

$$n = \begin{pmatrix} 0 & 1 & 2 \end{pmatrix}$$

$$h = \begin{pmatrix} 0 & 1 & 2 \end{pmatrix}$$

$$\text{np.outer}(h, n) = \begin{pmatrix} 0 \\ 1 \\ 2 \end{pmatrix} \cdot \begin{pmatrix} 0 & 1 & 2 \end{pmatrix}$$

$$= \begin{pmatrix} 0.0 & 0.1 & 0.2 \\ 1.0 & 1.1 & 1.2 \\ 2.0 & 2.1 & 2.2 \end{pmatrix} = \begin{pmatrix} 0 & 0 & 0 \\ 0 & 1 & 2 \\ 0 & 2 & 4 \end{pmatrix}$$

$$y = T_w \cdot x$$

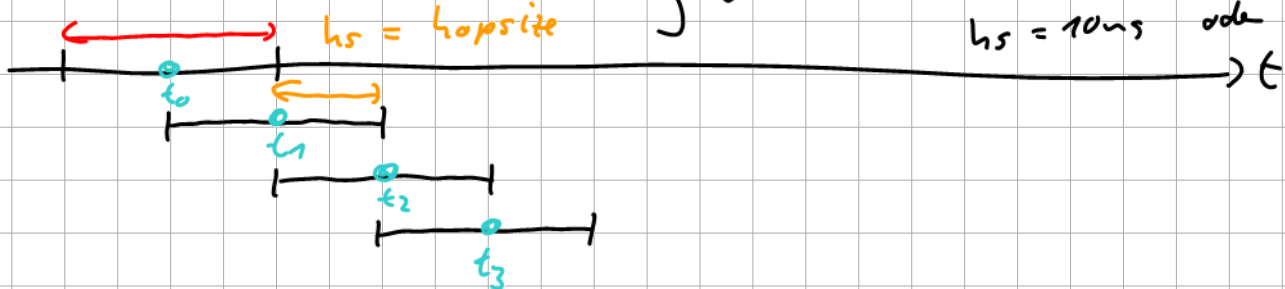
$$z = T_{\text{DFT}} \cdot y = \underbrace{T_{\text{DFT}} \cdot T_w}_{\text{offline Berechnung: einmalig}} \cdot x = T \cdot x$$

Zeitachse der STFT

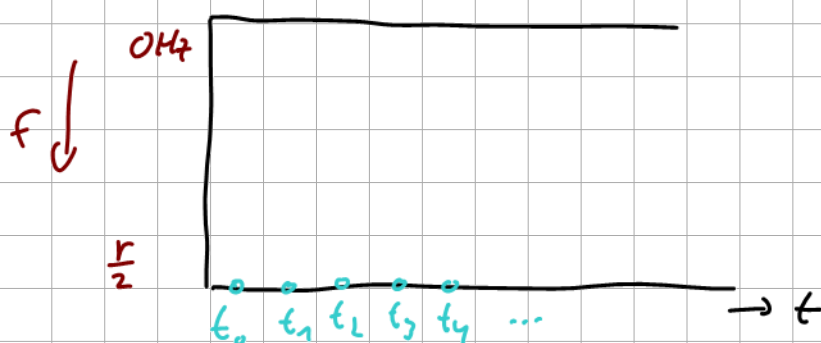
$w_s = \text{window size}$

$h_s = \text{hop size}$

typisch: $w_s = 2 \cdot h_s$ oder $w_s = 4 \cdot h_s$
 $h_s = 10 \text{ms}$ oder $h_s = 20 \text{ms}$

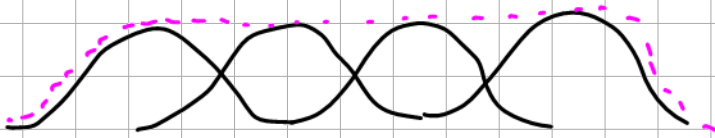


STFT





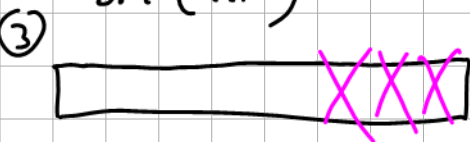
Ereignisse in diesem Bereich werden „verpasst“



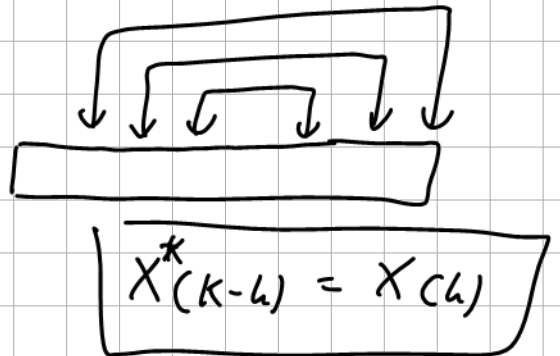
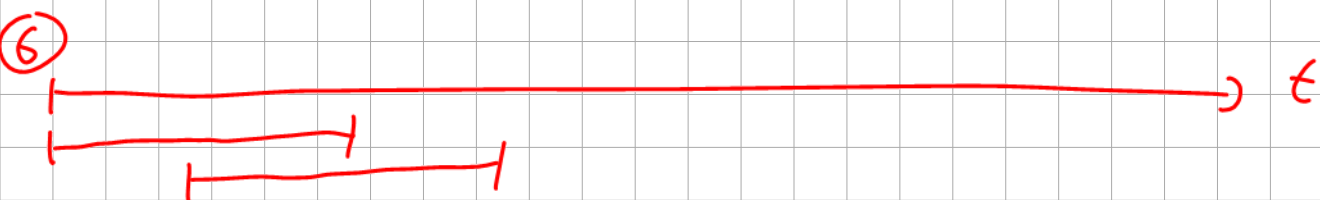
Zeitauflösung von Mensch: $t_s \approx 1\text{ms}$



② DFT (...)



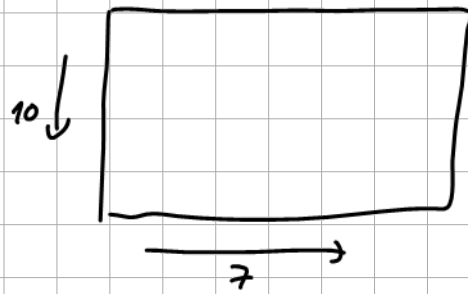
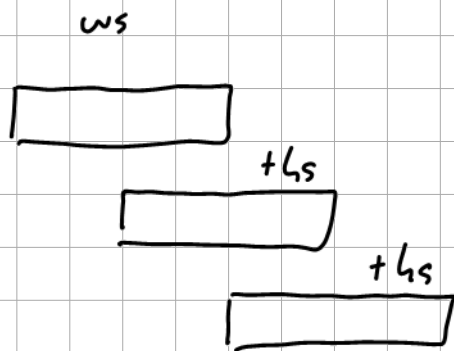
⑤ IFFT (...)



infft

$$ws = 4$$

$$hs = 2$$



$$ws + (7-1) \cdot hs$$

↓
↑
 $X.shape[1] \hat{=} \text{Anzahl Spalten}$













