BINUS UNIVERSITY INTERNATIONAL

COMP6341 - Multimedia and Human Computer Interaction

Compression - Lossy

Week 6 - Session 2

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Session Learning Outcomes

Upon completion of this session, students are expected to be able to

- LO 6 - Distinguish the different compression principles, techniques and multimedia compression standards

Introduction

- Lossless compression algorithms do not deliver compression ratios that are high enough.
- Hence, most multimedia compression algorithms are lossy.
- What is lossy compression?
  - The compressed data is not the same as the original data, but a close approximation of it.
  - Give a much higher compression

Lossy Compression Methods

- Our eyes and ears cannot distinguish subtle changes.
- In such cases, we can use a lossy data compression method.
- These methods are cheaper—they take less time and space when it comes to sending millions of bits per second for images and video.

Lossy Compression Methods

- Several methods have been developed using lossy compression techniques.
- JPEG (Joint Photographic Experts Group) encoding is used to compress pictures and graphics
- MPEG (Moving Picture Experts Group) encoding is used to compress video
- MP3 (MPEG audio layer 3) for audio compression.

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Image compression – JPEG

- An image can be represented by a 2-dimensional array (table) of picture elements (pixels).
- A grayscale picture of 307,200 pixels is represented by 2,457,600 bits, and a color picture is represented by 7,372,800 bits.
- In JPEG, a grayscale picture is divided into blocks of 8 × 8 pixel blocks to decrease the number of calculations because, as we will see shortly, the number of mathematical operations for each picture is the square of the number of units.

Image compression – JPEG

- JPEG grayscale example, 640 × 480 pixels

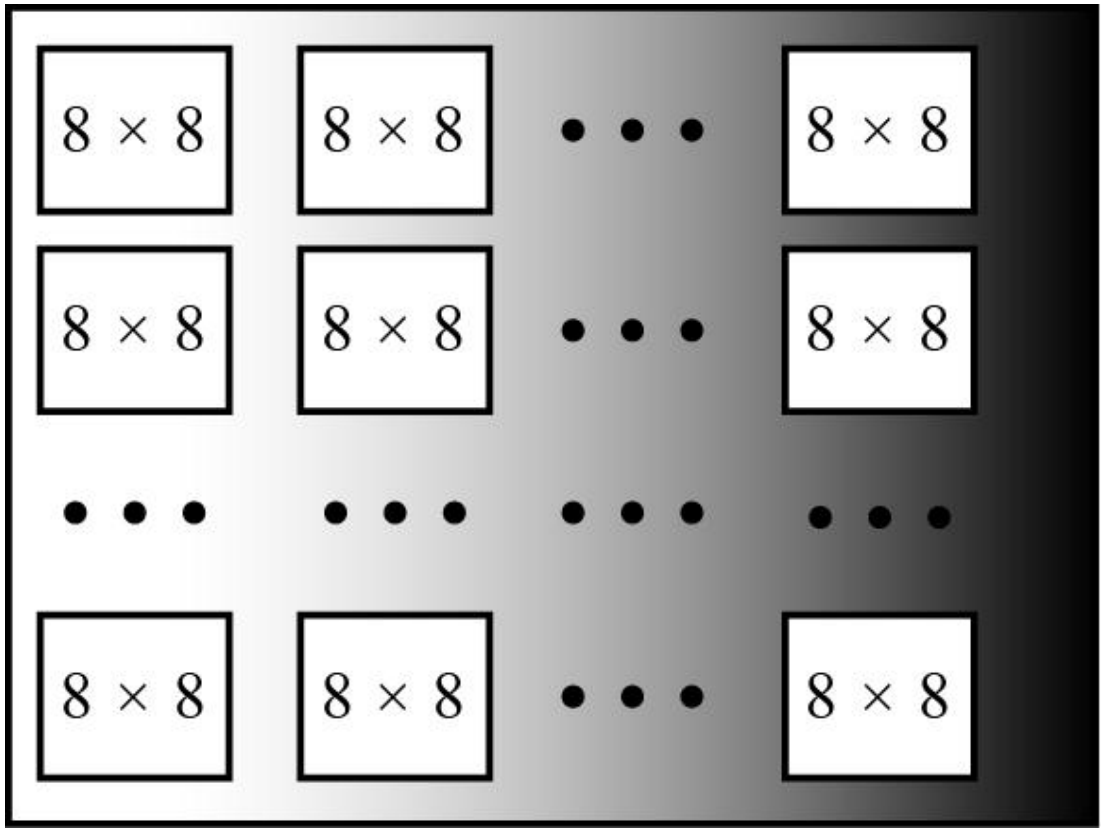

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Image compression – JPEG

- The whole idea of JPEG is to change the picture into a linear (vector) set of numbers that reveals the redundancies.
- The redundancies (lack of changes) can then be removed using one of the lossless compression methods we studied previously.

Image compression – JPEG

- A simplified version of the process

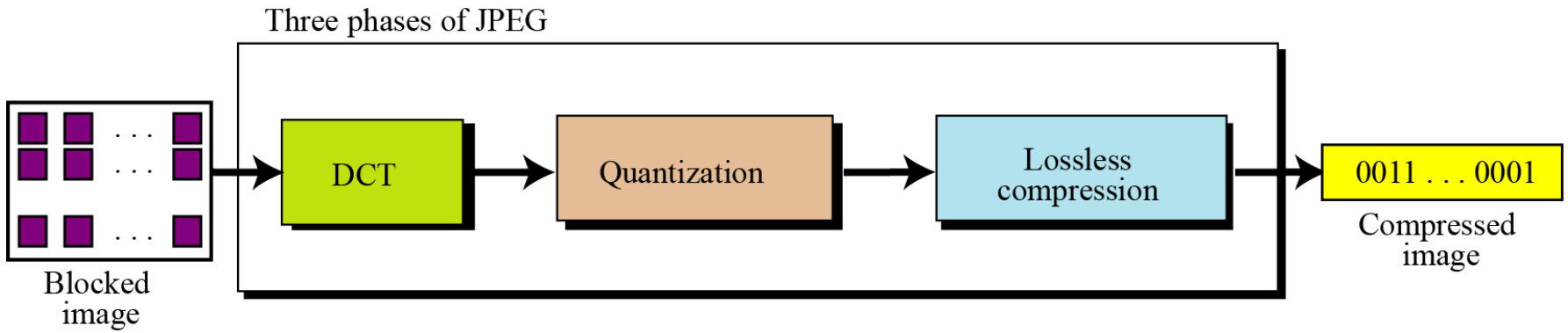

Image compression – JPEG

Discrete cosine transform (DCT)

- In this step, each block of 64 pixels goes through a transformation called the discrete cosine transform (DCT).
- The transformation changes the 64 values so that the relative relationships between pixels are kept but the redundancies are revealed.

Image compression – JPEG

- The formula is

$$X_k = \sum_{n=0}^{N-1} x_n \cos\left[\frac{\pi}{N}\left(n+\frac{1}{2}\right)k\right] \qquad k = 0, \ldots, N-1.$$

Image compression – JPEG

Quantization

- Quantization divides the number of bits by a constant and then drops the fraction.
- This reduces the required number of bits even more.

Image compression – JPEG

Compression

- After quantization the values are read from the table, and redundant 0s are removed.
- However, to cluster the 0s together, the process reads the table diagonally in a zigzag fashion rather than row by row or column by column.
- JPEG usually uses run-length encoding at the compression phase to compress the bit pattern resulting from the zigzag linearization.

Image compression – JPEG