Image processing and computer vision

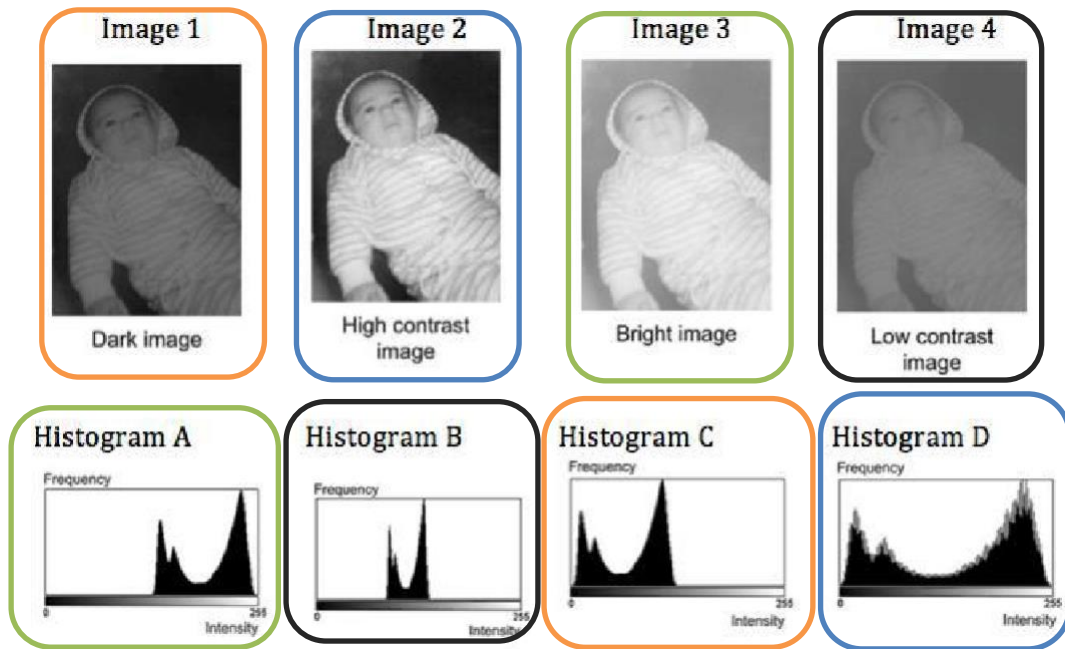**Sample Written Exam**

> **Notes:**
> - Sample exam (20 questions) that covers the same parts and has similar difficulty level of the final exam.
> - The final exam will be 40 questions.

Choose all correct answers (more than one answer can be correct)

1. Smoothing in frequency domain of a given image is achieved by applying which of the following?
   a. suppressing of high-frequency components
   b. suppressing low-frequency components
   c. suppressing high amplitude components
   d. suppressing low amplitude components

2. Which of the following filters leads to less sharp details with respect to the original image?
   a. High-pass filter
   b. Low-pass filter
   c. Gaussian low-pass filter
   d. None of the mentioned

3. Which of the following is not a valid response when we apply a second derivative of an image?
   a. Zero response at onset of gray level step
   b. Nonzero response at onset of gray level step
   c. Zero response at flat segments
   d. Nonzero response along the ramps

4. The type of Interpolation where the intensity of the 4 neighboring pixels is used to obtain intensity a new location is called _____
   a. Nearest neighbor interpolation
   b. Bilinear interpolation
   c. Bicubic interpolation
   d. Averaging

5. Which is a colour attribute that describes a pure colour?
   a. Saturation
   b. Hue
   c. Brightness
   d. Intensity

6. Match the images below with corresponding histogram:

Image 1	Image 2	Image 3	Image 4
Dark image	High contrast image	Bright image	Low contrast image

Histogram A	Histogram B	Histogram C	Histogram D

7. Hit-or-miss transformation is used for shape
   a. Removal
   b. Detection
   c. Compression
   d. Decompression

8. The gradient vector is:
   a. Perpendicular to the contour lines of the image (in the direction of intensity change)
   b. Points towards the direction of the higher intensity
   c. Parallel to the contour lines of the image (perpendicular to the direction of intensity change)
   d. Points towards the direction of the lower intensity

9. The aim of applying a gaussian filter as a step for edge detection is to:
   a. Sharpen edges
   b. Reduce noise
   c. Highlight details
   d. Increase blur

10. Affine transformation includes
    a. Translation
    b. 2D in-plane rotation
    c. Uniform scale
    d. Shearing

11. For edge localization, which of the following operations can be applied
    a. First derivative in the direction of the change and finding the local maximum
    b. Second derivative in the direction of the change and finding the local maximum
    c. First derivative in the direction of the change and finding the zero crossing
    d. Second derivative in the direction of the change and finding the zero crossing

12. What is the process of moving a filter mask over the image and computing the sum of products at each location (without flipping the mask) called as?
    a. Convolution
    b. Correlation
    c. Template matching
    d. Smoothing

13. During training, slow convergence and "underflow" can be avoided by

    a. ... using a different activation function whose derivative is not bounded by one
    b. ... using a different cost function
    c. ... normalizing network parameters at every iteration
    d. All of the above

14. Backpropagation is

    a. ... a numerical approach to facilitate optimization via gradient descent
    b. ... an expression for the rate of change in cost function per rate of change in network parameters
    c. ... a method to overcome the upper bound of the derivative of the sigmoid function
    d. All of the above

15. Smoothing of an image can be applied by convolving a Gaussian kernel
    a. True
    b. False

16. Applying convolution with the derivative of the Gaussian kernel results in the same image as convolving the Gaussian kernel then calculating the derivative of the output of image after convolution
    a. True
    b. False

17. Two-dimensional Gaussian filtering can be separated into 2 one-dimensional Gaussian filters
    a. True
    b. False

18. Two-dimensional Laplacian of Gaussian can be separated into 2 one-dimensional Gaussians
    a. True
    b. False

19. Higher sigma of the Gaussian filter will result in detection of more weak edges
    a. True
    b. False
20. After calculating the second derivative of an image, the higher the slope at the zero-crossing the weaker the edge is.
    a. True
    b. False