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| **Q no** | **Description** | **Answer** |
| 1 | Why even size of filter/mask is not recommended to use? | Even size of filter/mask has no symmetry. It means there is no central or middle pixel on which we can apply the calculated value. |
| 2 | What is difference in filter, mask, window, template, and kernel? | * Filter is collection of kernels and hence not unique. It contains coefficients as value. * Mask usually contain binary values that tells about what part of the image is to hide or show. It contains coefficients as value. * A window is necessarily a rectangular array of pixels. In most cases, values are a portion of an image. It contains pixel intensity as value. * Template is not necessarily a rectangle. In most cases, values are a portion of an image. It contains pixel intensity as value. * Kernel is unique and usually smaller than filter. It contains coefficients as value. |
| 3 | Difference in pixel value and coefficient? | * Coefficients are used in filtering and masking to calculate a value to be assigned to the central pixel. It is as a whole calculation. * Pixel values are used in window and template to quantify that how much closer a particular pixel value is. It is one-to-one comparison. |
| 4 | What are different types of neighbors of a pixel in an image? Briefly explain each one. | There are two types of neighbor pixels   * Immediate neighbors are pixels whose has common boundary with central pixel. They are located on UP, DOWN, LEFT, RIGHT. * Far neighbors are pixels that do not directly share boundary with the central pixel. |
| 5 | What t is 2, 4, and 8 connectivity? | In a 4X4 kernel   * 2-Connectivity pixels are those who share the edges of central pixel. They are Vertical OR Horizontal pixels. * 4-Connectivity pixels are those who share the edges of central pixel. They are Vertical AND Horizontal pixels. * 8-Connectivity pixels shar edges and vertices of central pixel. They are Vertical, Horizontal and diagonal pixels |
| 6 | What is impact of neighbor size when applying any neighborhood operation? | In most cases, intensity of results increases with increase in neighbors while applying any neighborhood operation |
| 7 | What is padding? | Set the pixels out of boundary to white or black before applying filter to the image. |
| 1 | What is feasible size of kernel? | Small, unique and symmetric sized kernel is feasible excluding 1x1 which will not involve any neighborhood computation. E.g. 3X3, 5X5, 7X7 and so on |
| 2 | Explain the difference in point pixel operation and neighborhood operation? | * In point pixel operation or point processing, each pixel goes through transformation function T irrespective of its neighbors. E.g. Negative, Power law, Logarithmic * In neighborhood processing, number of neighbors are included in altering the pixel. E.g. Average filter, Gaussian blur, Laplacian |
| 3 | Which of the filter can be used to remove salt noise from an image? Why? | Median filter is used to remove salt and pepper noise. In salt and pepper noise, pixel values abruptly change. Median filter always chooses median pixel in the neighborhood. Noisy pixel will always be at Start or at the End so it will not be included. |
| 4 | Explain the difference in median filter and mean filter? | * Median filter arranges the pixel values in kernel, extract the middle value and assigns it to central pixel. Used in removing salt and pepper noise. * Mean filter takes average of pixel intensities of each pixel in neighborhood and then apply to central pixel. Used in blurring the image. |
| 1 | What is process of convolution? | Convolution provides a way of multiplying together two arrays of pixel intensity values, generally of different sizes, but of the same dimensionality, to produce a third array of numbers of the same dimensionality. |
| 2 | How to perform sum of product (SOP) on an image? | The sum of product is performed by first calculating the all the products of a coefficient of a sub-image with the pixel value of the original image. Then adding all these products to get the single value that is replaced with the pixel value of the middle pixel. |
| 3 | Take an image of 7 x 7, a mask of size 3 x 3, and apply it on image. Show the resultant image. |  |
| 1 | Why averaging filters are used? | * Averaging filters are used to make images unsharp, Blur or smooth. * Averaging filters are involved in detecting global features such as contours detection to filter out color of choice. |
| 2 | What are pros and cons of averaging filters? | Pros.   * It enhances global features of an image. * It smooths unwanted noise in the image   Cons.   * It diminishes individual pixel value. * It reduces the gross detail of an image. |
| 3 | Differentiate average filter and median filter | * Median filter arranges the pixel values in kernel, extract the middle value and assigns it to central pixel. Used in removing salt and pepper noise. * Mean filter takes average of pixel intensities of each pixel in neighborhood and then apply to central pixel. Used in blurring the image. |
| 1 | What is impact of increasing the size of averaging filter? | Resulting image will be more blurred with increase in size of filter. |
| 2 | What is difference in simple averaging filter and weighted averaging filter? | * Simple average is just arithmetic mean in which all quantities equally contribute in calculation. * In weighted average, weights of contribution of each quantity are assigned. Pixels closer to central pixel have usually higher weights. |
| 3 | What is thresholding in image processing? | Image thresholding is a simple, yet effective, way of partitioning an image into a foreground and background. This image analysis technique is a type of image segmentation that isolates objects by converting grayscale images into binary images. |
| 4 | Design a weighted smoothing filter in which total sum is 128 | |  |  |  |  |  | | --- | --- | --- | --- | --- | | 1 | 2 | 5.3138 | 2 | 1 | | 2 | 4 | 10.6276 | 4 | 2 | | 5.3138 | 10.6276 | 28.2364 | 10.6276 | 5.3138 | | 2 | 4 | 10.6276 | 4 | 2 | | 1 | 2 | 5.3138 | 2 | 1 |  * It is impossible with integer values   Linear combination is vector that I approximated is   |  |  |  |  |  | | --- | --- | --- | --- | --- | | 1 | 2 | 5.3138 | 2 | 1 |  * Sum is 128.002 |
| 1 | Why median filter is suggested over simple averaging filter? | For noise removal, median filter is suggested over averaging filter because averaging filter reduces finer details and make the image blur. |
| 2 | What are indications of noise in an image? | * Abrupt and random variation in pixel values. * Gray screened image. |
| 3 | Take a median filter of size 3 x3, an image of 5 x 5, and apply this filter on image. Also show the output image. |  |
| 1 | What are different techniques to deal with boundary values when applying a filter? | * Omit missing pixels * Pad the image * Replicate border pixels * Truncate the image * Allow pixels wrap around the image |
| 2 | What is difference in correlation and convolution? | * Correlation is measurement of the similarity between two-pixel sequences. * Convolution is measurement of effect of one signal on the other signal. The convolution process rotates the matrix by 180 degrees as correlation. |
| 3 | Define the convolution in mathematical form | G[i,j] = ∑ku=-k ∑kv=-k h[u,v] F[i-u , j-v] |
| 1 | What is image sharpening and objectives of image sharpening? | * Image sharpening is related to make an image acute and revealing the finer details. * Objectives of image sharpening includes   + Highlighting finer details   + Unshapen image   + Restore to original image |
| 2 | What is difference in gross details and fine details of an image? | * Gross details are overall image details. E.g. Scene, Color space * Fine details are related to individual objects present in the image. E.g. Facial expressions, Gender recognition |
| 3 | What are applications of image sharpening? | * Text Recognition * Signal categorization * Image categorization in Deep Learning * Machine/Robot vision |
| 4 | What is difference in image sharpening and image smoothing? | * Image sharpening is related to make an image acute and revealing the finer details. * Image smoothing is inverse of image sharpening. It makes image blur. Average filter and Gaussian blur are some averaging filters. |
| 5 | What are edges in an image? How these edges are detected? | * In an image, an edge is a curve that follows a path of rapid change in image intensity. Edges are often associated with the boundaries of objects in a scene. * Multiple techniques are used to detect edges such as   + Sobel edge detector   + Canny edge detector   + Derivative   + Laplacian |