جامـــــعة المـــــستـقبـل
AL MUSTAQBAL UNIVERSITY

قســـم الامـــــن الـــــــــسيبرانـــــــي

Department of Cyber Security

Subject:

Image Processing

Class:

Third

Lecturer:

Asst. Prof. Dr. Ali Kadhum Al-Quraby

Lecture: (4)

Homework/Activity

Homework/Activity: Image Processing Fundamentals and Geometry

Total Points: 20

Part 1: Conceptual Understanding (5 Points)

1. **Define and Differentiate (3 Points):**
   - Explain the primary distinction between **Computer Vision** and **Image Processing** based on the role of the human operator in the "visual loop".
   - Provide one real-world application for each of the two fields.

2. **Image File Categories (2 Points):**
   - In computer graphics, what are the two primary categories of image data[3]? Briefly describe how each type represents visual information.

Part 2: Image Representation and Data Analysis (5 Points)

1. **Image Model Components (2 Points):**
   - The simple image model, ***f(x,y)***, is characterized by two components. Identify and describe what each component represents physically.

2. **Image Storage Calculation (3 Points):**
   - An uncompressed image has a resolution of **2048 * 2048** pixels. If the image is a standard **Gray-Scale Image** (8 bits/pixel), calculate the total storage space required for the image in **Megabytes (MB)**. Show your work.
   - ***Note:*** *Assume 1 Megabyte (MB) = 1024^2 Bytes.*

Part 3: Image Geometry and Zooming Techniques (10 Points)

1. Convolution for Image Enlargement (5 Points):

   Given the following 3* 3 original image array:

$$\begin{pmatrix} 10 & 20 & 30 \\ 5 & 15 & 25 \\ 1 & 2 & 3 \end{pmatrix}$$

   The image is to be enlarged using the Convolution Process (First-Order Hold) with the mask:

$$\text{Mask} = \begin{pmatrix} 1/4 & 1/2 & 1/4 \\ 1/2 & 1 & 1/2 \\ 1/4 & 1/2 & 1/4 \end{pmatrix}$$

   - **Step A (2 Points):** Show the size and structure of the **Extended Image Array** after the first step of the convolution method (adding rows and columns of zeros between existing data).
   - **Step B (3 Points):** Calculate the value of the new pixel that is inserted *between* the original pixels **20** and **15**. (This pixel is vertically between 20 and 15 in the extended array). Show the equation and the resulting value.

2. **K-Times Zooming Algorithm (5 Points):**

   An image is to be enlarged using the K-times zooming algorithm with a factor **K=3**.

   - **Step A (2 Points):** If the original image dimensions are **4*5** (rows * columns), what will be the dimensions of the new zoomed image? Write down the formula used.

- **Step B (3 Points):** If two adjacent pixels in a row are **100** and **115**, what are the two new values that will be inserted between them during the row-wise zooming process with **K=3?** Show the steps for calculating the inserted values.