

1. Basic Operations on Images

A. Change Brightness, Flip, Color Components, Gray Scale, Negative

Q1: What happens when you increase the brightness of an image?

A1: Increasing brightness adds a constant value to pixel intensities. This shifts the histogram towards the right (brighter values).

Q2: Difference between vertical flip and horizontal flip?

A2:

- Vertical Flip → Mirrors image along horizontal axis (top becomes bottom).
- Horizontal Flip → Mirrors image along vertical axis (left becomes right).

Q3: What are color components in an image?

A3: Color images are usually represented in **RGB** format (Red, Green, Blue). Each pixel has three values corresponding to these components.

Q4: What is a grayscale image?

A4: A grayscale image has intensity values only (0–255), no color information. It's a single channel image.

Q5: What is the negative of an image and where is it used?

A5: Negative is obtained by $\text{new_pixel} = 255 - \text{original_pixel}$. Used in medical imaging, photo film processing, and highlighting bright/dark regions.

2. Histogram and Image Quality Analysis

Q6: What is a histogram of an image?

A6: It's a graphical representation of the frequency of pixel intensity values (0–255).

Q7: What is histogram equalization?

A7: Technique to enhance contrast by redistributing intensity values so that they span the entire range evenly.

Q8: Where is histogram equalization used?

A8: Used in medical imaging, satellite imaging, and low-light image enhancement.

3. Image Filtering (Low Pass & High Pass Filters)

Q9: Difference between low-pass and high-pass filters?

A9:

- **Low-pass:** Smooths image, removes noise, preserves low-frequency content (e.g., Average, Gaussian, Median filter).
- **High-pass:** Highlights edges, enhances fine details (e.g., Sobel, Laplacian).

Q10: What is a median filter and why is it preferred for noise removal?

A10: Median filter replaces each pixel by median of its neighborhood → effective for removing **salt-and-pepper noise**.

Q11: Explain Sobel operator.

A11: Sobel uses convolution kernels to detect edges in horizontal and vertical directions using gradient approximation.

Q12: What is Laplacian filter used for?

A12: Second-order derivative filter used for edge detection and finding regions of rapid intensity change.

4. Edge Detection with Gradient & Convolution

Q13: What is an edge in image processing?

A13: A significant change in intensity that indicates boundaries of objects.

Q14: Why use convolution in edge detection?

A14: Convolution applies kernels to detect intensity changes in specific directions (gradient-based detection).

Q15: Examples of edge detection algorithms?

A15: Sobel, Prewitt, Canny, Roberts operators.

5. Image Thresholding

Q16: What is image thresholding?

A16: A process of converting grayscale image into binary (black & white) image using a threshold value.

Q17: Difference between global and adaptive thresholding?

A17:

- Global: Uses single threshold for entire image.
- Adaptive: Calculates threshold for small regions (good for non-uniform illumination).

Q18: What is RGB thresholding?

A18: Applying threshold separately on each of R, G, B channels to segment color objects.

6. Background Subtraction

Q19: What is background subtraction?

A19: Technique to separate foreground objects from background (often used in video surveillance, motion detection).

Q20: Why do we need background subtraction?

A20: Helps track moving objects, detect anomalies, or isolate regions of interest.

7. Color Conversion (Gray & HSV)

Q21: What is HSV color model?

A21: Stands for **Hue, Saturation, Value** – better for color-based segmentation than RGB.

Q22: Why convert to grayscale?

A22: Reduces computational complexity, keeps only intensity information needed for many algorithms.

8. Edge Detection + 2D DFT/DCT + Frequency Domain Filtering

Q23: What is 2D DFT used for?

A23: Converts image from spatial domain to frequency domain, revealing high/low frequency components.

Q24: Difference between DFT and DCT?

A24:

- **DFT:** Complex transform, uses both sine and cosine components.
- **DCT:** Real transform, uses only cosine → better energy compaction, widely used in JPEG compression.

Q25: Why filter in frequency domain?

A25: Some operations (like low-pass filtering) are easier and faster when applied in frequency domain.

9. Display of Color Images

Q26: Difference between RGB and BGR image representation?

A26: OpenCV uses **BGR** by default, while most image formats use **RGB**.

Q27: What function is used to display images in OpenCV?

A27: `cv2.imshow(window_name, image)` is used to display images.

10. DWT & Segmentation

Q28: What is DWT (Discrete Wavelet Transform)?

A28: A transform that decomposes image into sub-bands (LL, LH, HL, HH) – used in image compression (JPEG2000).

Q29: What is watershed segmentation?

A29: Region-based segmentation algorithm treating grayscale image as topographic surface → finds “watershed lines” to separate objects.

Q30: When is watershed transform preferred?

A30: When objects are touching/overlapping and need precise boundary segmentation.

Cross-Questions Examiner Can Ask

- **Why do we normalize images before processing?**
 👉 To bring pixel values into a fixed range (0–1) and avoid overflow/underflow errors.
- **What happens if threshold value is too low or too high?**
 👉 Too low → background becomes foreground. Too high → objects may disappear.

- **Why choose median filter over average filter for noise removal?**
 👉 Median filter preserves edges better and removes impulse noise effectively.
 - **Can histogram equalization make image worse?**
 👉 Yes, in already well-exposed images it can over-enhance and add artifacts.
 - **Difference between spatial domain & frequency domain filtering?**
 👉 Spatial domain works on pixels directly, frequency domain works on Fourier coefficients.
 - **Why prefer HSV for color segmentation?**
 👉 Hue separates color from intensity, making segmentation robust to lighting changes.
-

Would you like me to prepare **short one-liner answers** (rapid-fire style) as well, so you can quickly revise before your viva? That might save time on the exam day.

You said:

WHAT IS SALT AND PEPPER NOISE

ChatGPT said:

Salt-and-pepper noise is a type of **impulse noise** that appears as **random white and black pixels** scattered over an image.

- "Salt" = white pixels (high intensity)
- "Pepper" = black pixels (low intensity)

It usually occurs due to:

- **Faulty camera sensors**
- **Transmission errors**
- **Dust or scratches on the lens or scanner**

Effect: It makes the image look grainy or dotted.

Removal: Best removed using **Median Filter** because it preserves edges while eliminating these random black/white dots.