

Übung Multimediatdatenbanken

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Formel für Matrixelement:
$$a_{j+1,k+1} = \overline{e_j(k)} = \frac{1}{\sqrt{n}} e^{-i \frac{2\pi jk}{n}}$$

Fall für diskrete Funktion mit 2 Werten:

$$a_{1,1} = \frac{1}{\sqrt{2}} e^{-i \frac{2\pi \cdot 0 \cdot 0}{2}} = \frac{1}{\sqrt{2}} e^0 = \frac{1}{\sqrt{2}}$$

$$a_{1,2} = \frac{1}{\sqrt{2}} e^{-i \frac{2\pi \cdot 0 \cdot 1}{2}} = \frac{1}{\sqrt{2}}$$

$$a_{2,1} = \frac{1}{\sqrt{2}} e^{-i \frac{2\pi \cdot 1 \cdot 0}{2}} = \frac{1}{\sqrt{2}}$$

$$a_{2,2} = \frac{1}{\sqrt{2}} e^{-i \frac{2\pi \cdot 1 \cdot 1}{2}} = \frac{1}{\sqrt{2}} e^{-i\pi} = \frac{1}{\sqrt{2}} (\cos \pi - i \sin \pi) = -\frac{1}{\sqrt{2}}$$



$$\frac{1}{\sqrt{2}} \begin{bmatrix} 1 & 1 \\ 1 & -1 \end{bmatrix}$$

Adjungierte Matrix A^* : $a_{j+1,k+1} = \overline{a_{j+1,k+1}}$

Wirkt sich nur auf die Imaginärteile aus!

- ◆ Input Funktion: $f_2 = (1, 2)^T$
- ◆ $F(x) = A * f$
- ◆ $f(x) = A^* * F$

Hin
$$\frac{1}{\sqrt{2}} \begin{bmatrix} 1 & 1 \\ 1 & -1 \end{bmatrix} \begin{pmatrix} 1 \\ 2 \end{pmatrix} = \frac{1}{\sqrt{2}} \begin{pmatrix} 1+2 \\ 1-2 \end{pmatrix} = \frac{1}{\sqrt{2}} \begin{pmatrix} 3 \\ -1 \end{pmatrix}$$

Zurück
$$\frac{1}{\sqrt{2}} \begin{bmatrix} 1 & 1 \\ 1 & -1 \end{bmatrix} \frac{1}{\sqrt{2}} \begin{pmatrix} 3 \\ -1 \end{pmatrix} = \frac{1}{2} \begin{pmatrix} 3-1 \\ 3+1 \end{pmatrix} = \begin{pmatrix} 1 \\ 2 \end{pmatrix}$$

Siehe Übungsfoliensatz MMDB 2006

$$\diamond f = (3, 6, 2, 1)^T$$

$$\Phi(x) = 1 \text{ für } 0 \leq x < 1, \Phi(x) = 0 \text{ sonst}$$

$$\Phi_0^2 = \frac{1}{\sqrt{2}} \sum_{x=0}^{n-1} f_4(x) \Phi(x/2 - 0) = \frac{1}{\sqrt{2}} f_4(0) + f_4(1) = \frac{1}{\sqrt{2}} (3 + 6) = \frac{9}{\sqrt{2}}$$

$$\Phi_1^2 = \frac{1}{\sqrt{2}} \sum_{x=0}^{n-1} f_4(x) \Phi(x/2 - 1) = \frac{1}{\sqrt{2}} f_4(2) + f_4(3) = \frac{1}{\sqrt{2}} (2 + 1) = \frac{3}{\sqrt{2}}$$

$$\Psi(x) = 1 \text{ für } 0 \leq x < \frac{1}{2}, \Psi(x) = -1 \text{ für } \frac{1}{2} \leq x < 1, \Psi(x) = 0 \text{ sonst}$$

$$\Psi_0^2 = \frac{1}{\sqrt{2}} \sum_{x=0}^{n-1} f_4(x) \Psi(x/2 - 0) = \frac{1}{\sqrt{2}} f_4(0) - f_4(1) = \frac{1}{\sqrt{2}} (3 - 6) = \frac{-3}{\sqrt{2}}$$

$$\Psi_1^2 = \frac{1}{\sqrt{2}} \sum_{x=0}^{n-1} f_4(x) \Psi(x/2 - 1) = \frac{1}{\sqrt{2}} f_4(2) - f_4(3) = \frac{1}{\sqrt{2}} (2 - 1) = \frac{1}{\sqrt{2}}$$