Unidade Curricular

“Informação e Codificação”

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IEETA

LASI

Outline

- Guiding questions
- Challenges
- Signals
- Sampling and quantization
- Multi-dimensional signals

Some guiding questions

1. What is a signal?
2. What are the main types of signals?
3. What types of values can represent a signal?
4. What is Digital Signal Processing
5. What is a system in signal processing, and how does it transform signals?
6. What is sampling? Why is it important in DSP?
7. What is quantization? How does it affect signal quality?

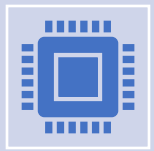
Challenge

How much storage space is needed for a simple text file?

Assume a text file contains 1,000,000 characters. Each character is stored as 1 byte (ASCII encoding).

How much space is required to store 1 minute of uncompressed audio?

Assume the audio has a sampling rate of 44.1 kHz, is recorded in stereo (2 channels), and uses 16-bit samples (2 bytes per sample).



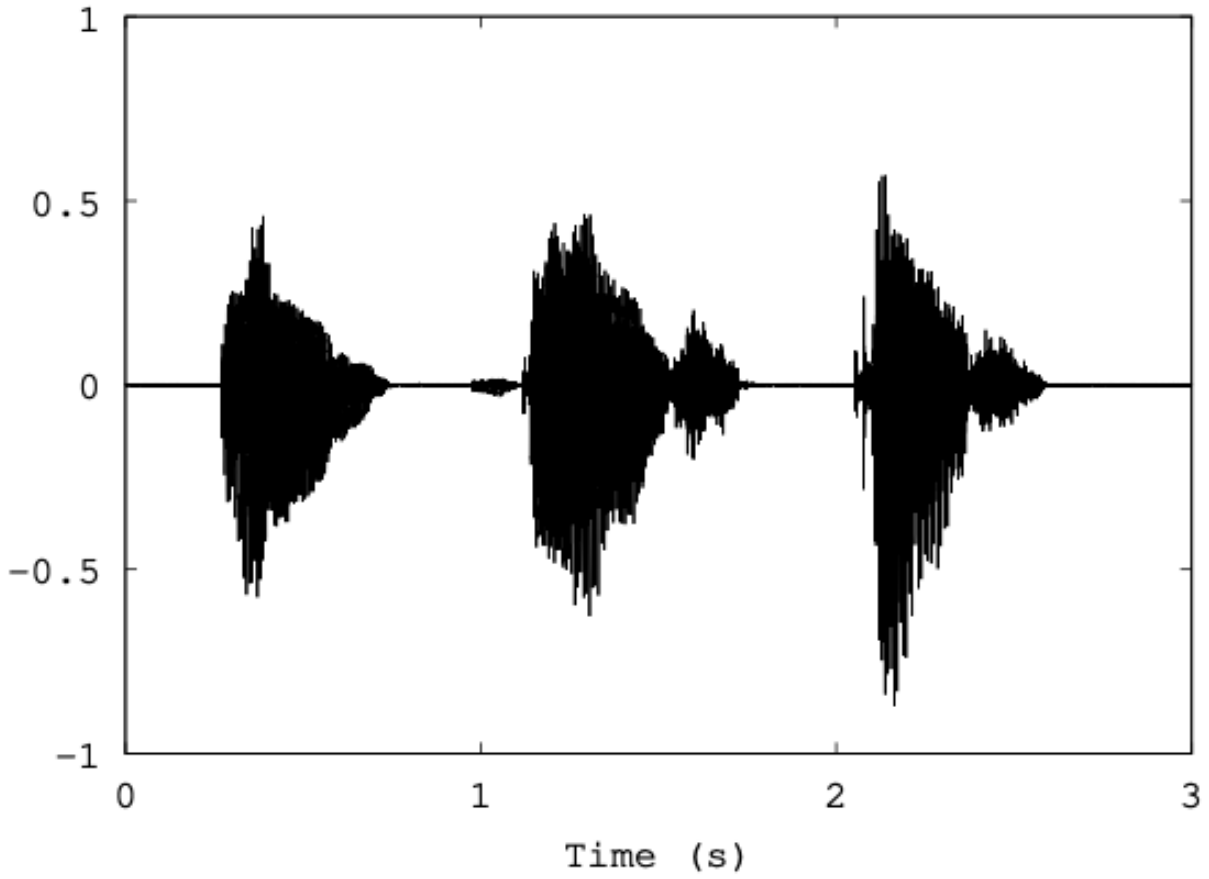
How much space is required for an uncompressed grayscale image?

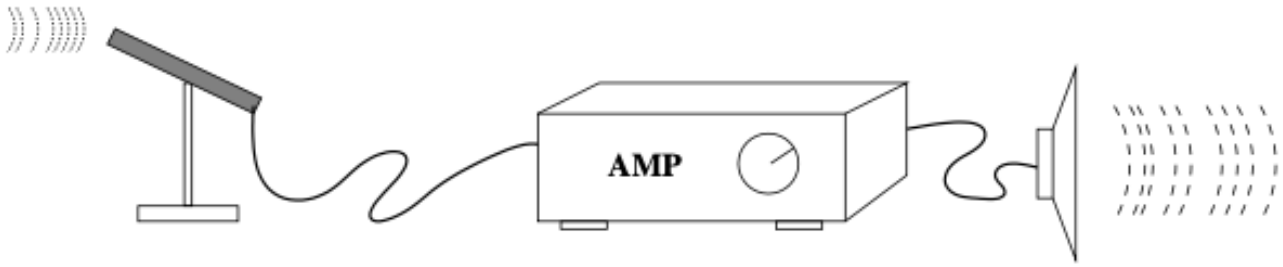
Assume an image is 1920x1080 pixels (Full HD resolution), and each pixel is represented by 8 bits (1 byte) for grayscale intensity.

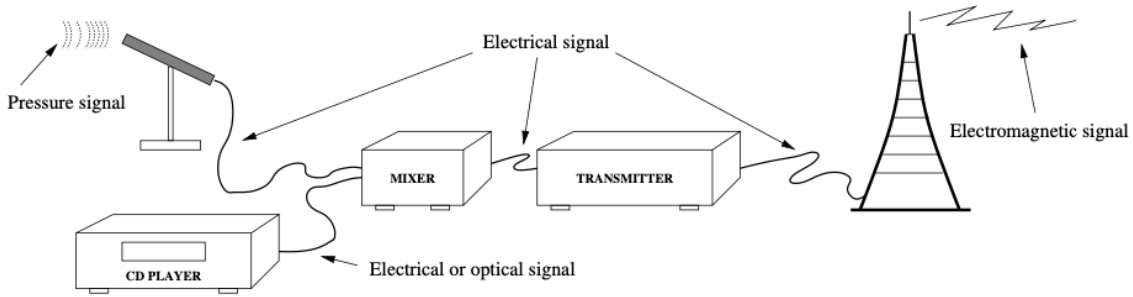
How much storage is required for 1 minute of uncompressed Full HD video (24 frames per second)?

Assume the video is 1920x1080 pixels (Full HD), 24 frames per second, and each pixel in each frame is represented by 24 bits (3 bytes for RGB color).

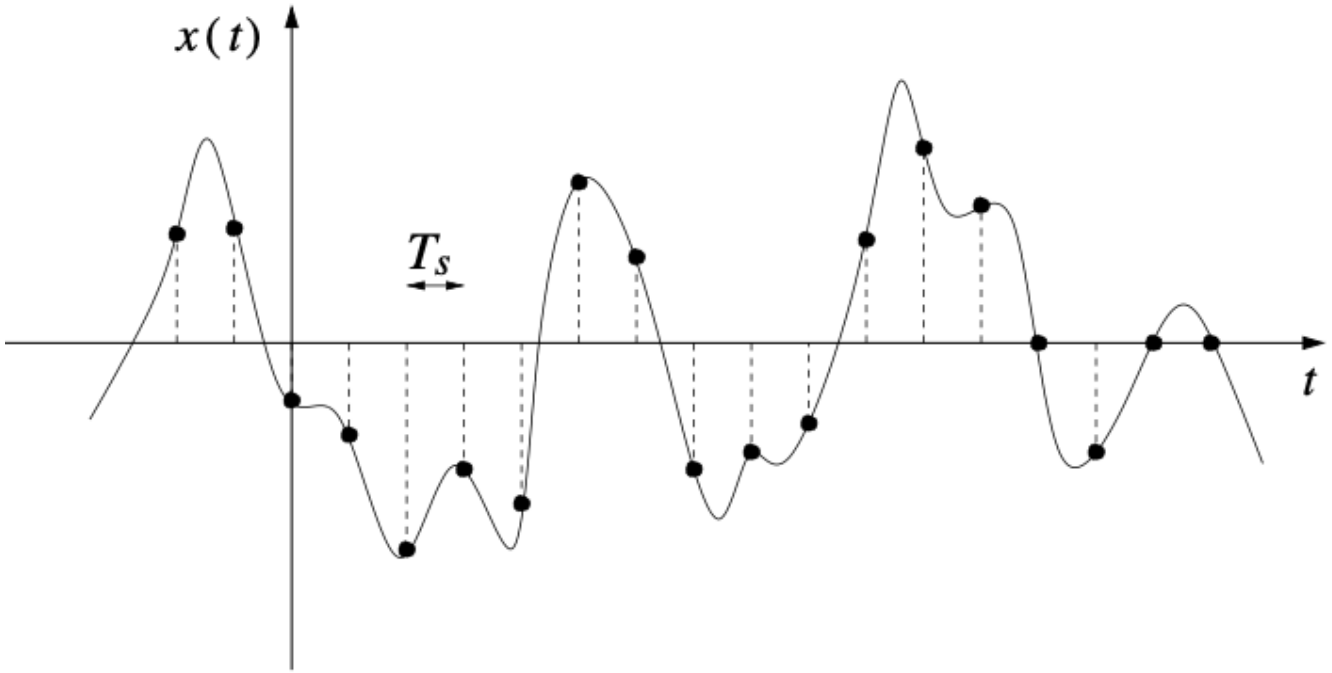
Signals

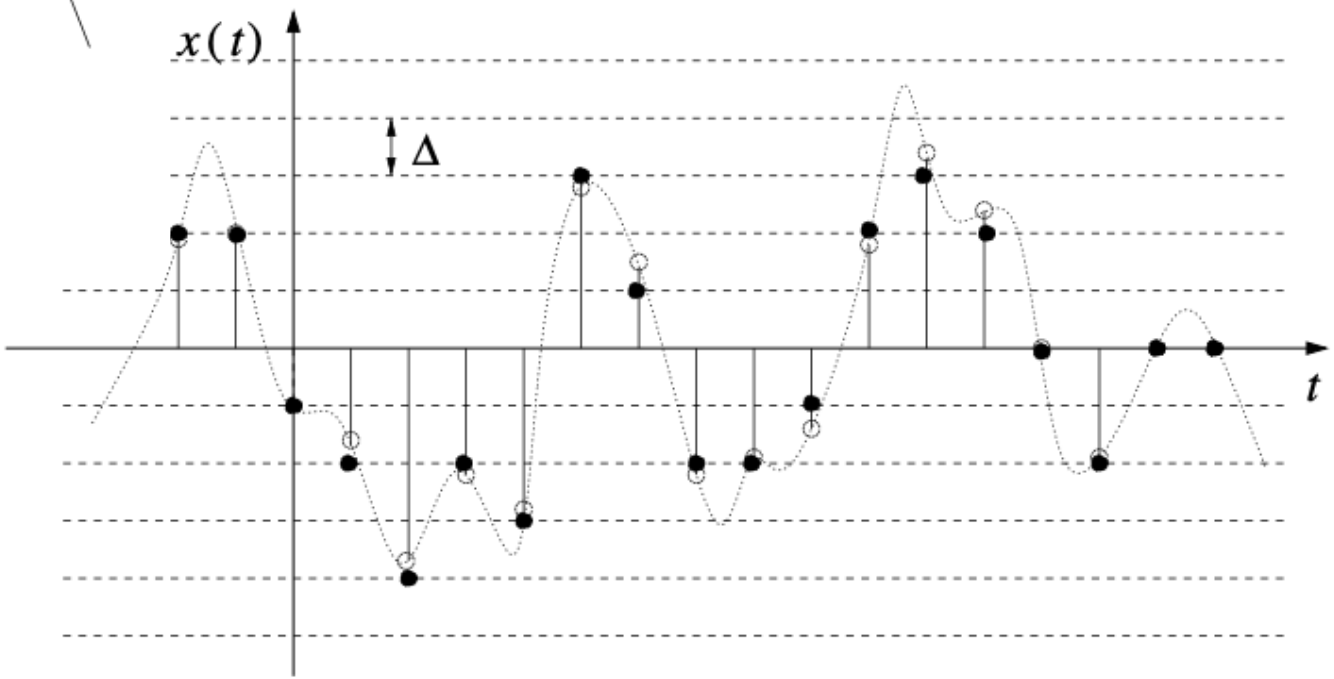

1
0.5
0
−0.5
−1
0
1
2
3
Time (s)


AMP

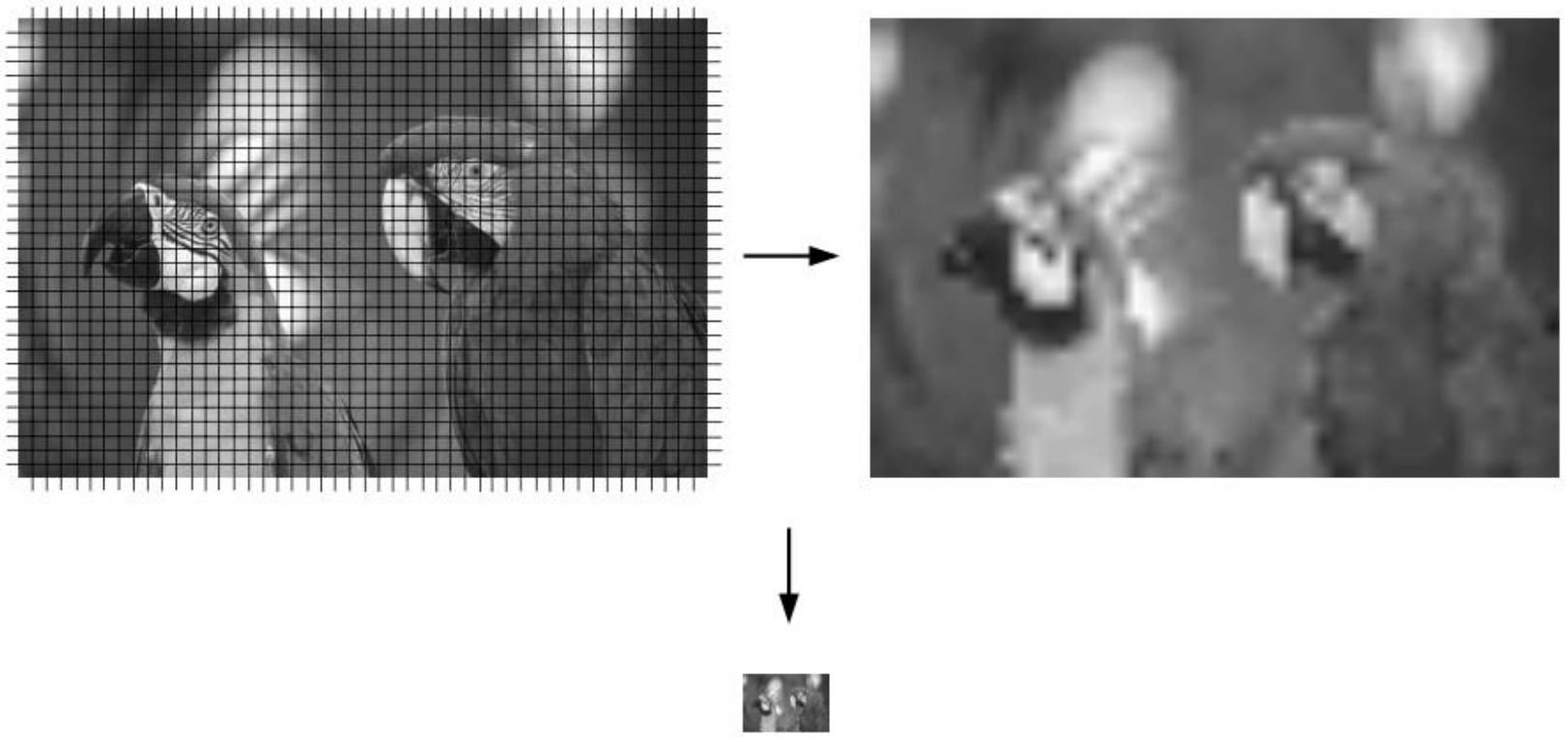

Pressure signal
Electrical signal
MIXER
TRANSMITTER
Electromagnetic signal
CD PLAYER
Electrical or optical signal

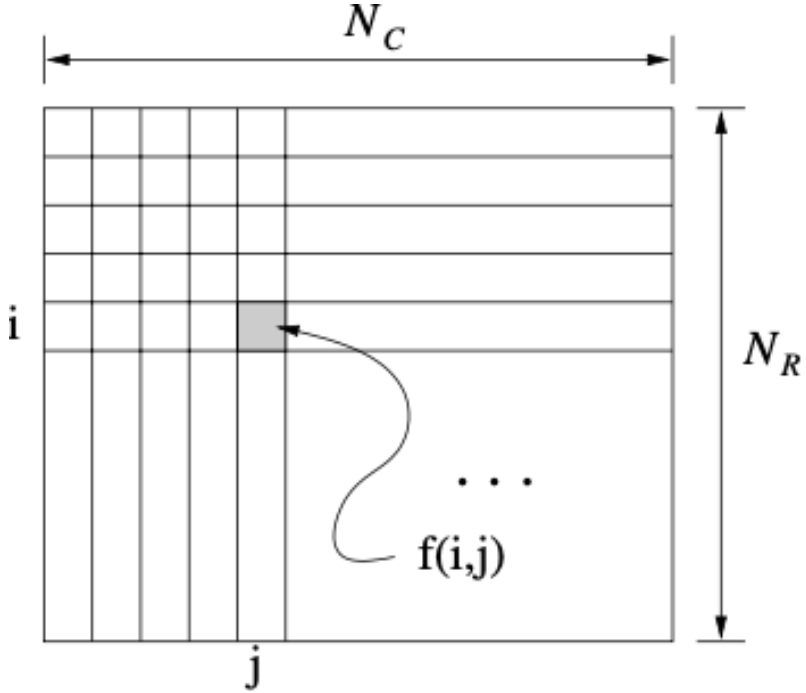
Sampling and quantization





Multi dimensional signals





Quantization and types of images

2 bits/pixel

4 bits/pixel

(a)

(b)

6 bits/pixel

8 bits/pixel (original)

(c)

(d)

(a) color; (b) indexed color (256 colors);
(c) gray level (256 levels); (d) binary (2 levels)