

# Lab Experiment # 4

## Digital Radiography (DR) *Digital Image Manipulation Functions*

### ***Purpose***

The purpose of this lab is to demonstrate the impact of various image manipulation post-processing techniques—such as image annotation, image flipping/rotating, electronic collimation, image inversion, magnification, and adjustments to window width and window level—on image quality in digital radiography (DR) and how these techniques can be used to optimize diagnostic images.

### ***Learning Objectives***

After completing this lab, you should be able to:

1. Use the laboratory equipment properly.
2. Set up the control console and ceiling tube mount correctly.
3. Function effectively in group work.
4. Perform the experiment independently.
5. Explain the effect of image annotation, flip, rotate, and collimation of the digital image.
6. Evaluate the effect of image inversion and magnification of the digital image.
7. Explain the use of window width & window level settings to improve image quality.
8. Summarize the use of window width and window level functions and their importance to producing optimum digital images.

### ***Materials Needed***

- Hand phantom
- Digital (DR) image receptor
- Set of lead markers
- You will be working with digital images produced and saved in the system

# Experimental Procedure

## *Instructions for all the Exposures*

1. Place the hand phantom in the center of the DR image receptor in the prone position for PA projection.
2. Direct the central ray **perpendicular** through the **center of the part and the image receptor**.
3. Tape the x-ray beam attenuating (lead) markers onto the image receptor and collimate the beam to the size of the **image receptor**.  
(The room, anatomical side, and exposure number must be labeled on **ALL** images.)
4. Set the x-ray tube, mode of operation and as indicated in the technique worksheet.
5. Take an exposure using the settings indicated in the technique worksheet.



Use the hand radiograph to perform post-processing manipulation

# Technique Worksheet

(PA HAND – Tabletop TT)

## Technical Factors for Room A, B, C, and D


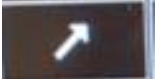


	mA	Time	mAs	kVp	Image Receptor	Focal Spot	SID	EI
	sec					Small or large	inches	
<b>1</b>	100		1	64	CR		40	

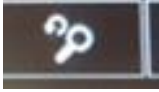
1. Please open the image in the software we use for image manipulation. Rotate the image 90 degrees to the left. After completing the rotation, identify and draw the icon or symbol that corresponds to this rotation function in the software
2. Mirror the image across the vertical axis. After completing the mirroring, identify and draw the icon or symbol that corresponds to the mirroring function in the software
3. Invert the contrast of the image. After completing the contrast inversion, identify and draw the icon or symbol that corresponds to the contrast inversion function in the software
4. Place a marker (R for right or L for left) on the image. After placing the marker, identify and draw the icon or symbol that corresponds to the marker placement function in the software
5. Place the marker by typing 'Right' or 'Left' on the image. After placing the text marker, identify and draw the icon or symbol corresponding to the software's text tool function.
6. Magnify the image to zoom in and observe finer details. After completing the task, identify and draw the icon or symbol corresponding to the software's magnification tool.
7. Measure the length of the third metacarpal. After measuring, note what unit of measurement is used for the length in the software and record the measurement. draw the icon or symbol corresponding to the software's measurement tool.

8. Measure the angle between the third and fourth metacarpals. After measuring, note the angle value and draw the icon or symbol corresponding to the software's angle measurement tool.
  
9. Sharpen the image and smooth it out using the appropriate tools. Observe how these adjustments affect the spatial resolution of the image and noise. After completing the task, identify and draw the icons or symbols corresponding to the software's sharpen and smooth functions.
  
10. Split the screen into two sections and display the hand X-ray in both sections. After completing the task, identify and draw the icon or symbol that corresponds to the software's split-screen function.
  
11. Change the window width (WW) of the image. Observe how this adjustment affects the image, specifically whether it alters the brightness or contrast. After making your observations, explain the relationship between window width (WW) and contrast or brightness. Additionally, identify and draw the icon or symbol corresponding to the software's window width adjustment tool.
  
12. Change the window level (WL) of the image. Observe how this adjustment affects the image, specifically whether it alters the brightness or contrast. After making observations, explain the relationship between window level (WL) and brightness or contrast. Additionally, identify and draw the icon or symbol corresponding to the software's window level adjustment tool.
  
13. Pan the image to move it around within the viewing area. After completing the task, explain the steps required to pan the image and identify and draw the icon or symbol corresponding to the pan function in the software.

14. Shutter the image to limit the visible area of the X-ray exposure to the third digit (finger). After completing the task, identify and draw the icon or symbol corresponding to the software's shutter tool.
  
15. Can you stitch two images together on the computer console? Is that function available in the image manipulation software? If yes, explain how to do it and identify the corresponding icon or tool.
  
16. Are there any other functions available on the computer console? If yes, identify the additional functions and explain their purpose. Also, draw the icons or symbols associated with these functions.


## Worksheet

Icon	Function (What does it do?)
1 	
2 	
3 	
4 	

5		
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6		
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7		
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8		
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## Post-Processing Manipulations of the Hand

Done

9. Horizontally flip the image to make it a **mirror-image**.

10. Rotate the image **90 degrees to the right**.

11. Magnify (pan and zoom) the image to **only see the the first PIP joint**

12. Electronically collimate, mask, or shutter the image to **only see the thumb**.

13. Reverse, or invert, the image's **black-white grayscale**.  
(aka image reversal or image inversion)

14. Place a letter "R" (right side marker) **next to the thumb.**  
(aka image annotation)



15. Measure the **width of the first proximal phalanx.**



16. Increase window width (WW).



17. Decrease window width (WW)



18. Increase window level (WL).



19. Decrease window level (WL).

