bitte mit K.M.C. die Gruppen in 2 Kategorien teilen 2) Mit KNN entscheiden zur welchen Gruppe Werk α gehört?

- $W_1[0,0]$ $W_2[0,2]$ $W_3[1,1]$ $W_4[3,2]$ $W_5[4,1]$ $W_6[4,3]$
- $W_\alpha[2,5]$

1) K.M.C. Gruppe 1 $[W_1, W_2]$ Gruppe 2 $[W_3, W_4, W_5, W_6]$

- Zentroide $Z_1 = \left[\frac{0+0}{2}, \frac{0+2}{2}\right] = [0,1]$; $Z_2 = \left[\frac{1+3+4+4}{4}, \frac{1+2+1+3}{4}\right] = [3, 1{,}75]$
- $d_{W1,Z1} = \sqrt{(0-0)^2+(0-1)^2} = 1$; $d_{W1,Z2} = \sqrt{(0-3)^2+(0-1{,}75)^2} = 3{,}47$

$d_{W2,Z1} = \sqrt{(0-0)^2+(2-1)^2} = 1$; $d_{W2,Z2} = \sqrt{(0-3)^2+(2-1{,}75)^2} = 3{,}01$

× $d_{W3,Z1} = \sqrt{(1-0)^2+(1-1)^2} = 1$; $d_{W3,Z2} = \sqrt{(1-3)^2+(1-1{,}75)^2} = 2{,}17$

$d_{W4,Z1} = \sqrt{(3-0)^2+(2-1)^2} = 3{,}16$; $d_{W4,Z2} = \sqrt{(3-3)^2+(2-1{,}75)^2} = 0{,}25$

$d_{W5,Z1} = \sqrt{(4-0)^2+(1-1)^2} = 4$; $d_{W5,Z2} = \sqrt{(4-3)^2+(1-1{,}75)^2} = 1{,}25$

$d_{W6,Z1} = \sqrt{(4-0)^2+(3-1)^2} = 4{,}47$; $d_{W6,Z2} = \sqrt{(4-3)^2+(3-1{,}75)^2} = 1{,}6$

- Neue Gruppen: $G_1[W_1, W_2, W_3]$ $G_2[W_4, W_5, W_6]$

$z_1^* = \left[\frac{0+0+1}{3}, \frac{0+2+1}{3}\right] = \left[\frac{1}{3}, 1\right]$ $\quad z_2^* = \left[\frac{3+4+4}{3}, \frac{2+1+3}{3}\right] = [3'67, 2]$

· $d_{w1,z_1^*} = \sqrt{\left(0-\frac{1}{3}\right)^2 + (0-1)^2} = 1'05$; $d_{w1,z_2^*} = \sqrt{(0-3'67)^2 + (0-2)^2} = 4'18$

$d_{w2,z_1^*} = \sqrt{\left(0-\frac{1}{3}\right)^2 + (2-1)^2} = 1'05$; $d_{w2,z_2^*} = \sqrt{(0-3'67)^2 + (2-2)^2} = 3'67$

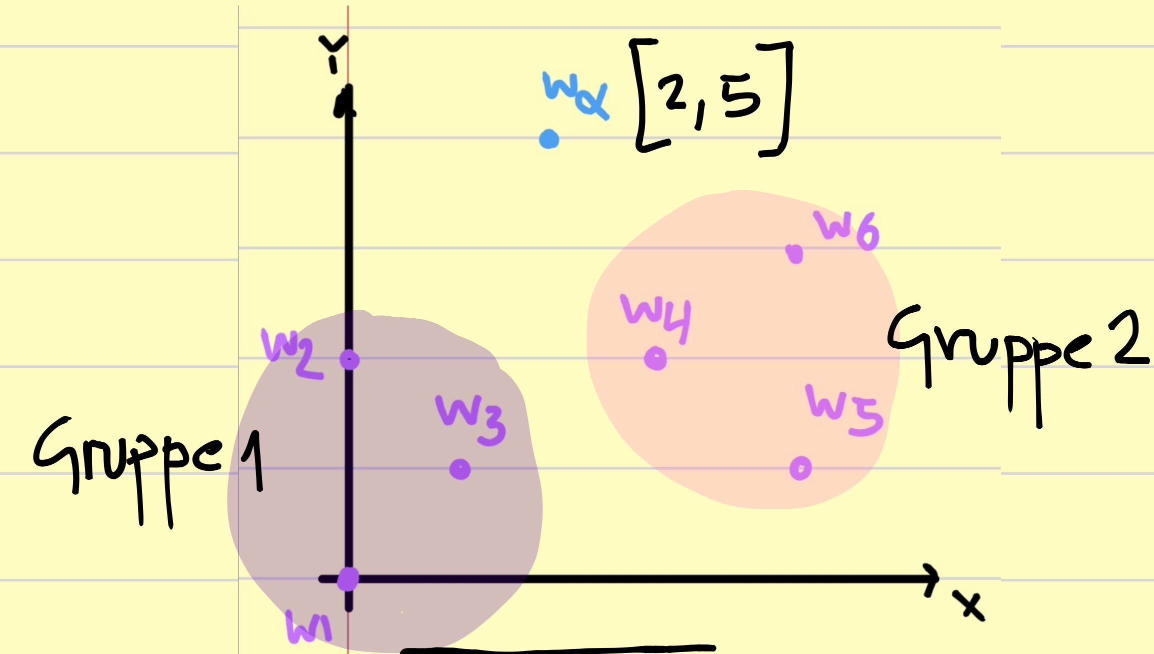
$d_{w3,z_1^*} = \sqrt{\left(1-\frac{1}{3}\right)^2 + (1-1)^2} = 1'05$; $d_{w3,z_2^*} = \sqrt{(1-3'67)^2 + (1-2)^2} = 2'85$

$d_{w4,z_1^*} = \sqrt{\left(3-\frac{1}{3}\right)^2 + (2-1)^2} = 2'84$; $d_{w4,z_2^*} = \sqrt{(3-3'67)^2 + (2-2)^2} = 0'67$

$d_{w5,z_1^*} = \sqrt{\left(4-\frac{1}{3}\right)^2 + (1-1)^2} = 3'67$; $d_{w5,z_2^*} = \sqrt{(4-3'67)^2 + (1-2)^2} = 1'05$

$d_{w6,z_1^*} = \sqrt{\left(4-\frac{1}{3}\right)^2 + (3-1)^2} = 4'18$; $d_{w6,z_2^*} = \sqrt{(4-3'67)^2 + (3-2)^2} = 1'05$

Die Gruppen sind Korrekt. $G_1[W_1, W_2, W_3]$ $G_2[W_4, W_5, W_6]$



KNN. $\quad d_{\alpha,w_1} = \sqrt{(2-0)^2 + (5-0)^2} = 5'38$ $\quad G_1$

$d_{\alpha,w_2} = \sqrt{(2-0)^2 + (5-2)^2} = 3'68$ $\quad G_1$

$d_{\alpha,w_3} = \sqrt{(2-1)^2 + (5-1)^2} = 4'12$ $\quad G_1$

$$d_{\alpha, w_4} = \sqrt{(2-3)^2 + (5-2)^2} = 3'16 \quad G2$$

$$d_{\alpha, w_5} = \sqrt{(2-4)^2 + (5-1)^2} = 4'47 \quad G2$$

$$d_{\alpha, w_6} = \sqrt{(2-4)^2 + (5-4)^2} = 2'23 \quad G2$$

- $d_{\alpha,} \left[w_6 < w_4 < w_2 < w_3 < w_5 < w_1 \right]$

$K=1: \; p(\alpha \in G_1) = \frac{0}{1} = 0 \; ; \; p(\alpha \in G_2) = \frac{1}{1} = 1$

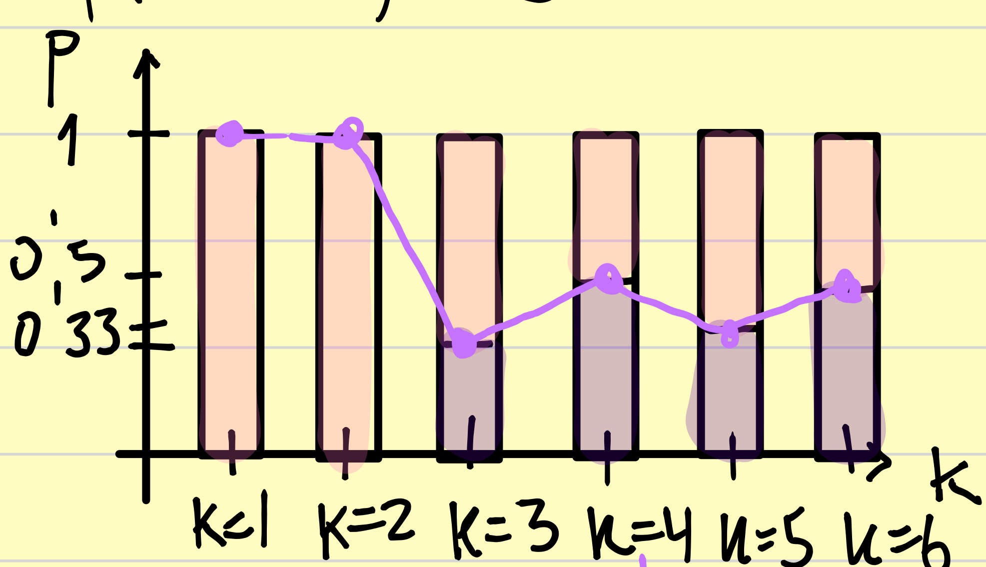
$K=2: \; p(\alpha \in G_1) = \frac{0}{2} = 0 \; ; \; p(\alpha \in G_2) = \frac{2}{2} = 1$

$K=3: \; p(\alpha \in G_1) = \frac{1}{3} = 0'33 \; ; \; p(\alpha \in G_2) = \frac{2}{3} = 0'67$

$K=4: \; p(\alpha \in G_1) = \frac{2}{4} = 0'5 \; ; \; p(\alpha \in G_2) = \frac{2}{4} = 0'5$

$K=5: \; p(\alpha \in G_1) = \frac{2}{5} = 0'4 \; ; \; p(\alpha \in G_2) = \frac{3}{5} = 0'6$

$K=6: \; p(\alpha \in G_1) = \frac{3}{6} = 0'5 \; ; \; p(\alpha \in G_2) = \frac{3}{6} = 0'5$



- Bei K=3 erreichen wir die beste Erklärung der Daten. Somit gehört w_α zur Gruppe 2.