ĆW (Model asocjacji)

Zdefinjujemy wektory pionowe $\vec{z}_0 = \begin{bmatrix} z_{0,1} \\ \vdots \\ z_{0,25} \end{bmatrix} \in \mathbb{R}^{25}$ i $\vec{z}_1 = \begin{bmatrix} z_{1,1} \\ \vdots \\ z_{1,25} \end{bmatrix} \in \mathbb{R}^{25}$ następująco.

$$\vec{z}_0 = \begin{array}{|c|c|c|c|c|} \hline \square & \square & \square & \square & \square \\ \hline \square & \blacksquare & \blacksquare & \blacksquare & \square \\ \hline \square & \blacksquare & \square & \blacksquare & \square \\ \hline \square & \blacksquare & \blacksquare & \blacksquare & \square \\ \hline \square & \square & \square & \square & \square \\ \hline \end{array} \qquad \vec{z}_1 = \begin{array}{|c|c|c|c|c|} \hline \square & \square & \square & \square & \square \\ \hline \square & \blacksquare & \blacksquare & \square & \square \\ \hline \square & \square & \blacksquare & \square & \square \\ \hline \square & \square & \blacksquare & \square & \square \\ \hline \square & \square & \square & \square & \square \\ \hline \end{array}$$

$\blacksquare = 1.0$, $\square = -1.0$ (Uwaga: NIE 0.0 !)

Zdefiniujemy macierz $W = [w_{ij}] \in M_{25\times 25}(\mathbb{R})$ (w_{ij} znajduje się w i-tym wierszu i j-tej kolumnie) wzorem wzorem $W = \frac{1}{25.0}\vec{z}_0\vec{z}_0^{\,T} + \frac{1}{25.0}\vec{z}_1\vec{z}_1^{\,T}$, gdzie $\vec{z}_\alpha^{\,T} = [z_{\alpha,1}, \cdots, z_{\alpha,25}]$ ($\alpha = 0, 1$) jest wektorem poziomym. Czyli

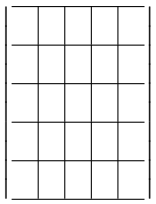
$$W = [w_{ij}] = \frac{1}{25.0}\begin{bmatrix} z_{0,1} \\ \vdots \\ z_{0,25} \end{bmatrix}[z_{0,1}, \cdots, z_{0,25}] + \frac{1}{25.0}\begin{bmatrix} z_{1,1} \\ \vdots \\ z_{1,25} \end{bmatrix}[z_{1,1}, \cdots, z_{1,25}],$$

$$w_{ij} = \frac{1}{25.0}z_{0,i}z_{0,j} + \frac{1}{25.0}z_{1,i}z_{1,j} \quad (1 \le i, j \le 25).$$

Zdefiniujemy funkcję $\vec{f}\colon \mathbb{R}^{25} \to \mathbb{R}^{25}$, $\vec{u} \mapsto \vec{f}(\vec{u})$ wzorem $\vec{f}(\vec{u}) = \begin{bmatrix} \mathrm{sgn}(y_1) \\ \vdots \\ \mathrm{sgn}(y_{25}) \end{bmatrix}$, gdzie $\begin{bmatrix} y_1 \\ \vdots \\ y_{25} \end{bmatrix} = W\vec{u}$,

$\mathrm{sgn}(y_i) = \begin{cases} -1.0 & \text{gdy } y_i < 0 \\ 1.0 & \text{gdy } y_i \ge 0 \end{cases}$ $(1 \le i \le 25)$.

Zadanie.

(1) Stworzyć interfejs "wektor" $\in \mathbb{R}^{25} \rightsquigarrow$  (obraz w ekranie, każdy piksel = $\blacksquare$ lub $\square$).

(2) Niech

$$\vec{u}_0 = \begin{array}{|c|c|c|c|c|} \hline \square & \square & \square & \square & \square \\ \hline \square & \blacksquare & \blacksquare & \blacksquare & \square \\ \hline \square & \blacksquare & \square & \blacksquare & \square \\ \hline \square & \blacksquare & \blacksquare & \blacksquare & \square \\ \hline \square & \square & \square & \square & \square \\ \hline \end{array} \qquad \vec{u}_1 = \begin{array}{|c|c|c|c|c|} \hline \square & \square & \square & \square & \square \\ \hline \square & \blacksquare & \blacksquare & \square & \square \\ \hline \square & \square & \blacksquare & \square & \square \\ \hline \square & \square & \blacksquare & \square & \square \\ \hline \square & \square & \square & \square & \square \\ \hline \end{array}.$$

Wyświetlić obrazy wektorów $\vec{f}(\vec{u}_0)$ i $\vec{f}(\vec{u}_1)$.

(3) Niech

$$\vec{u}'_0 = \begin{array}{|c|c|c|c|c|} \hline \square & \blacksquare & \blacksquare & \blacksquare & \square \\ \hline \square & \blacksquare & \square & \blacksquare & \square \\ \hline \square & \blacksquare & \square & \blacksquare & \square \\ \hline \square & \blacksquare & \blacksquare & \blacksquare & \square \\ \hline \square & \square & \square & \square & \square \\ \hline \end{array} \qquad \vec{u}'_1 = \begin{array}{|c|c|c|c|c|} \hline \square & \square & \blacksquare & \square & \square \\ \hline \square & \square & \blacksquare & \square & \square \\ \hline \square & \square & \blacksquare & \square & \square \\ \hline \square & \square & \blacksquare & \square & \square \\ \hline \square & \square & \square & \square & \square \\ \hline \end{array}.$$

Wyświetlić obrazy wektorów $\vec{f}(\vec{u}'_0)$ i $\vec{f}(\vec{u}'_1)$.

Wskazówki dla opisu zmień w programie (Propozycja)

(1) $\vec{z}_0 \rightsquigarrow z0[i]$, $\vec{z}_1 \rightsquigarrow z1[i]$ $(1 \leq i \leq 25)$

$$\text{np. } \vec{z}_0 \rightsquigarrow z0[i] = \begin{bmatrix} -1.0, & -1.0, & -1.0, & -1.0, & -1.0, \\ -1.0, & 1.0, & 1.0, & 1.0, & -1.0, \\ -1.0, & 1.0, & -1.0, & 1.0, & -1.0, \\ -1.0, & 1.0, & 1.0, & 1.0, & -1.0, \\ -1.0, & -1.0, & -1.0, & -1.0, & -1.0 \end{bmatrix} \quad \text{(Python?)}$$

(2) $w_{ij} \rightsquigarrow w[i][j]$ $(1 \leq i, j \leq 25)$

(3) $\vec{u}_0 \rightsquigarrow u0[i]$, $\vec{u}_1 \rightsquigarrow u1[i]$, $\vec{u}'_0 \rightsquigarrow u0\_prime[i]$, $\vec{u}'_1 \rightsquigarrow u1\_prime[i]$