Assignment 2

Date of announcement: 29th Jan 2019
Submission deadline: 19th Feb 2019

Description

In this assignment you will gain a practical understanding of issues that relate to image and video processing and more specifically with displaying videos, transitioning videos, and aliasing problems that result from such transitions. A set of videos will be provided and your objective is to render the videos and perform the user-specified transitions.

Questions

- Bit Rates / Sampling

  The high-frequency limit of human hearing extends to approximately 20 KHz, but studies have shown that intelligible speech requires frequencies only up to 4 K Hz.

  1. Justify why the sampling rate for an audio Compact Disc (CD) is 44.1 kHz. What is the Nyquist rate for reliable speech communications?
  2. What is the Nyquist rate for reliable speech communications? Why do you think people sound different on the phone from in person?
  3. Suppose intelligible speech requires 7 bits per sample. If the phone system is designed to just meet the requirements for speech (which is the case), what is the maximum bit rate allowable over telephone lines?

  CDs use 16 bits per sample. What is the bit rate of music coming off a CD? Is a modem connection fast enough to support streamed CD quality audio?

- Color

  1. What is the color gamut of a CRT screen?
  2. Why do most standards use the YCrCb color space instead of the RGB color space?
  3. Choose the color mode for each of the following types of projects:
     - You want to post a copy of your own artwork on your Web page.
     - You need to put a copy of your signature on your computer typed report
     - You need to print the digital photograph of a pencil sketch of the map.

     (Your choices are 1-bit, 8-bit grayscale, RGB, and CMYK.)

- Bit Rates

  Suppose a camera has 450 lines per frame, 520 pixels per line, and 25 Hz frame rate. The color-subsampling scheme is 4:2:0, and the pixel aspect ratio is 16:9. The camera uses interlaced scanning, and each sample of Y, Cr, Cb is quantized with 8 bits.

  1. What is the bit-rate produced by the camera?
  2. Suppose we want to store the video signal on a hard disk, and, in order to save space, re-quantize each chrominance (Cr, Cb) signals with only 6 bits per sample. What is the minimum size of the hard disk required to store 10 minutes of video?

  Repeat the exercise (both questions) assuming color subsampling scheme 4:2:2.

Submission (electronic submission through Moodle only)

Please create a zip file containing your code, a readme text file (.txt). In the readme file document the features and functionality of the application, and anything else you want the grader to know i.e. control keys, keyboard/mouse shortcuts, etc.