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CA-I

Q1. Define Computer vision?

Ans Computer vision is the field of computer science that focuses on creating digital systems that can process, analyse, and make sense of visual data (images or videos) in the same way that humans do. The concept of computer vision is based on teaching computers to process an image at a pixel level and understand it. Technically, machines attempt to retrieve visual information, handle it and interpret results through special software algorithms.

Q2. what are the Components of Image Processing System?

Ans The components of Image Processing System are:-

=> Image Sensors:- Image Sensors Senses the intensity, amplitude, co-ordinates and other features of the images and passes the result to the image processing hardware. It includes the problem domain.

=> Image Processing Hardware:- Image processing hardware is the dedicated hardware that is used to process the instructions obtained from the image sensors. It passes the result to general purpose computer.

=> Computer:- Computer used in the image processing system is the general purpose computer that is used by us in our daily life.

=> Image processing software :- Image processing software is the software that includes all the mechanisms and algorithms that are used in image processing system.

=> Mass storage :- Mass storage stores the pixels of the image during the processing.

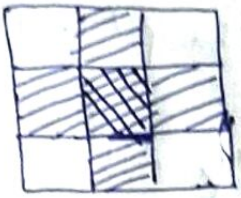
=> Hard copy Device :- Once the image is processed then it is stored in the hard copy device. It can be a pen drive or any external ROM device.

=> Image Display :- It includes the monitor or display screen that displays the processed images.

=> Network :- Network is the connection of all the above elements of the image processing system.

Q3. 8 connected pixel and 4 connected pixel.

Ans 4 connected pixel :- Pixels are connected if their edges touch. Two adjoining pixels are part of the same object if they are both on and are connected along the horizontal or vertical direction.



8 connected pixel :- Pixels are connected if their edges or corners touch. Two adjoining pixels are part of the same object if they are both on and are connected along the horizontal, vertical or diagonal direction.

Q4. Spatial Resolution and grey level.

Ans Spatial resolution states that the clarity of an image cannot be determined by the pixel resolution. The number of pixels in an image does not matter.
In short, what spatial resolution refers

to is that we cannot compare two different types of images to see that which one is clear or which one is not. If we have to compare the two images, to see which one is more clear or which has more spatial resolution, we have to compare two images of the same size.

grayscale images simplifies the algorithm and reduces computational requirements. As color, increase the complexity of the model, providing with unnecessary information. Let's try out a really basic implementation of grayscaling.

Q5. RGB and CMY model

Ans The RGB color model is one of the most widely used color representation method in computer graphics. It use a color coordinate system with three primary colors: R(red), G(green), B(Blue)
Each primary color can take an intensity value ranging from 0 (lowest) to 1 (highest) mixing these three primary colors at different intensity levels produces a

variety of colors. The collection of all the colors obtained by such a linear combination of red, green and blue forms the cube shaped RGB color space.
The corner of RGB color cube that is at the origin of the coordinate system corresponds to black, whereas the corner of the cube that is diagonally opposite to the origin represents white. The diagonal line connecting black and white corresponds to all the gray colors between black and white, which is also known as gray axis.

CMY or Cyan, magenta and yellow are the secondary colors of light and the primary colors of pigments. This means, if white light is shined on a surface coated with cyan pigment, no red light is reflected from it. Cyan subtracts red light from white light. Unlike the RGB color model, CMY is subtractive, meaning higher values are associated with darker colors rather than lighter ones.

Q6. What do you mean by image enhancement?

Ans Image enhancement is the procedure of improving the quality and information content of original data before processing. Common practices include contrast enhancement, spatial filtering, density slicing, and FCC. Contrast enhancement or stretching is performed by linear transformation expanding the original range of gray level. Spatial filtering improves the naturally occurring linear features like fault, shear zone, and lineaments. Density slicing converts the continuous gray tone range into a series of density intervals marked by a series of color or symbol to represent different features.

Q7. What do you mean by radiometry in image processing?

Ans Radiometry is the field of measurement of any electromagnetic radiations, in particular light.

Foreshortening is a phenomenon in which

a source or a patch of surface which is fitted with respect to the direction in which the illumination is travelling. It "walls smaller" to patch or the source respectively.

Radiance is the amount of energy travelling at some point in a specified direction, per unit time, per unit area, per unit solid angle. It is function of position and direction.

Q8. What do you mean by edge detection?

Ans Edge detection is a technique of Image processing used to identify points in a digital image with discontinuities. Simply to say, sharp changes in the image brightness. These points where the image brightness varies sharply are called edges of the images.

It is one of the basics steps in Image processing, pattern recognition in image and computer vision. When we process very high-resolution digital images, convolution technique come to our rescue.

Q9. Canny Edges detector.

Ans The canny Edge detector is a edge detection operator that uses a multi-stage algorithm to detect a wide range of edges in images.

Canny Edge detection is a technique to extract useful structural information from different vision objects and dramatically reduce the amount of data to be processed. It has been widely applied in various computer vision systems. Canny has found that the requirement for the application of edge detection on diverse vision system are relatively similar.

Q10. What do you mean by Histogram stretching and linear stretching?

Ans Histogram stretching increases contrast. Contrast is the difference between maximum and minimum pixel intensity.
The formula of stretching the histogram of the image to increase the contrast is

$$g(x,y) = \frac{f(x,y) - f_{min}}{f_{max} - f_{min}} \times 2^{bpp}$$

The formula requires finding the minimum and maximum pixel intensity multiply by level of gray. In our case the image is 8 bpp.

The minimum value is 0 and the maximum value is 255. so the formula is

$$g(x,y) = \frac{f(x,y) - 0}{255 - 0} \times 255$$

where $f(x,y)$ denotes the value of each pixel intensity. For each $f(x,y)$ in an image we will calculate this formula. After doing this, we will be able to enhance our contrast.

Linear stretching technique can be applied to image where substantial lack of contrast can result in false identification of objects, its special relationship and significance contrast enhancement by linear stretch can be applied to image with very low or very high ~~contrast~~ variations of brightness. To apply the linear search algorithm an image needs to be converted into

gray-scale and all 8 bit pixels have its value and recorded with histogram.

Linear stretch is applied in histogram as follows :-

→ create histogram of the original image.

→ Set new maximum and minimum value of bins = (OMAX - OMIN)

→ Calculate spacing for new histogram so space = (NMAX - NMIN)/(OMAX-OMIN)

→ Create a new histogram with corresponding positions of new bins (Nb).

$Nb(j) = NMIN + (j \times space)$.

→ use new histogram to create new image.