

Indian Institute of Technology Hyderabad

EE6310: Image and Video Processing

Quiz 4, 25.04.2023, 10 points

1. Given that you are predicting the current video frame $I(i, j, k)$ from the previous frame $I(i, j, k - 1)$, **label** the signals at the various blocks of the video encoder. Clearly notate and indicate the signal that undergoes spatial redundancy removal and quantization. How is this signal related to $I(i, j, k)$ and $I(i, j, k - 1)$? Use appropriate notation for the intermediate predicted signal. (2)
2. Suppose you are streaming a video at 30 fps encoded using the GOP structure $IPPP$ with an I -frame interval of 29 frames. You end up losing the twenty-first P frame due to transmission errors, **explain** the expected behavior at the decoder. When in time do you expect the video to recover? (1)
3. What is the *aperture problem* and how does it relate to the optical flow constraint equation? (1)
4. Is the Horn-Schunck optical flow estimation method sensitive to noise? Justify your answer. (1)
5. We formalized the concept of wavelet decomposition for the **Haar** basis. Given the following function:

$$f^j(x) = \begin{cases} -1, & 0 \leq x < 1/4 \\ 4, & 1/4 \leq x < 1/2 \\ 2, & 1/2 \leq x < 3/4 \\ -3, & 3/4 \leq x < 1 \end{cases}$$

- (a) **Plot** $f^j(x)$. (1)
- (b) **Find** j and **express** $f^j(x)$ in terms of the basis for V_j . (1)
- (c) **Decompose** f^j into its components in V_0, W_0, \dots, W_{j-1} . (2)
- (d) **Plot** each of these components. (1)