

*Lecture 2*

*Fourth stage*

*Medical Physical Department*



# *Medical Imaging Processing*

**Types of Medical Images- Digital Image  
Representation**

By

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## Medical Imaging Processing (Image Types and Formats)

**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.

**Note:** Many image format types can be converted to one of other type by easily available image conversion software. **Most the type 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** contain 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

### 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):** GIF files are limited to a maximum of 8 bits/pixel The GIF image header is 13 byte long & contains basic information.

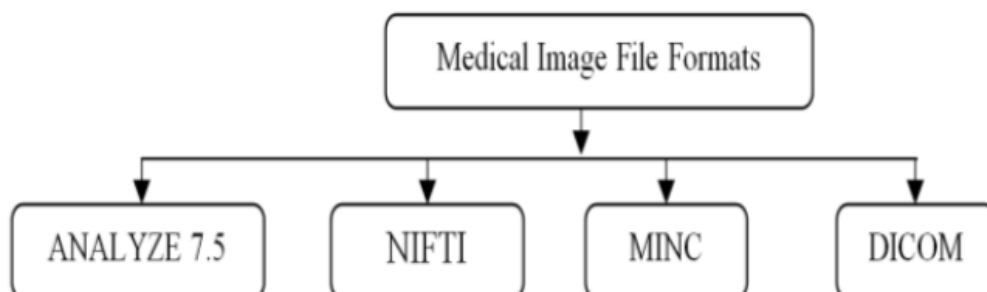
**5. JPEG (Joint photo Graphic Experts Group):**

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.

### Medical image Format

Medical image files were stored in two ways.

- The first is metadata stored in an image itself. The main advantage of the first method is all the image information stored in a single file. On the other hand problems may arise when extracting or modifying information from the file because of its size and complex structure.
- The second method uses separate file to store the metadata information called a header with .hdr extension. Famous file formats used in the medical industry is shown in Figure 1. General characteristics of medical image file format are listed in Table 1.



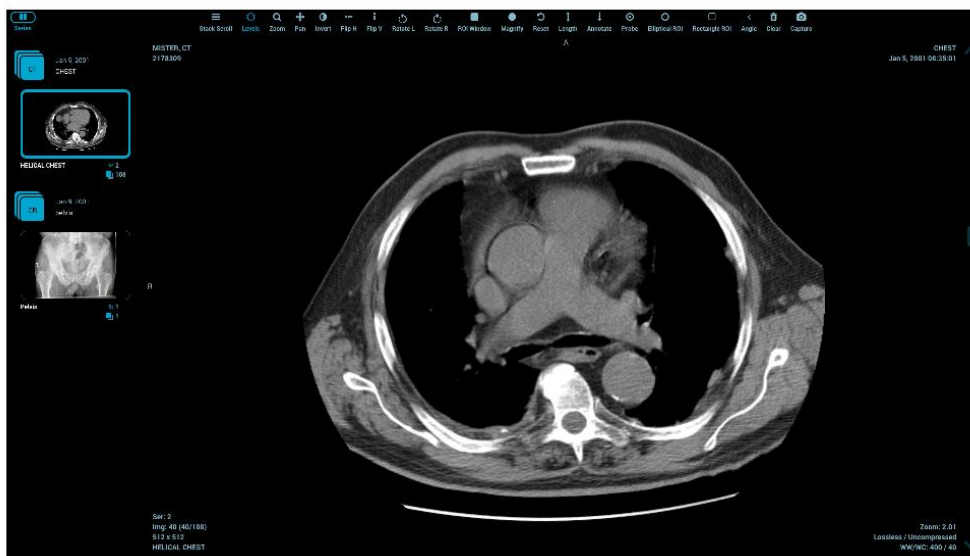
**Figure 1: File Format of Medical Images**

**Table 1: characteristics of famous medical image formats**

| Format      | Year | Extension | Header Length (in Bytes)                       | Files per Scan        | Produced by  |
|-------------|------|-----------|--|-----------------------|--|
| Analyze 7.5 | 1980 | .img/.hdr | 348 bytes                                      | Two                   | PET  |
| NIFTI-1     | 2000 | .nii      | 352 bytes                                      | More number of Slices | PET  |
| MINC 2.0    | 1992 | .mnc      | Highly standardized and extensible             | One                   | Diffusion MRI (dMRI)   |
| DICOM       | 1993 | .dcm      | 128 bytes File Preamble + 4 bytes DICOM prefix | More number of Slices | CT, MRI, X-ray, fluoroscopy, angiography, mammography, PET, SPECT, Endoscopy, microscopy |

For example to display dicom image (file.dcm) in matlab See the following codes in figure 1

```
X=imread ('5.png');  
imshow(X);
```



**Figure 1: Display dcm Image in Matlab**

## Image analysis

Image analysis is primarily data reduction process. As we have seen, images contain enormous amount of data, typically on the order hundreds of kilobytes

or even megabytes. Often much of this information is not necessary to solve a specific computer imaging problem, so primary part of the image analysis task is to determine exactly what information is necessary. Image analysis is used both computer vision and image processing.

For computer vision, the end product is typically the extraction of high-level information for computer analysis or manipulation. This high-level information may include shape parameter to control a robotics manipulator or color and texture features to help in diagnosis of a skin tumor.

The image analysis process, can be broken down into three primary stages:

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

**Preprocessing** Is used to remove noise and eliminate irrelevant, visually unnecessary information. Noise is unwanted information that can result from the image acquisition process, other preprocessing steps might include Gray –level or spatial quantization (reducing the number of bits per pixel or the image size or finding regions of interest for further processing.

**Data Reduction** Is the second stage of image analysis. it Involves either reducing the data in the spatial domain or transforming it into

