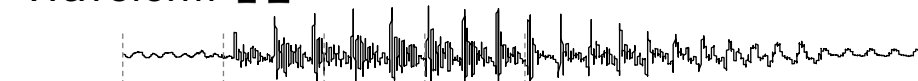
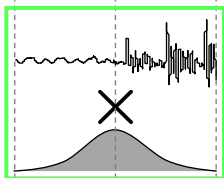


Time domain

Waveform \mathbf{X}



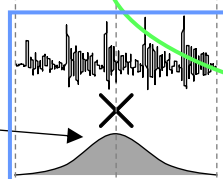
$\mathbf{x}^{(1)}$



...

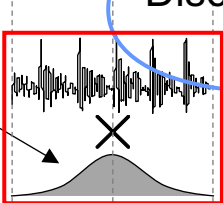
Discrete Fourier transform

$\mathbf{x}^{(2)}$



Discrete Fourier transform

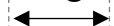
$\mathbf{x}^{(3)}$



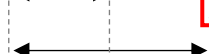
Discrete Fourier transform

Window
function ω

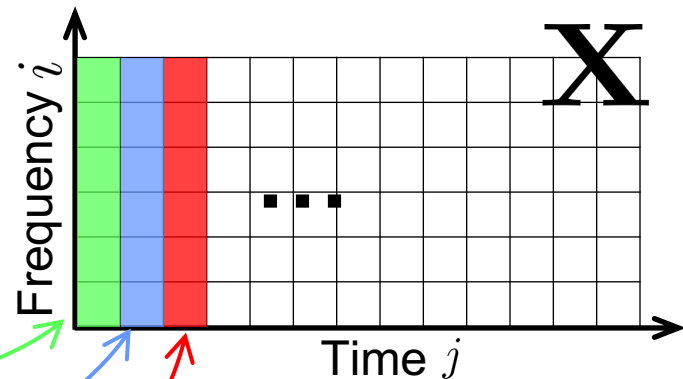
Shift length \mathcal{T}



Short-time length Q



Time-frequency domain



Spectrogram
complex-valued matrix