EE6427 Video Signal Processing

CA1 Home Assignment

Instructions:

1. Two-dimensional Discrete Cosine Transform (2-D DCT) is a transform employed in the JPEG standard. The 2-D DCT of an $N \times N$ pixel block is given by:

$$S_{uv} = \alpha(u)\alpha(v)\sum_{i=0}^{N-1}\sum_{j=0}^{N-1} s_{ij}\cos\frac{(2i+1)u\pi}{2N}\cos\frac{(2j+1)v\pi}{2N} \qquad u,v = 0,...,N-1$$

where

$$\alpha(k) = \begin{cases} \sqrt{\dfrac{1}{N}} & \text{for } k = 0 \\ \sqrt{\dfrac{2}{N}} & \text{for } k = 1, 2, ..., N-1 \end{cases}$$

Compute **manually** the 2-D DCT of the following image block **A** using 2-stage decomposition.

$$A = \begin{bmatrix} 10 & 10 & 20 & 20 \\ 10 & 10 & 20 & 20 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \end{bmatrix}$$

2. Generative AI is an important emerging application in image/video signal processing. In this homework, you will research the objective, applications / trends / challenges of generative AI in image/video signal processing. You will write a short abstract / report on the topic. You can use the following suggested format or any other format that you see fit in the abstract / report:

1. Objective / motivation.
2. Discussion (applications / trends / challenges, etc.)

Other requirements:

1. Your report should be **within one A4 pages, Time New Roman, font 11, single column.**
2. Include references as a separate page at the end of the report. References are not counted towards the page limit.
3. This is an individual home assignment. Do not plagiarize or use generative AI.
4. Conduct research, brainstorming, and explain your own thoughts.