

MATLAB Practical Question

Image Sampling and Quantization [30 marks]

Objective: To understand the effects of sampling and quantization on digital images.

Background: Image sampling converts a continuous image into a discrete spatial representation. Quantization, on the other hand, is mapping a large set of input values to a smaller set, typically used in digital images to reduce the colour depth from 16 million colours to a smaller number of colours.

Task:

1. **Image Loading and Display:**
 - Load a standard colour image from our local environment (a picture of your lab or JKUAT main) in MATLAB.
 - Display the original image.
2. **Image Sampling:**
 - Downsample the image by a factor of 2, 4, and 8. This can be done by keeping every n th pixel in each row and column, where n is the downsampling factor.
 - Display the downsampled images alongside the original image.
3. **Image Quantization:**
 - Quantize the original image to different levels (e.g., 64, 16, 4, and 2 levels). You can achieve this by reducing the number of colors in the image.
 - Display the quantized images alongside the original image.
4. **Analysis:**
 - Analyze the effects of sampling and quantization on the image quality. Specifically, observe the changes in detail and color depth.
5. **Bonus (Optional):**
 - Implement bilinear interpolation to upsample one of the downsampled images back to its original size. Compare the quality of this image with the original image.

Deliverables:

- MATLAB code for each step.
- A short report including the displayed images and a discussion of the observed effects of sampling and quantization.

This task will give you a practical understanding of how sampling and quantization affect digital images, which is fundamental in the field of digital image processing.