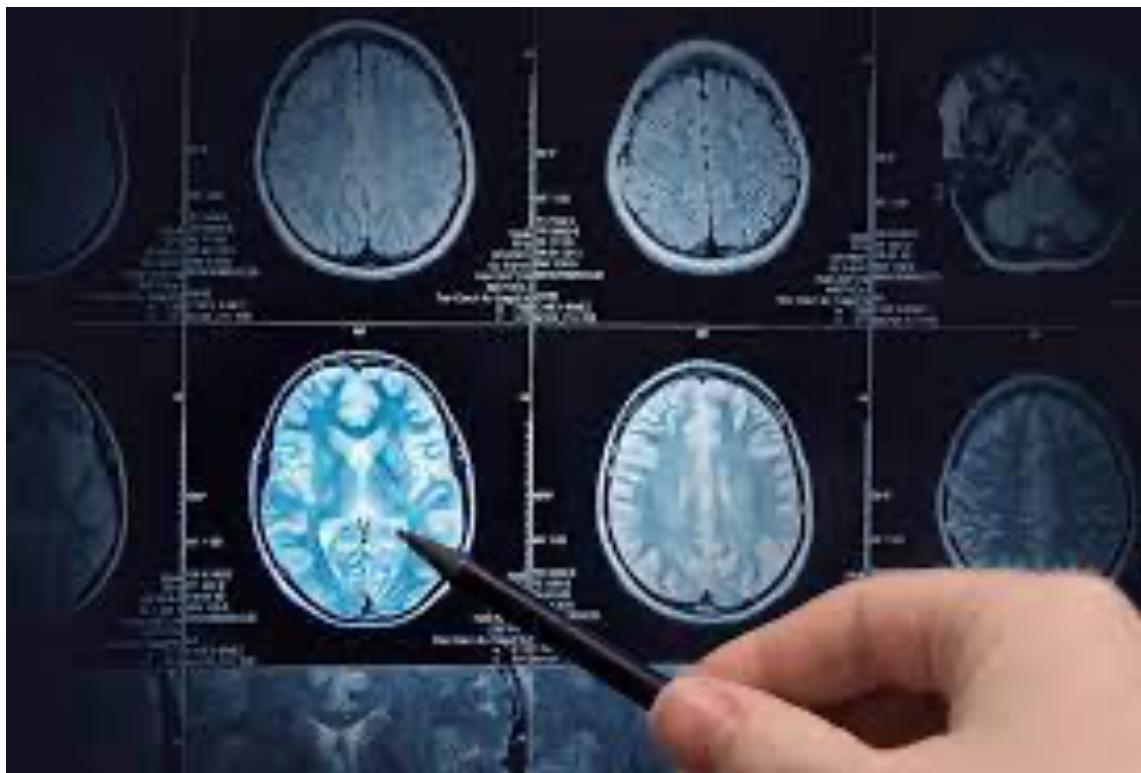




Mansoura University
Faculty of Computers and Information science.
Information Technology Department.
Course: Health Information Management and Medical Data Analysis.
Code: [MED142]
Fourth Year (IT & BIO departments)



Health Information Management and Medical Data Analysis





LAB 01: Introduction

LAB Objectives

The goal of this lab is to introduce our course and to practice implementing medical image analysis techniques.

After completing this lab:

- Students should be able to understand the meaning of Health Information Management and Medical Data Analysis.
- They get to implement medical data analysis techniques.
- They will get task on this lab's content.

LAB Content

1. Health Information Management and Medical Data Analysis:

- There are many problems in medical image analysis and interpretation involve the need for a computer aided system to understand the images and image structure and know what it means.
 - Technology today is extremely advanced and now physicians can call upon a variety of imaging techniques to help examine the inside of the body and therefore make an accurate diagnosis such as Scans and images of the body.
 - **Health Information Management and Medical Data Analysis** is the science that contains the solving/analyzing medical problems based on different **imaging modalities** and **digital image analysis techniques**.
-

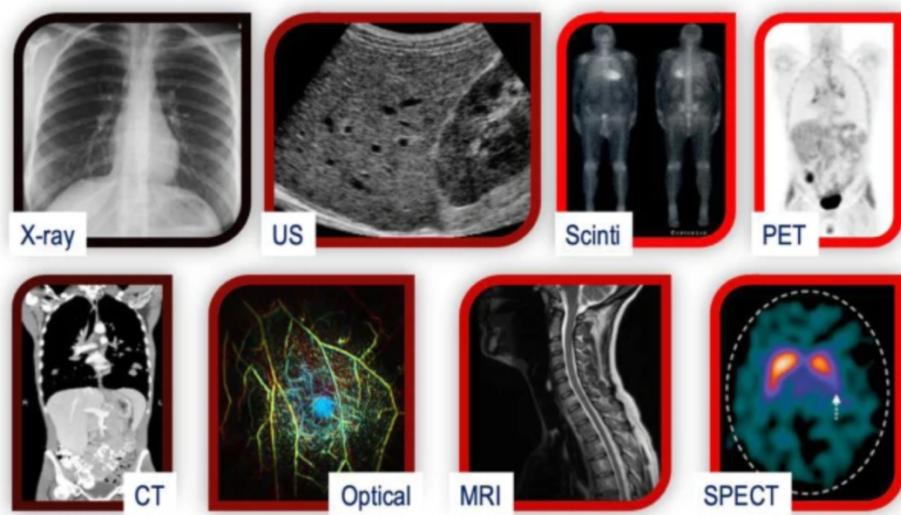


2. Image Modality

- Imaging Modality: a type of medical imaging technique that utilizes a certain physical mechanism to detect patient internal signals that reflect either anatomical structures or physiological events.
- Each modality is unique in terms of the images it gathers, equipment it uses, and conditions it helps radiologists diagnose.

3. Different Image Modalities:

- Geometric
- X-ray: 2D and 3D
- MR-Images: 2D, 3D, 4D, etc.
- Tomographic methods
- Microscopic images
 - Standard (requires staining)
 - HMC (Huffman modulated contrast)
- SPECT (Radioactive isotopes)
- Ultrasound
- Different artificially created images (bullseye for hearts)





4. Medical Problems:

- There are many problems that lead to develop Health Information Management and Medical Data Analysis
 - Diagnosis
 - Follow up on treatments.
 - Comparing different treatments/patients/drugs
 - Predicting development
-

5. Difference between Medical Images and Others:

- Analysis questions for a photograph are often based on a detection or tracking task.
- In medical image, the appearance of the depicted object is not caused by light **reflection**, but from the **absorption** of x rays.
- Medical images refer to several different technologies that are used to view the human body to diagnose, monitor, or treat medical conditions.
- **Medical images** play a vital role in dealing with the detection of various diseases in patients.

Computer vision picture



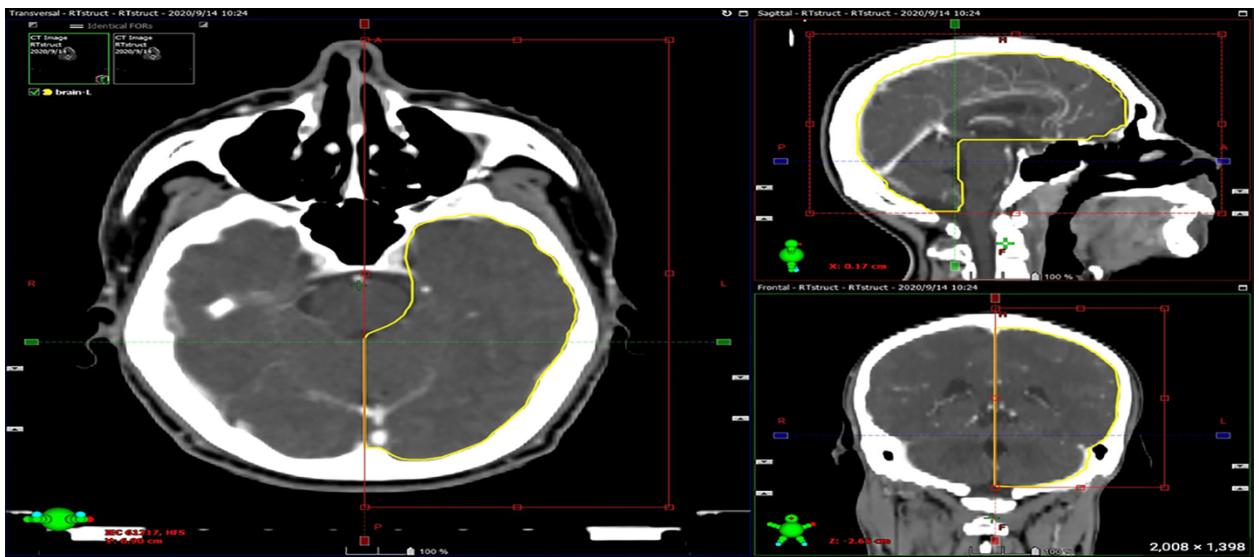


Medical Image picture



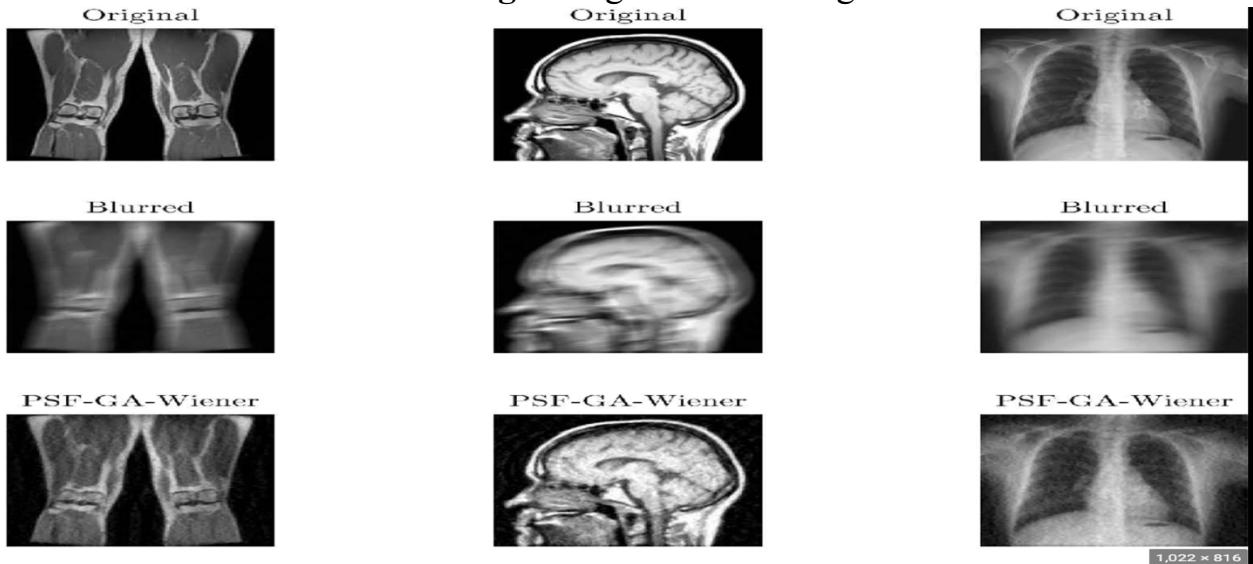
6. Function Of Health Information Management and Medical Data Analysis:

- Delineation: the act of outlining or representing something with lines or words.



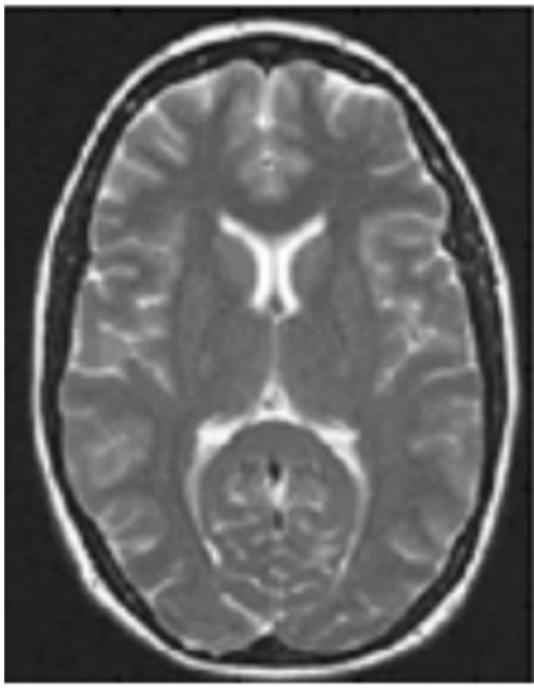


- Restoration: is a process by removing blur and noise from **image** and get back the original form.

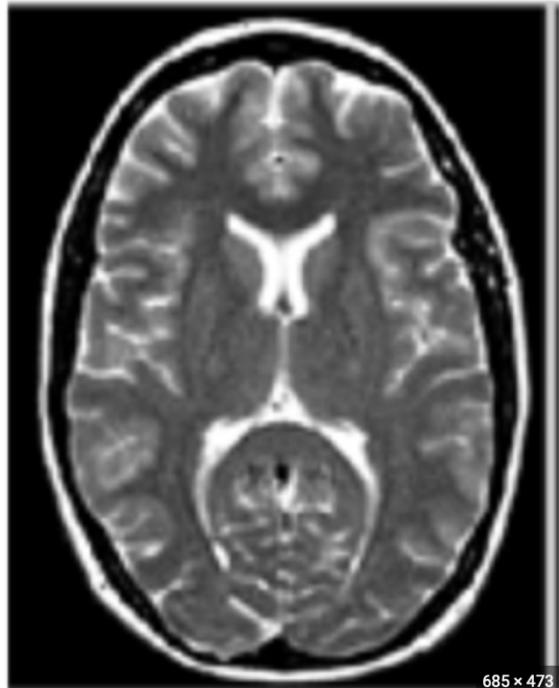


- Enhancement: is to improve the visual appearance of an **image**, or to offer a “better transform representation of the **image**.

Original Image

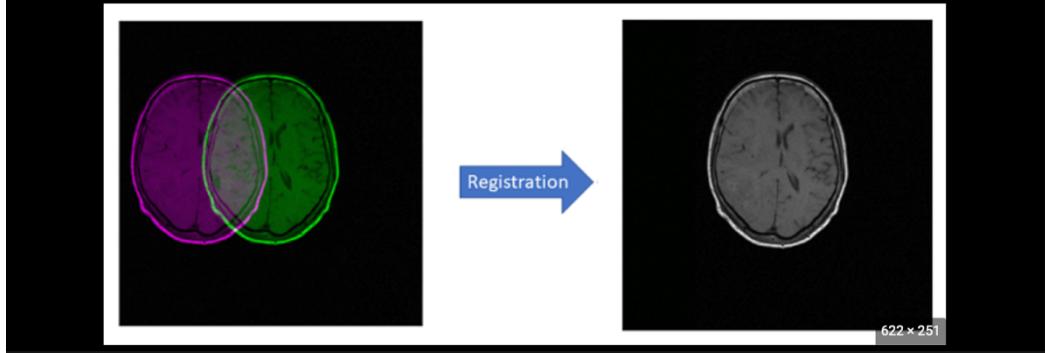


Enhanced Image





- Registration: is defined as a process that overlays two or more images from various imaging equipment or sensors taken at different times and angles, or from the same scene to geometrically align the images for analysis.



- Image registration is an [image processing technique](#) used to align multiple scenes into a single integrated image. It helps overcome issues such as image rotation, scale, and skew that are common when overlaying images.
- [Image registration](#) is often used in medical and satellite imagery to align images from different camera sources. Digital cameras use image registration to align and connect adjacent images into a single panoramic image.

7. Practical

- I Do Imaging (<http://www.idoimaging.com>)
 - I do imaging is a Web site contains free medical imaging software.



The screenshot shows the homepage of the I Do Imaging website. At the top, there's a navigation bar with links for HOME, PROGRAMS, DEMO, DATA, WIKI, BLOG, and ABOUT. On the right, there are buttons for REGISTER and LOG IN. A search bar is also present. Below the navigation, there's a section titled "I Do Imaging" with a sub-section "FREE MEDICAL IMAGING SOFTWARE". To the left, there's a "Find Software" section with a search bar labeled "SEARCH FOR PROGRAMS". To the right, there's a "Quick Links" section with three categories: "View DICOM Images" (Windows, Mac, Linux), "Convert DICOM Images" (Windows, Mac, Linux), and "Anonymize DICOM Images" (Windows, Mac, Linux). Further down, there are two sections: "Newly-added programs" featuring "Plastimatch" (Medical image computation focusing on high-performance volumetric registration) and "New version releases" featuring "OHIF Viewers" (DICOM image viewer in Javascript) and "DICOM image viewer in Javascript" (4.12.45, 2022-11-21).

- MIPAV (<http://mipav.cit.nih.gov>)
-

8. What is MIPAV?

- The MIPAV is (Medical Image Processing, Analysis, and Visualization)
 - It is an application that enables quantitative analysis and visualization of medical images of numerous modalities such as PET, MRI, CT, or microscopy.
 - Using MIPAV's standard user-interface and analysis tools, researchers at remote sites (via the internet) can easily share research data and analyses, thereby enhancing their ability to research, diagnose, monitor, and treat medical disorders
 - MIPAV is a [Java](#) application and can be run on any Java-enabled platform such as Windows, UNIX, or Macintosh OS X.
-

9. Goals For MIPAV:

- MIPAV is to meet the following goals:



- ✓ To develop computational methods and algorithms to analyze and quantify biomedical data;
 - ✓ To collaborate with NIH researchers and colleagues at other research centers in applying information analysis and visualization to biomedical research problems;
 - ✓ To develop tools (in both hardware and software) to give our collaborators the ability to analyze biomedical data to support the discovery and advancement of biomedical knowledge.
-

10. Imaging:

- **Imaging** is essential to medical research and clinical practice.
 - ✓ Biologists study cells and generate three-dimensional (3D) confocal microscopy datasets.
 - ✓ virologists generate 3D reconstructions of viruses from micrographs.
 - ✓ Radiologists identify and quantify tumors from Magnetic Resonance Imaging (MRI) and Computed Tomography (CT) scans.
 - ✓ Neuroscientists detect regional metabolic brain activity from Positron Emission Tomography (PET) and functional MRI (fMRI) scans.
-

11. Visualization Of Images:

- The visualization of datasets with two or more dimensions is an important aspect of image dataset analysis and research.
- The ability to visualize the orientation, locality, or progression (time) of structures in clinical and nonclinical datasets can be vital to researchers.



- MIPAV allows researchers to visualize datasets using a variety of presentation formats, including lightbox, triplanar, cine, and animate.
 - The methods for visualizing data are considered as the graphical representation of information and data. These data are first analyzed and computed depending on the criteria and purpose of users. Thereafter, they are visualized or simulated by using visual elements like charts, graphs and maps to explore, understand their characteristics and data structure.
-

12. Volume Of Interest (VOI) Segmentation and Analysis:

- Another significant research activity is the quantification of data from image datasets.
 - the actual quantification of the data is typically required to evaluate the researchers' hypothesis. Researchers must be able to identify regions-of-interest (ROIs) and/or volumes-of-interest (VOIs).
 - An ROI is used in the context of 2D image datasets. VOI for datasets with more than two dimensions. But in this program uses the term VOI to represent both ROI and VOI.
-

13. Image Segmentation:

- Image segmentation is the process of identifying connected regions of images as members of a common group.
- It is the process of automatic or semi-automatic detection of boundaries within a 2D or 3D **image**.
- In the medical field, physicians must routinely identify (i.e., segment) structures in medical image datasets to facilitate the treatment of patients.



- There are a multitude of image dataset segmentation methods; the choice of segmentation algorithm depends on the image data type and task.

Open The Website > [Http://Mipav.Cit.Nih.Gov](http://Mipav.Cit.Nih.Gov)

The screenshot shows the NIH Center for Information Technology website. The top navigation bar includes links for CIT Home, Products & Services, Information Security, Support, Science, IT Policies, and About CIT. Below the navigation is a search bar labeled "Search CIT: [] GO". A breadcrumb trail indicates the current location: CIT Home > Science > Collaborative Research > Biomedical Imaging > MIPAV. The main content area features a banner with the word "SCIENCE" and a background image of laboratory glassware. On the left, there's a sidebar with a "MIPAV" section containing a thumbnail of the Vitruvian Man and the text "MEDICAL IMAGE PROCESSING AND VISUALIZATION". It also lists "Version 9.0.0 (2019-09-20)" as the current downloadable version and provides a "What's New" link. The main content on the right is titled "About MIPAV" and includes a link to "MIPAV feature listing". Below this is a section titled "What is MIPAV?" with a detailed description of the application's purpose and capabilities. Further down are sections for "Goals for MIPAV" (listing goals such as developing computational methods and collaborating with researchers) and "Need for MIPAV".

➤ Steps of downloading MIPAV

- ✓ Down load the program from the website and setup it.
- ✓ Fill out the required form – type your name and e-mail address.
- ✓ Scroll down the page to locate and read the installation instructions provided for installing MIPAV on your workstation's platform.
- ✓ You might choose to download the tested release version or the nightly release, which is the most recent un-tested version.



- ✓ Click the appropriate platform link—Windows, Linux, Solaris, Macintosh, or Other. The File Download dialog box opens.

M I P A V

Download MIPAV

Two versions of MIPAV can be downloaded for each platform:

- [Current binaries](#)
- [Source code](#)
- [Archived binaries](#)

What's the difference?

The release version of MIPAV is tested to ensure that it installs and runs. We make new release versions available when we feel a significant number of changes have accumulated. A nightly built, test version is released nightly and it incorporates changes made to MIPAV during the course of the day.

Which to download?

Most users will find that the release version fits their needs; the group has deemed that added functionality does not have any noticeable errors. However, because the nightly-built, test version will track recent changes, a user seeking a solution to a known problem may be able to find it corrected before we are ready to make a new release. Any temporary errors may prevent the MIPAV project software from even installing.

MIPAV current binary releases

The latest release is version: 10.0.0 (2020-03-26)

The latest nightly build is version: 10.0.0-2021-03-27 (2021-03-27)

Please fill out the form below and click on the button for your particular operating system to download MIPAV.

[View the MIPAV Installation Guide](#)

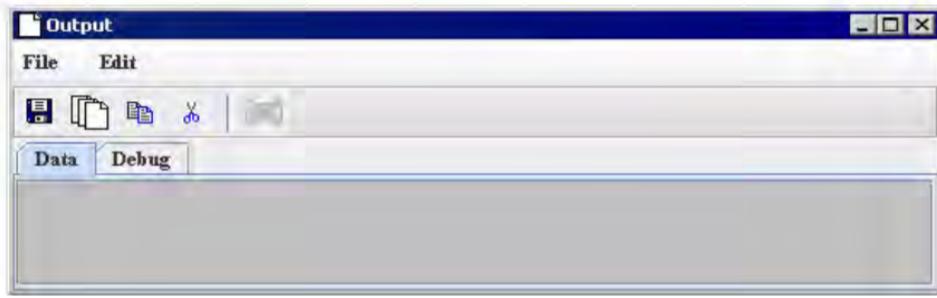
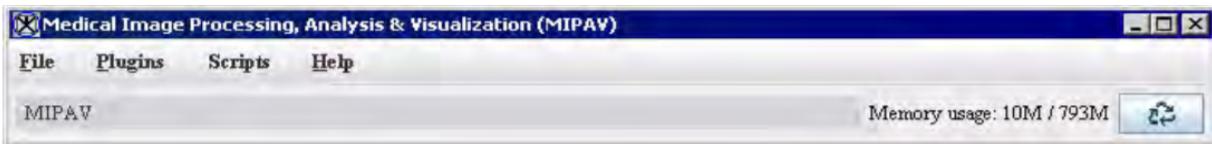
Name (required)	
Email (required)	
Join the MIPAV Listserv ?	<input type="checkbox"/>
Institute or Center	Not at the National Institutes of Health, Maryland, USA. <input type="button" value="▼"/>
Interest in MIPAV	

➤ Starting MIPAV

- ✓ Select Start > Programs > mipav > mipav.
- ✓ Both the main Medical Image Processing, Analysis, & Visualization (MIPAV) window and the Output window appear on your desktop.



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Homework 01:

Student Name	
Student ID	
Section, Dept.	
Date	

Question1: Write some examples of medical image modalities.

Question2: What are the differences between medical images and others?

Question3: What are Functions of Health Information Management and Medical Data Analysis?

Question4: What is Visualization of Images?

Question5: What's the difference between VOI and ROI?

Question6: What's the concept of Image Segmentation?

Question7: What's MIPAV?

Question8: What's Image Modality?