

Motivation

- steganographic tools on the Internet
 - about 20 available tools at present
 - secret message mostly hidden in pictures
 - replacement of least significant bits
- security of those tools
 - based on encryption of the secret message
 - embedded data detectable, contents not

Steganographic Video Conference

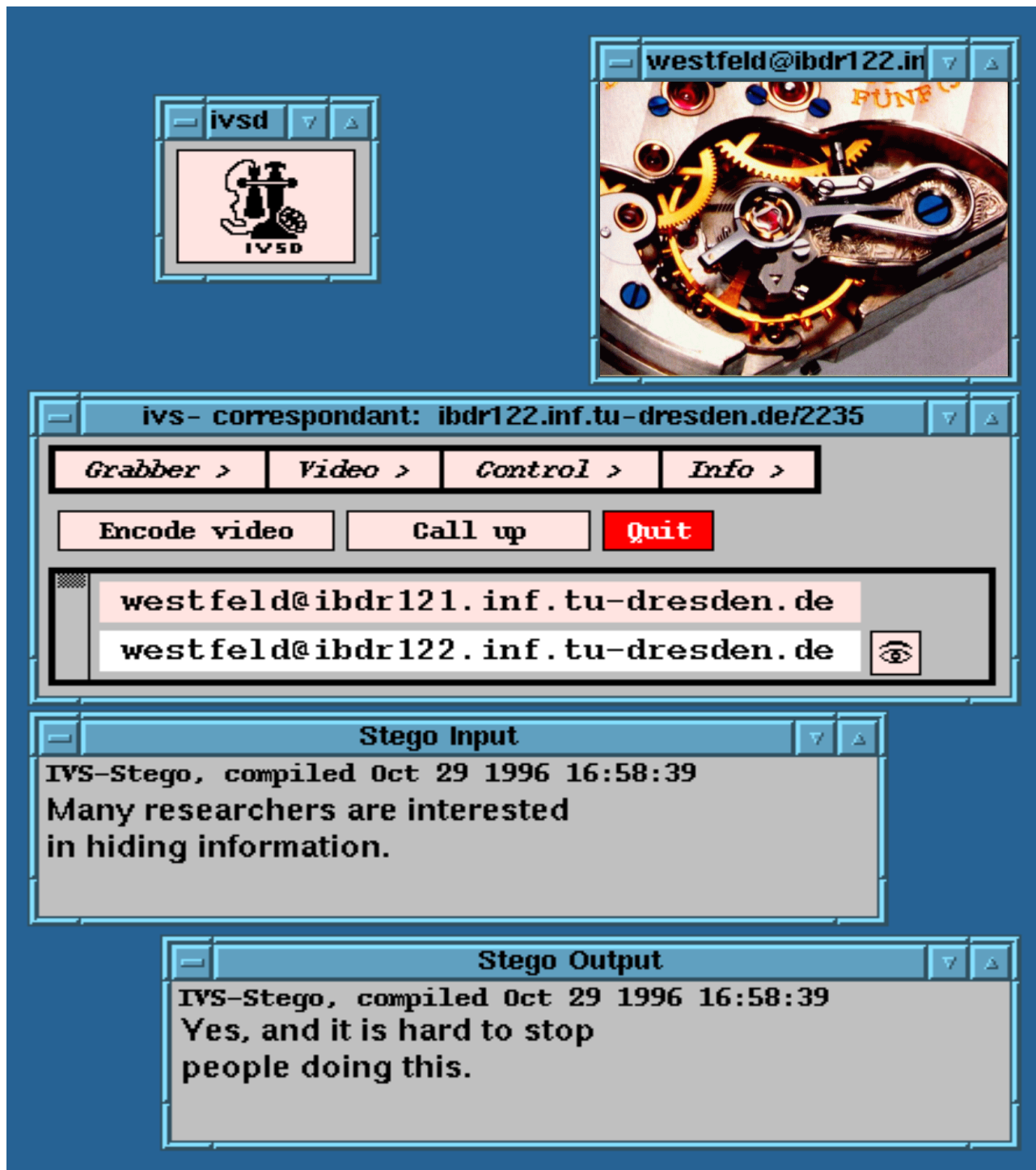
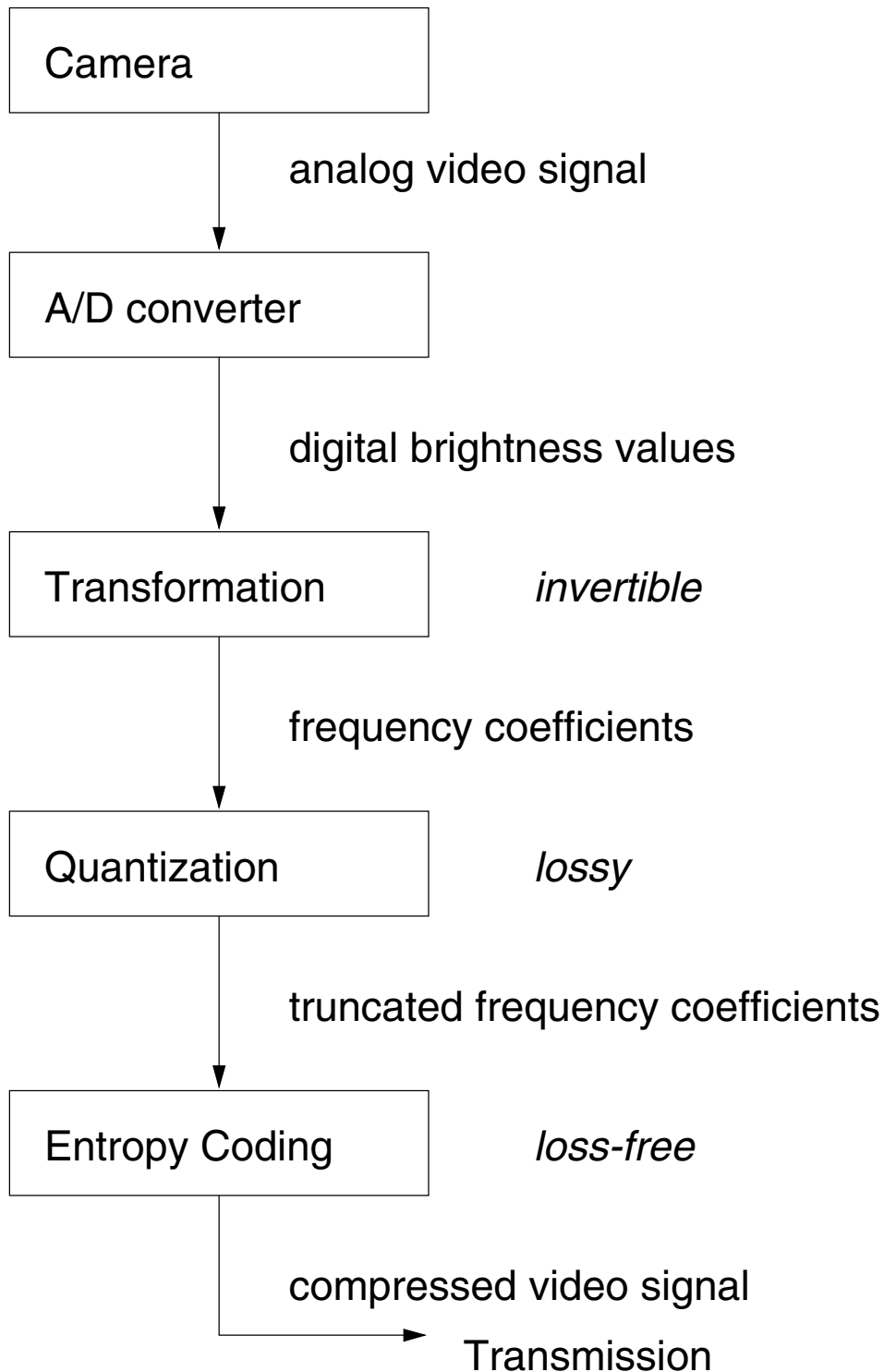
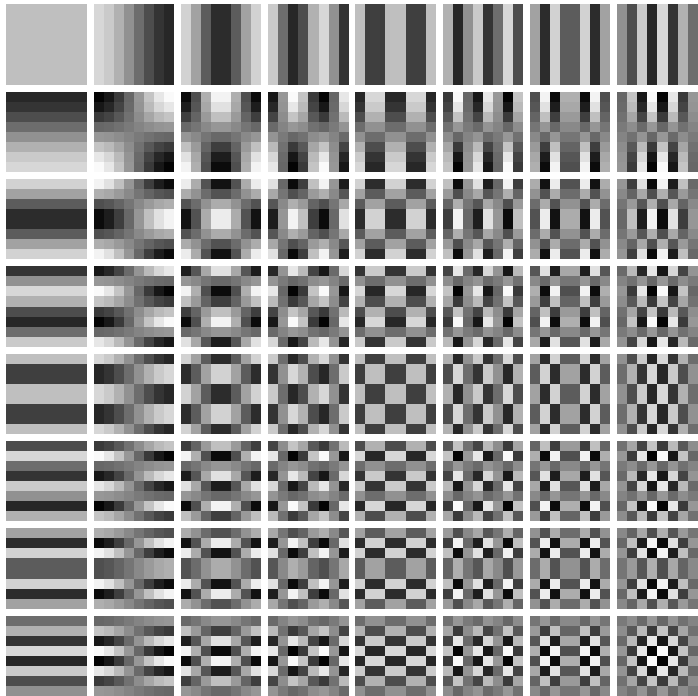


Image and Video Compression



Discrete Cosine Transformation (DCT)

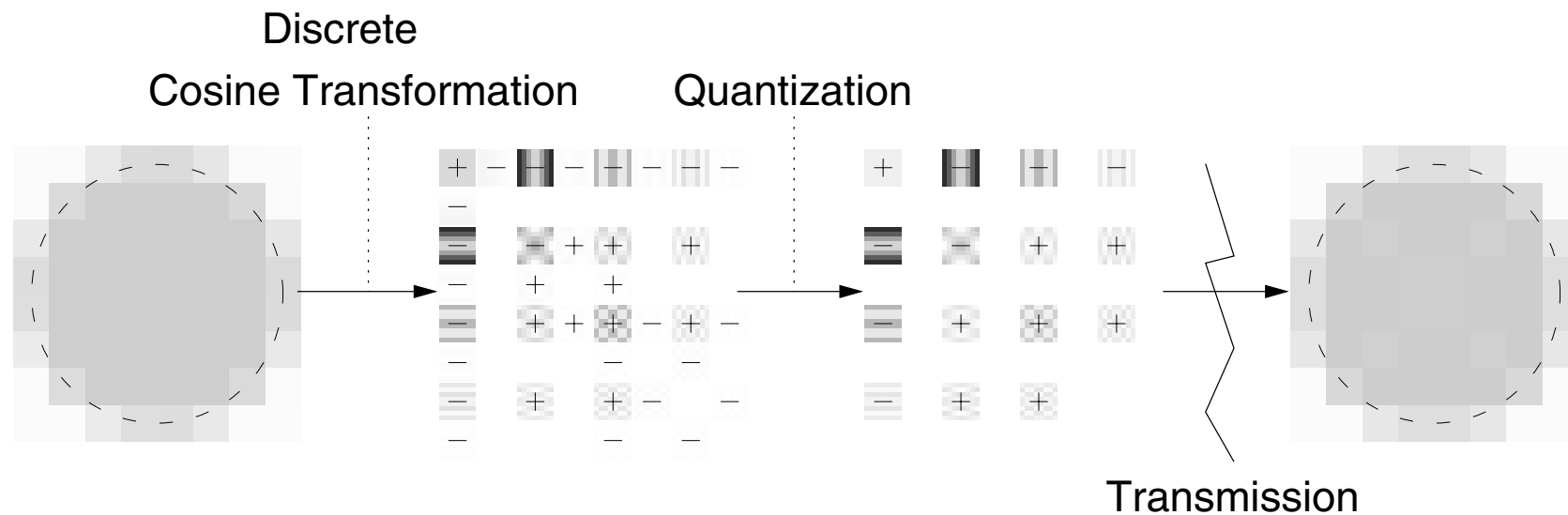
$$\begin{array}{|c|} \hline 8 \times 8 \\ \text{image} \\ \hline \end{array} = f(0,0) \cdot \begin{array}{|c|} \hline \text{DC component} \\ \hline \end{array} + f(0,1) \cdot \begin{array}{|c|} \hline \text{cosine wave} \\ \hline \end{array} + f(0,2) \cdot \begin{array}{|c|} \hline \text{cosine wave} \\ \hline \end{array} + \dots + f(7,6) \cdot \begin{array}{|c|} \hline \text{cosine wave} \\ \hline \end{array} + f(7,7) \cdot \begin{array}{|c|} \hline \text{cosine wave} \\ \hline \end{array}$$



- take the image to pieces
- transform the pieces to frequencies
- this process is invertible

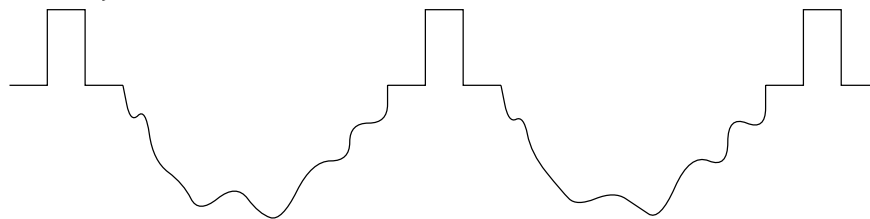
Image and Video Compression (2)

- starting point: 64 brightness values
- e. g. transmission of only 15 entropy coded values
- change of values after lossy quantization step

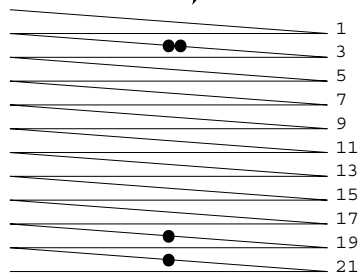


Horizontal Vagueness of the Pixels

vagueness of the horizontal synchronizing pulses



80 ns



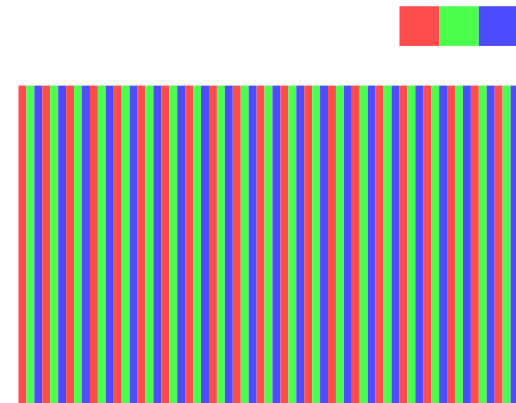
– H/V bandwidth ratio 800:1

– more noise in horizontal direction

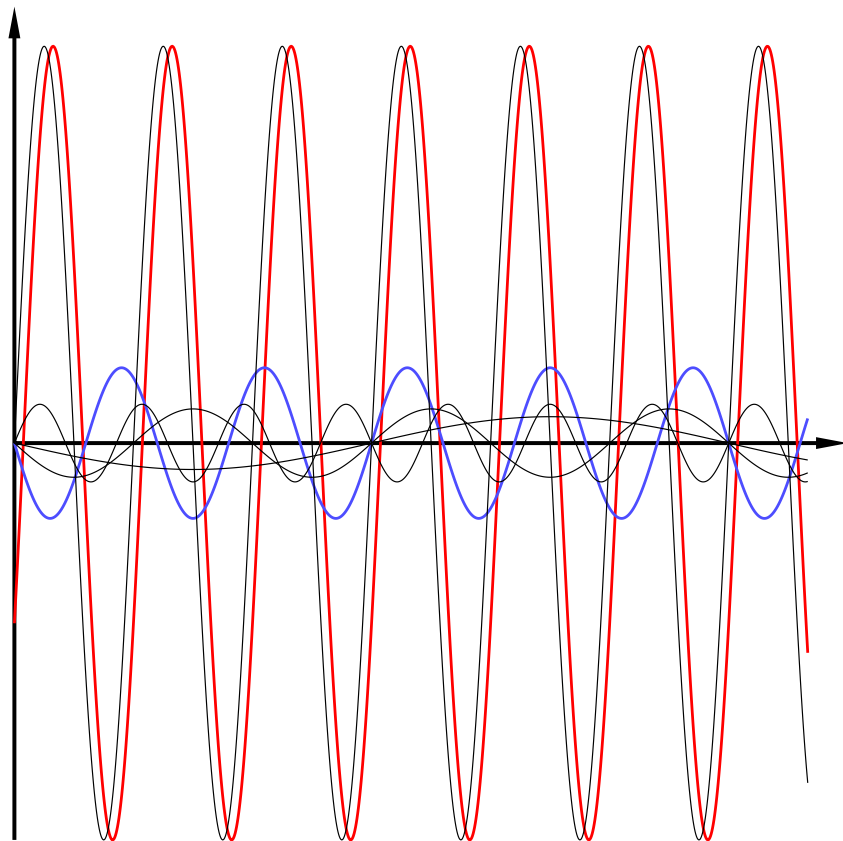
64 μ s

Sensor Distance

- CCD as image sensor
- matrix of sensors behind stripe filter
- 3 sensors make one pixel
- sensor distance is neglected
- sensor distance corresponds to $\frac{1}{4}$ pixel distance on screen
(already with QCIF: 176 x 144)
- horizontal sharpness less than digital resolution
- horizontal dephasing inconspicuous



Producing a Frequency Spectrum by Shifting



— shifted signal

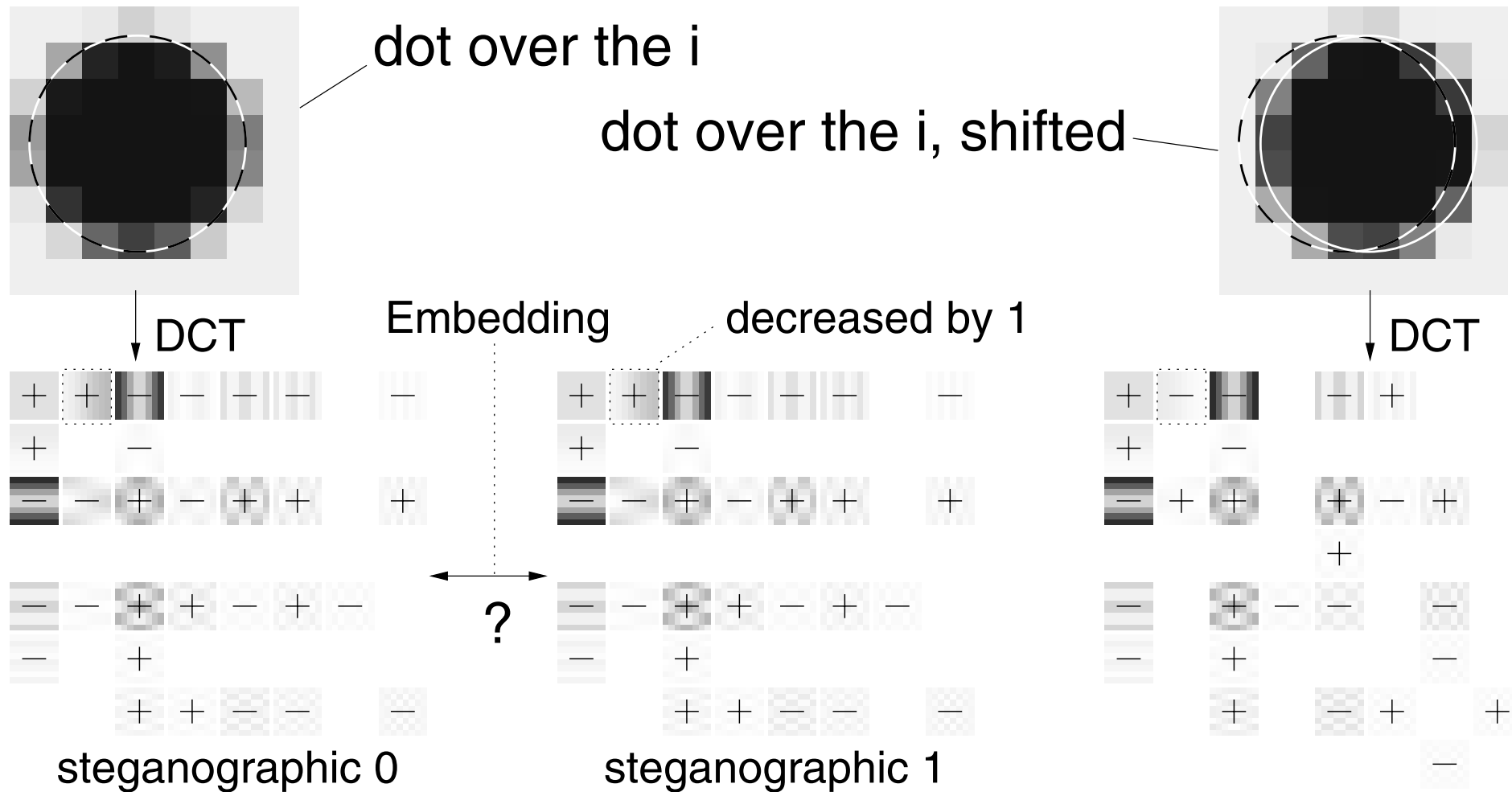
— largest amplitude produced

– phase shifting causes additional frequencies

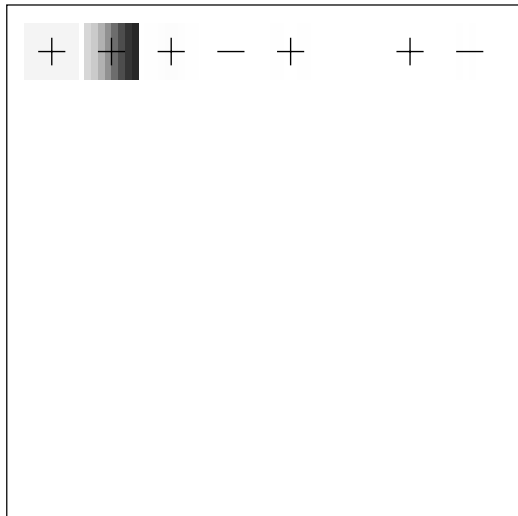
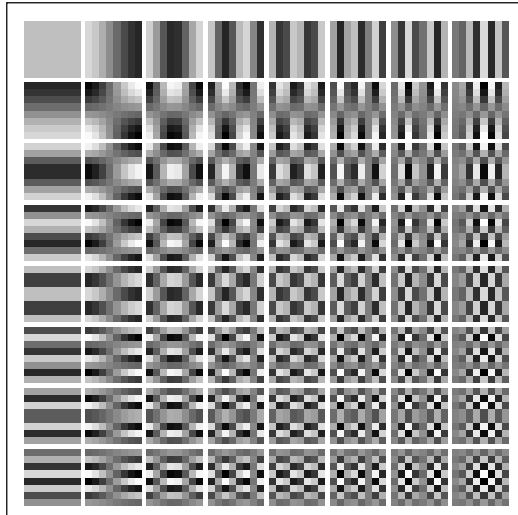
– superimposing a frequency causes a phase shift

$$\sin(6x - d) = -0.07 \sin x - 0.09 \sin 3x - 0.19 \sin 5x + \sin 6x + 0.10 \sin 7x$$

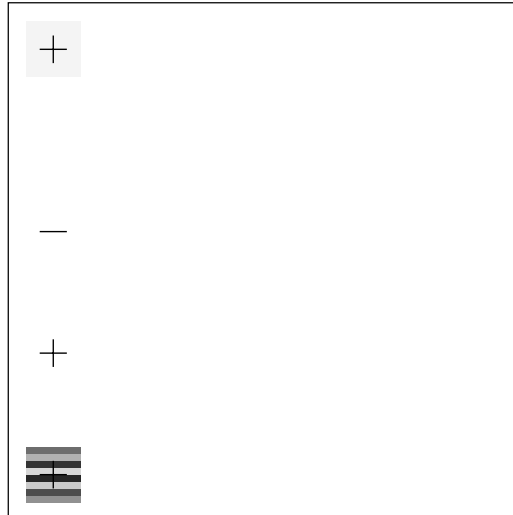
Embedding: Shifting by Changing the Frequency Spectrum



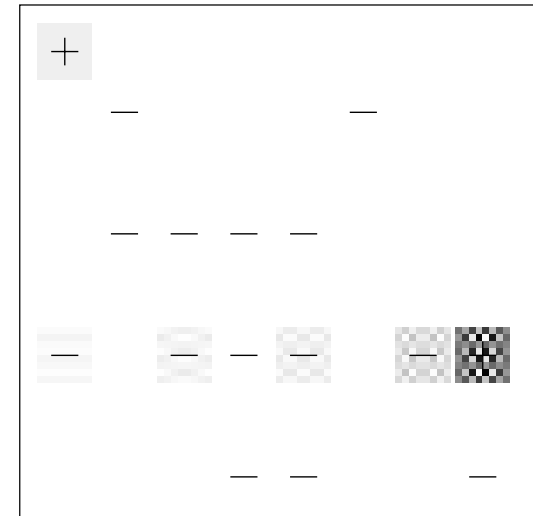
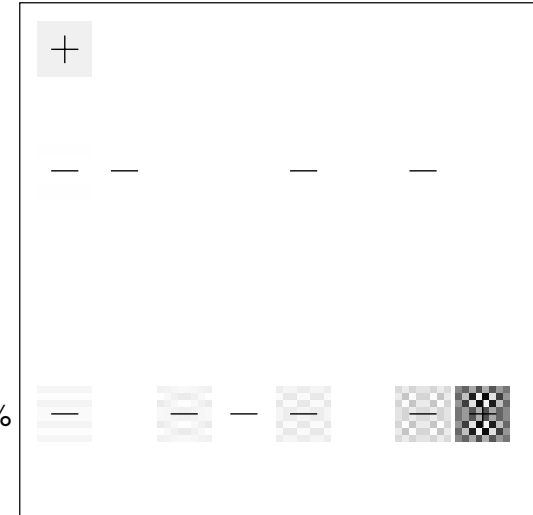
Investigation by Transforming Shifted Base Images



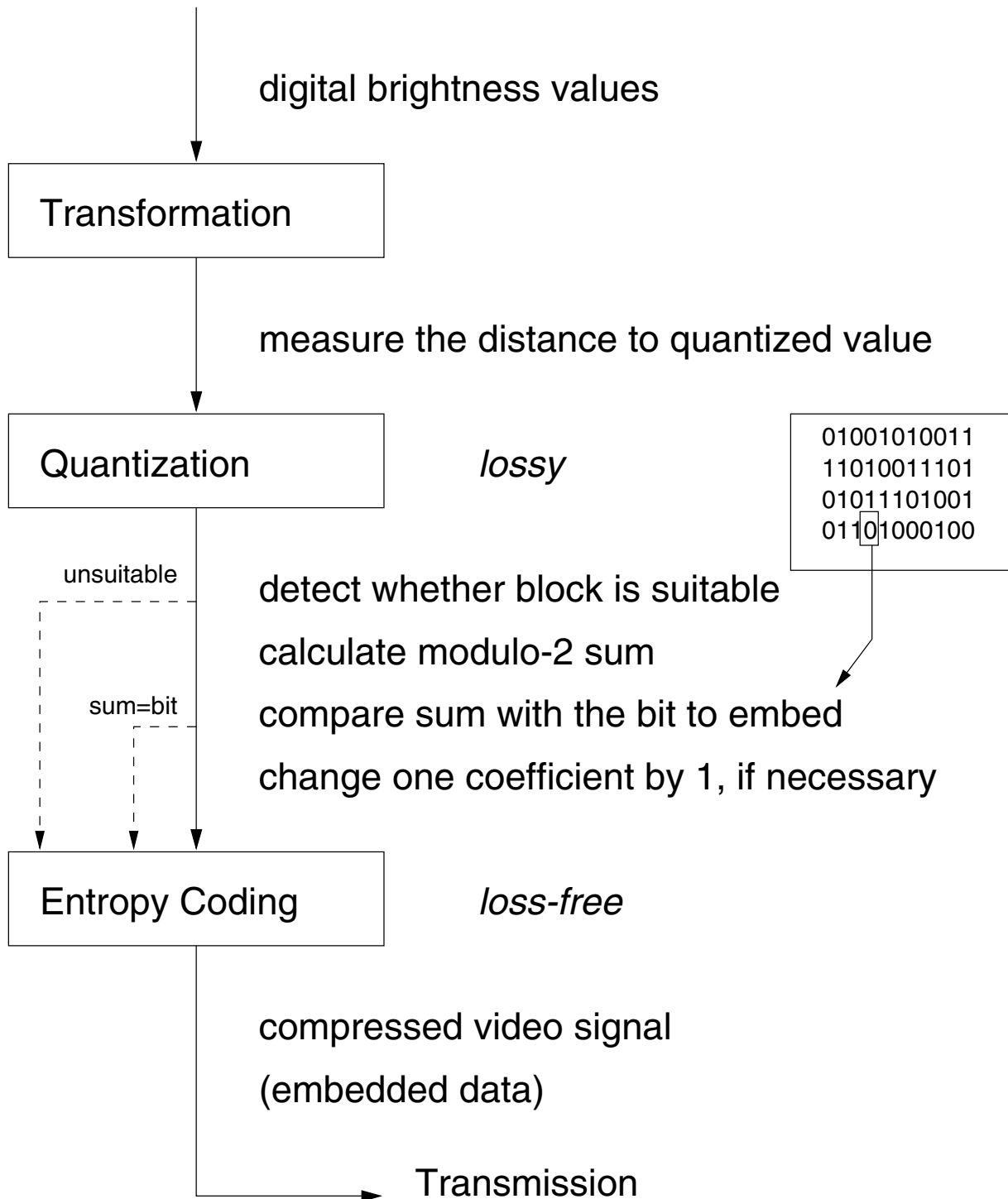
1.51 %



12.3 %



Embedding



Extraction

