

IEG4160 Image and Video Processing

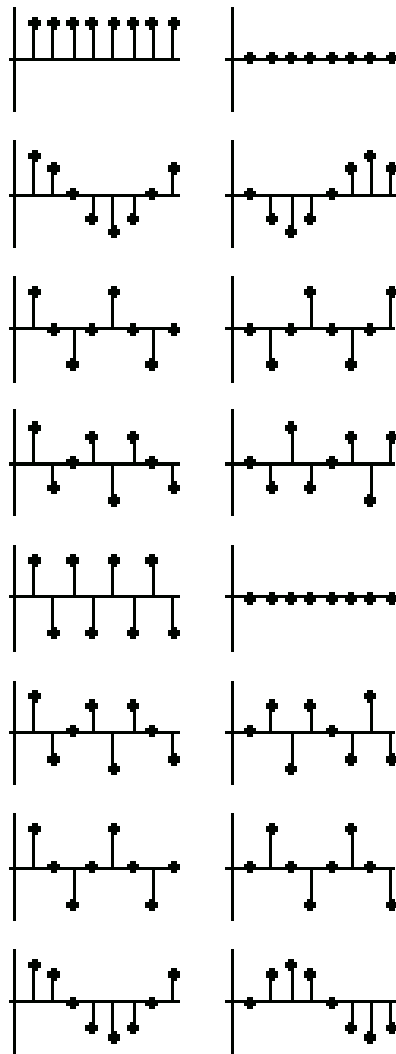
# Transforms – Summary

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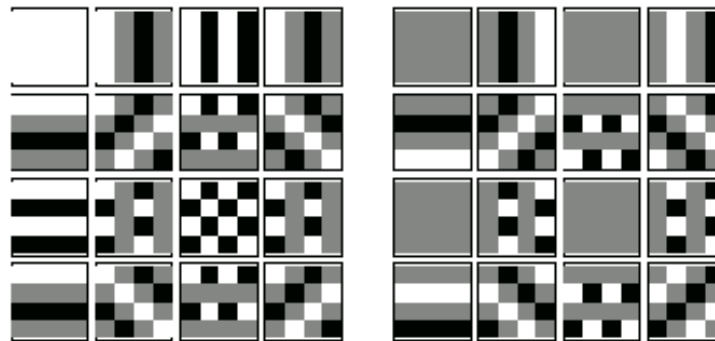
*Chang-Su Kim*

# DFT

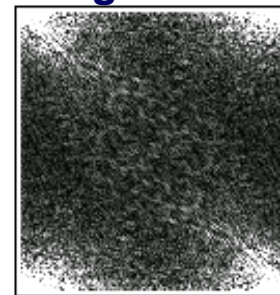
1D basis vectors  
(real, imaginary)



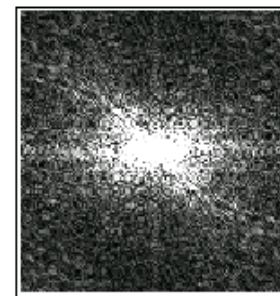
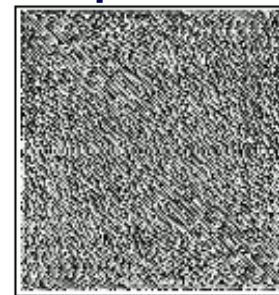
2D basis images (real, imaginary)



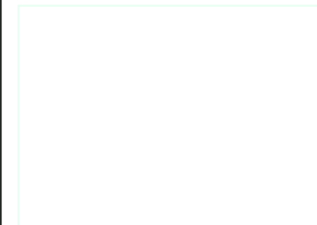
magnitude



phase



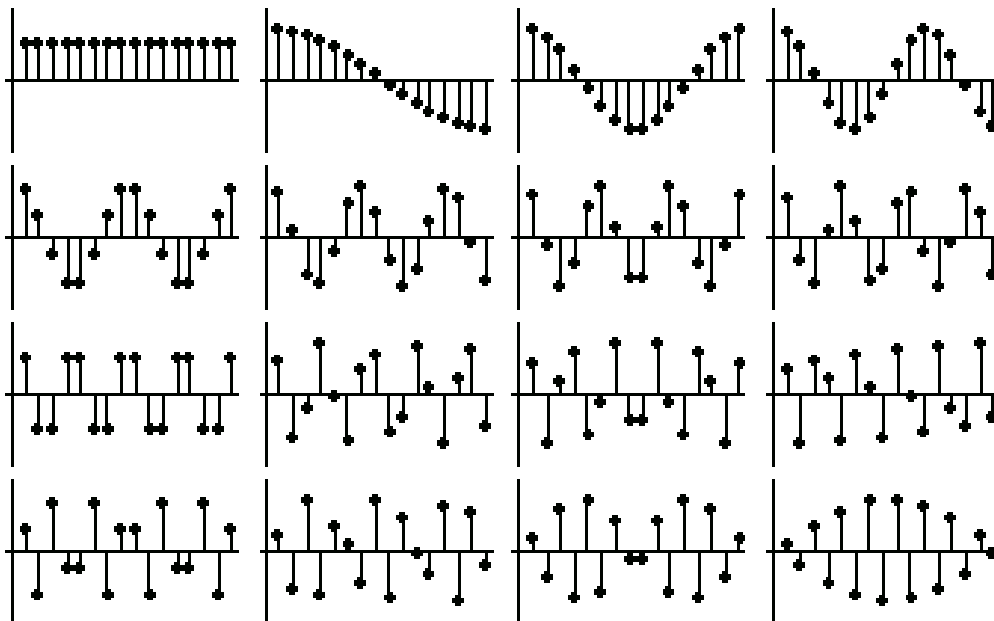
shifted magnitude



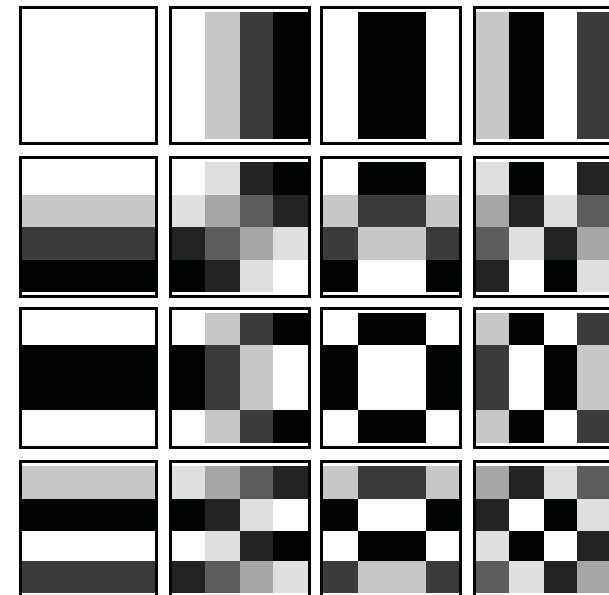
# DCT

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1D basis vectors

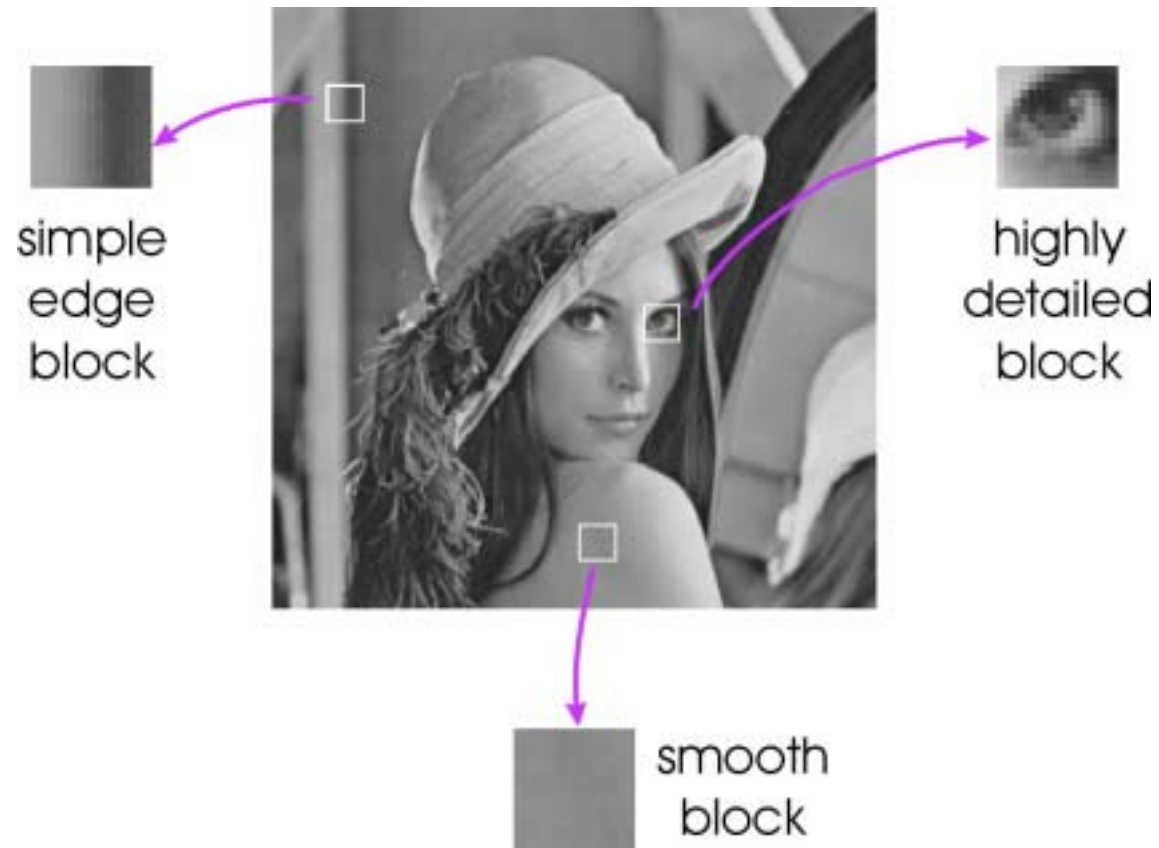


2D basis images

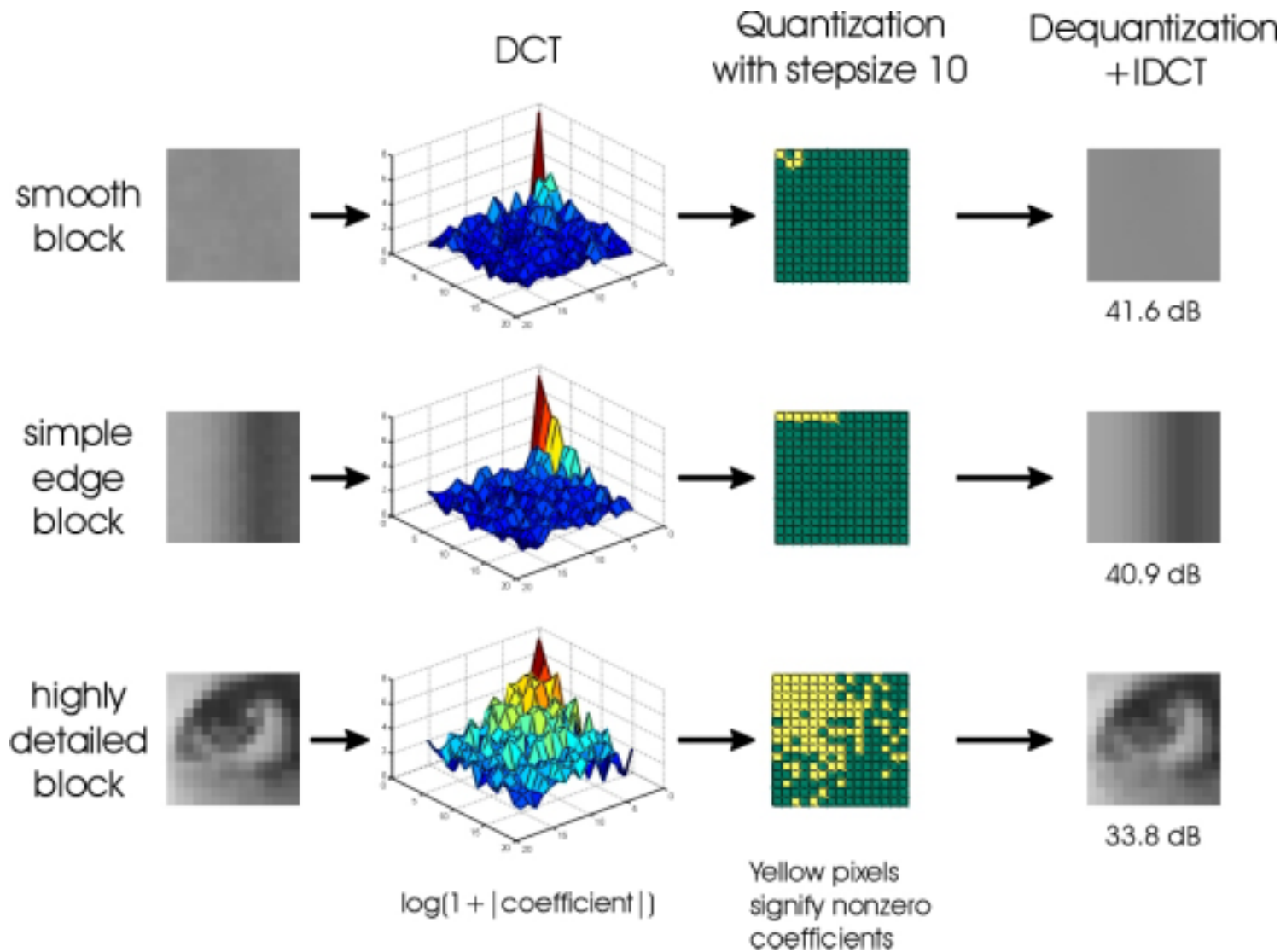


# DCT

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# DCT



# Hadamard Transform

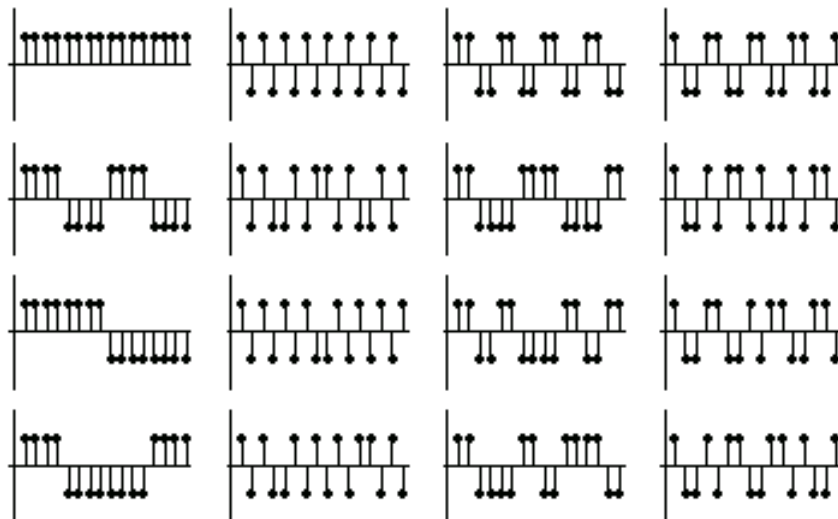
1D transform matrix

$$H_2 = \frac{1}{2} \begin{bmatrix} 1 & 1 & 1 & 1 \\ 1 & -1 & 1 & -1 \\ 1 & 1 & -1 & -1 \\ 1 & -1 & -1 & 1 \end{bmatrix}$$

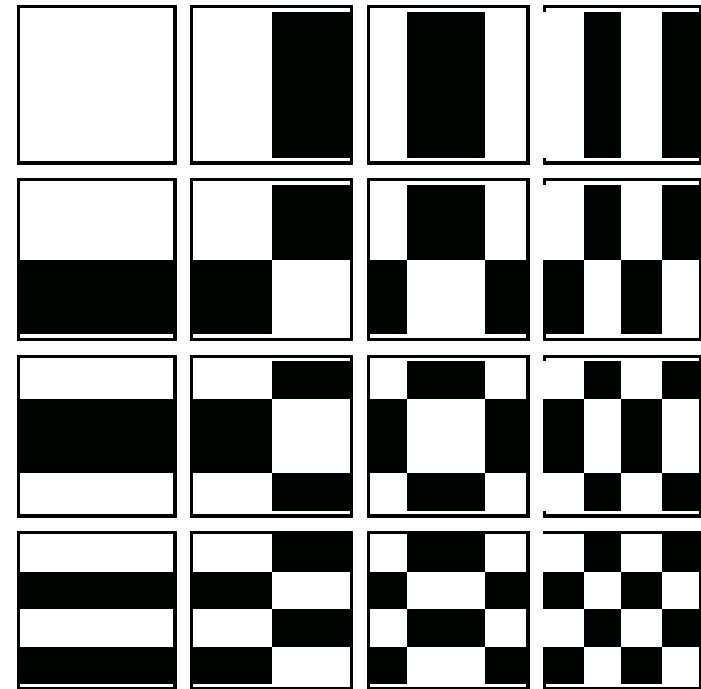
$$\tilde{H}_2 = \frac{1}{2} \begin{bmatrix} 1 & 1 & 1 & 1 \\ 1 & 1 & -1 & -1 \\ 1 & -1 & -1 & 1 \\ 1 & -1 & 1 & -1 \end{bmatrix}$$

1D basis vectors

for 16-point Hadamard transform



2D basis images



# Haar Transform

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1D transform matrix

$$A = \begin{bmatrix} \frac{1}{2} & \frac{1}{2} & \frac{1}{2} & \frac{1}{2} \\ \frac{1}{2} & \frac{1}{2} & -\frac{1}{2} & -\frac{1}{2} \\ \frac{1}{\sqrt{2}} & -\frac{1}{\sqrt{2}} & 0 & 0 \\ 0 & 0 & \frac{1}{\sqrt{2}} & -\frac{1}{\sqrt{2}} \end{bmatrix}$$

2D basis images

