Learning-based Multimedia Processing

2021/2022

Quizz #1

IST number: _____

Name: _____

Duration: 20 minutes

Provide clear, legible, and succinct answers.
Always justify your assumptions.

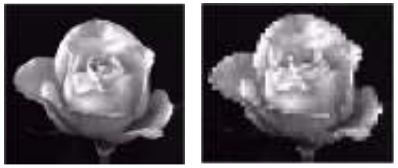
Questions

1. The human visual system (HVS) allows to see both with very low, as well as with high, illumination intensities.

a) What is the type of photoreceptors supporting night vision?

b) Which visual process explains the fact that a period of time is needed, e.g., when entering an illuminated room from the dark outside during the night, for the HVS to adapt to the new illumination conditions?

2. Consider an original scene (left) and acquired image (right). What can explain the acquired image characteristics? How should the acquisition system be modified to solve the problem?



3. Consider a CCD sensor with a resolution of 1000x1000 *pixels*, where each picture element occupies an area of 10μm x 10μm. If the size of the object to be imaged is 1m x 1m, and a lens with focal distance of 10 mm is used, how far away from the object should the acquisition system be placed so that the object image fully occupies the sensor?
(Start by drawing a figure illustrating the image formation process)

4. Consider an application that uses and audio signal with maximum frequency of 8 kHz. This signal is digitized using 8 bits to represent the value of each sample. The application needs to transmit the resulting digital signal using a channel with maximum bitrate of 50 kbit/s. Can it be done? How? Briefly discuss your proposed solution.

5. Explain why, in MPEG video coding, the order of image/frame encoding and visualization is not the same.

Solutions

1

a) rods

b) brightness adaptation

2

spatial resolution is too low (sampling problem) – increase the number of number of elements in the sensor matrix

3

$d = f \times H/h = 0.01 \times 1/(1000 \times 10.10^{-6}) = 1$ *m*

4

8000 x 2 samples/s x 8 bit/sample = 128 kbit/s – the audio needs to be compressed before transmission

5

to better explore temporal redundancy – B frames allow exploring bidirectional temporal redundancies