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قسم الامن السيبراني
Department of Cyber Security

Subject:

Image Processing

Class:

Third

Lecturer:

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Lecture: (2)

Digital Image File Format

Digital Image File Format

Why do we need so many different types of image file format?

- The short answer is that there are many different types of images and application with varying requirements.
- A more complete answer, also considers market share proprietary information, and a lack of coordination within the imaging industry.

Note: Many image format types can be converted to one of other type by easily available image conversion software. Field related to computer imaging is that **computer graphics**.

Computer graphics is a specialized field within that refers to the computer science realm that refers to the reproduction of visual data through the use of computer.

In computer graphics, types of image data are divided into two primarily categories:

1. **Bitmap image (or raster image):** can represented by our image model I(r, c), where we have pixel data and corresponding brightness values stored in some file format.
2. **Vector images:** refer to the methods of representing lines, curves Shapes by storing only the key points. These key points are sufficient to define the shapes, and the process of turning theses into an image is called rending after the image has been rendered, it can be thought of as being in bit map format where each pixel has specific values associated with it.

Most the types of file format fall into category of bitmap images.

In general, these types of images contain both header information and the raw pixel data. The **header information** contains information regarding:

(1)The number of rows (height),

(2) The number of columns (Width),

(3)The number of bands,

(4) The number of bit per pixel,

(5) the file type , Additionally, with some of the more complex file formats, the header may contain information about the type of compression used and other necessary parameters to create the image, I(r,c)).

Image File Formats :

1. BMP format:

It is the format used by the windows, it's a compressed format and the data of image are located in the field of data while there are two fields one for header (54 byte) that contains the image information such as (height ,width , no. of bits per pixel, no of bands , the file type).

The second field is the color map or color palette for gray level image, where its length is 0-255).

2. BIN file format:

It is the raw image data I(r,c) with no header information.

3. PPM (Portable Pix Map) file format :

It contain raw image data with simplest header, the PPM format, include PBM(binary),PGM(gray),PPM (color), the header contain a magic number that identifies the file.

4. **TIFF(Tagged Image File Format) and GIF(Graphics Interchange Format):** They are used on World Wide Web (WWW). GIF files are limited to a maximum of 8 bits/pixel and allows for a

type of compression called LZW. The GIF image header is 13 byte long & contains basic information.

5. JPEG (Joint photo Graphic Experts Group):

It is simply becoming standard that allows images compressed algorithms to be used in many different computer platforms.

JPEG images compression is being used extensively on the WWW. It's, flexible, so it can create large files with excellent image equality.

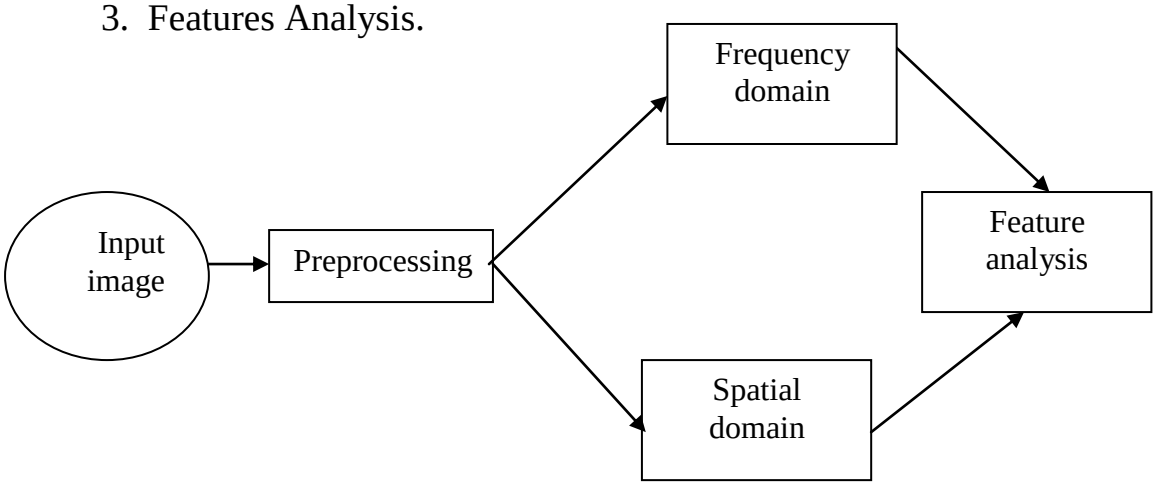
Image analysis

Image analysis involves manipulating the image data to determine exactly the information necessary to help solve a computer imaging problem.

System model

The image analysis process, illustrated in fig(1), can be broken down into three primary stages:

1. Preprocessing.
2. Data Reduction.
3. Features Analysis.



Preprocessing

The preprocessing algorithm, techniques and operators are used to perform initial processing that makes the primary data reduction and analysis task easier. They include operations related to:

• Extracting regions of interest.

• Performing basic algebraic operation on image.

• Enhancing specific image features.

• Reducing data in resolution and brightness.

Preprocessing is a stage where the requirements are typically obvious and simple, such as removal of artifacts from images or eliminating of image information that is not required for the application. For example, in one application we needed to eliminate borders from the images that have been digitized from film. Another example of preprocessing step involves a robotics gripper that needs to pick and place an object; for this we reduce a gray-level image to binary (two-valued) image that contains all the information necessary to discern the object's outlines.

Data Reduction Is the second stage of image analysis. It involves either reducing the data in the spatial domain or transforming it into another domain called the frequency domain, and then extraction features for the analysis process.

In the third stage, Features Analysis, The features extracted by the data reduction process are examine and evaluated for their use in the application.

Preprocessing: Region –of-Interest Image Geometry

Often, for image analysis we want to investigate more closely a specific area within the image, called region of interest (ROI). To do this we need operation that modifies the spatial coordinates of the image, and these are categorized as image geometry operations. The image geometry operations discussed here include:

Crop, Zoom, enlarge, shrink, translate and rotate.

Image Cropping

The image crop process is the process of selecting a small portion of the image, a sub image and cutting it away from the rest of the image.

Example: Lenna.bmp image was cropped at points p1(40,40),p2(100,100)

Lenna.bmp

Cropped part

After we have cropped a sub image from the original image we can zoom in on it by enlarge it. The zoom process can be done in numerous ways:

1. Zero-Order Hold.
2. First _Order Hold.
3. Convolution.

Zero-Order hold: is performed by repeating previous pixel values, thus creating a blocky effect.

Example: if we have an image of size(n*n), we can zooming it using zero order method with size (2n)*(2n)

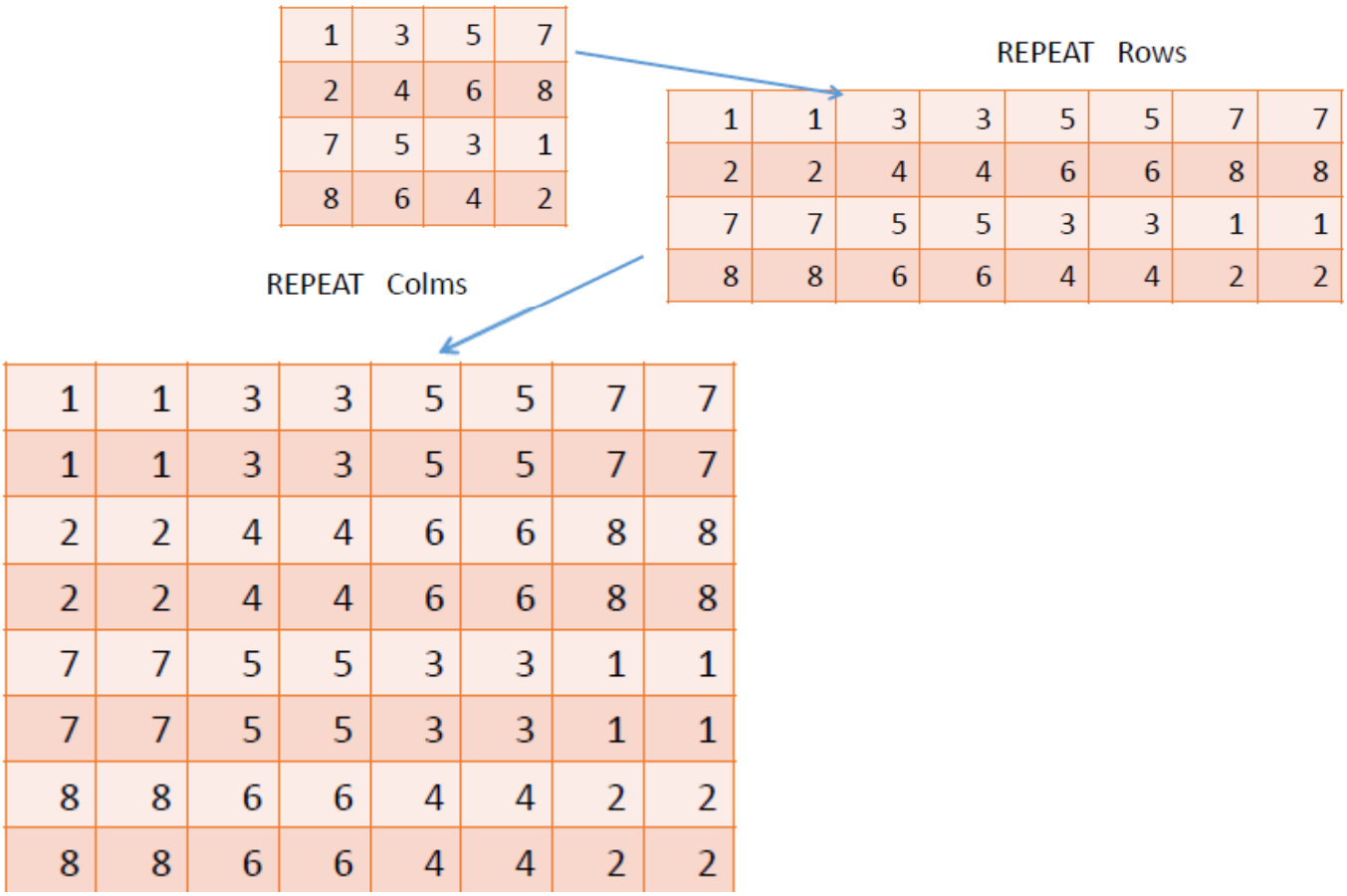
$$\begin{bmatrix} f(x,y) & f(x,y+1) \\ f(x+1,y) & f(x+1,y+1) \end{bmatrix}_{2\times2}$$

$$\begin{bmatrix} f(x,y) & f(x,y) & f(x,y+1) & f(x,y+1) \\ f(x,y) & f(x,y) & f(x,y+1) & f(x,y+1) \\ f(x+1,y) & f(x+1,y) & f(x+1,y+1) & f(x+1,y+1) \\ f(x+1,y) & f(x+1,y) & f(x+1,y+1) & f(x+1,y+1) \end{bmatrix}_{4\times4}$$

a-Original image

b- cropped image

c- zoomed imag



1	3	5	7				
2	4	6	8				
7	5	3	1				
8	6	4	2				

1	1	3	3	5	5	7	7
2	2	4	4	6	6	8	8
7	7	5	5	3	3	1	1
8	8	6	6	4	4	2	2

1	1	3	3	5	5	7	7
1	1	3	3	5	5	7	7
2	2	4	4	6	6	8	8
2	2	4	4	6	6	8	8
7	7	5	5	3	3	1	1
7	7	5	5	3	3	1	1
8	8	6	6	4	4	2	2
8	8	6	6	4	4	2	2

Advantage and disadvantage:

One of the advantage of this zooming technique is , it is very simple. You just have to copy the pixels and nothing else.

The disadvantage of this technique is that image got zoomed but the output is very blurry. And as the zooming factor increased , the image got more and more blurred. That would eventually result in fully blurred image.

First _Order Hold: is performed by finding linear interpolation between a adjacent pixels, i.e., finding the **average** value between two pixels and use that as the pixel value between those two, we can do this for the rows first as follows:

$$\begin{bmatrix} 8 & 4 & 8 \\ 4 & 8 & 4 \\ 8 & 2 & 8 \end{bmatrix} \longrightarrow \begin{bmatrix} 8 & 6 & 4 & 6 & 8 \\ 4 & 6 & 8 & 6 & 4 \\ 8 & 5 & 2 & 5 & 8 \end{bmatrix}$$

The first two pixels in the first row are averaged (8+4)/2=6, and this number is inserted between those two pixels. This is done for every pixel pair in each row. Next, take result and expanded the columns in the same way as follows:

$$\begin{bmatrix} 8 & 6 & 4 & 6 & 8 \\ 6 & 6 & 6 & 6 & 6 \\ 4 & 6 & 8 & 6 & 4 \\ 6 & 5.5 & 5 & 5.5 & 6 \\ 8 & 5 & 2 & 5 & 8 \end{bmatrix}$$

This method allows us to enlarge an N×N sized image to a size of (2N-1) ×(2N-1) and be repeated as desired.

Original image

cropped image

zooming image

Advantages and disadvantage

One of the advantage of this zooming technique , that it does not create as blurry picture as compare to the zero order hold method. But it also has a disadvantage that it can only run on the multiply by 2. if image dimensions equal to 3x3. Then you will zoom it again and you will get dimensions equal to 5 x 5. Now if you will do it again, you will get dimensions equal to 9 x 9 and so on .

Digital Image Processing: MCQs- Lecture 2

Image File Formats and Categories

1. In computer graphics, the two primary categories of image data are:
2. Which type of image data is represented by I(r,c), where pixel data and corresponding brightness values are stored?
3. The process of turning key points of a vector image into a bitmap format image is called:
4. Which image file format contains the raw image data I(r,c) with **no** header information?
5. The BMP format is primarily used by:
6. Which image file format is limited to a maximum of 8 bits/pixel and allows for LZW compression?
7. Which file format is becoming a standard that uses compressed algorithms on many different computer platforms and is used extensively on the WWW?
8. In general, which of the following is **NOT** typically found in the header information of a digital image file?
9. The PPM file format includes three types: PBM, PGM, and PPM. These correspond to which image types, respectively?

Image Analysis and Processing Stages

10. The image analysis process is broken down into which three primary stages?
11. The stage of image analysis where algorithms are used to perform initial processing, such as removal of artifacts or eliminating unrequired image information, is called:
12. Preprocessing operations include all of the following **EXCEPT**:
13. In the second stage of image analysis, **Data Reduction** involves:

14. For a robotics gripper application, a preprocessing step involves reducing a gray-level image to a:
15. In the third stage, **Features Analysis**, what are examined and evaluated for their use in the application?

Image Geometry Operations

16. A specific area within an image that one wants to investigate more closely is called a:
17. Operations that modify the spatial coordinates of the image, such as crop, zoom, enlarge, shrink, translate, and rotate, are categorized as:
18. The image crop process is defined as:
19. Which of the following is **NOT** listed as a way to perform the zoom process on a cropped image?
20. The **Zero-Order Hold** zooming technique is performed by:
21. A disadvantage of the **Zero-Order Hold** zooming technique is that:
22. Using the Zero-Order Hold method, an image of size n×n can be zoomed to a size of:
23. The **First-Order Hold** zooming technique is performed by:
24. A 3×3 image enlarged using the First-Order Hold method will result in an image of size:
25. An advantage of the **First-Order Hold** zooming technique compared to the Zero-Order Hold method is that: