Introduction to Linux VisionX and Image presentation

Lab 1 Questions

A. General Image Manipulation

1. What is the pixel coordinates of Albert's right eye?
   A: 106, 155

2. How did you make this measurement?
   A: I put my mouse tracker at the center of Albert's right eye (shown on the left of his picture), and then read the coordinates from the left bottom side.

3. What is the width of Albert's mustache?
   A: 47.5

4. What are the main issues in making distance measurements on images? Consider and comment on the following:
   A:
   Mouse control: During the measurement, we should put the mouse in correct position and mark the precise boundary we choose.

   Feature visibility: Adjust the image properties to view the feature to be measured more visible.

   Image Size: Use zoom-in and out to scale the image for us to make details more clearly.

   Question ambiguity: Read the question carefully to identify exact feature we need to measure.

D. Image Set Display, Pixel Quantization

1. What does the girl image sequence show?
   A: Display how a picture will perform under different Grey and BPP parameters.

2. What do the image parameters printed in the caption of the image mean?
   A: Grey stands for greyscalse and it carries the intensity information, also means black and white composed of shades of grey. BPP stands for Bits Per Pixel means number of colors can be represented by a pixel.

3. At what quantization does degradation in image quality become noticeable?
   A: Degradation in image quality become noticeable when Grey level = 10 and BPP = 4

4. What is the implication of this observation for image display design? Comment on the number of gray levels you would include in a product for general use and why?
   A: (1) When we design image display, if we care about user experience, we should set grey level and BPP parameters more than the parameters when image quality degradation become noticeable. (2) I would like to use grey level = 10 and BPP = 5.

Because at this parameter shown in given image, degradation in image quality is not noticeable yet and the quality looks nice. Also, if we store an image using grey level > 32 and BPP > 5, the image will consume more space to store. So, I will choose grey level = 32 and BPP = 5 as my parameters when I design an image display.

5. Many home theater systems claim to have a 4000 to 1 contrast ratio or (much) greater. Assuming that this is possible by the image encoding methods used how is such a large range useful given human visual system limitations?
A: The contrast ratio is a property of a display system, defined as the ratio of the luminance of the brightest color (white) to that of the darkest color (black) that the system is capable of producing. A high contrast ratio is a desired aspect of any display. It has similarities with dynamic range. If it exceeds HVS limitations, even though we can't distinguish the difference, but it will make the movies more vivid and we will feel more reality. Just like Retina display.

E. Terminal command and log enhancement

1. What does the vmath command do?
A: vmath command computes a primitive mathematical function or a set of functions on each pixel of a given image data file.

2. How does the vmath operation affect the visibility of image features?
Are some parts of the image easier to see after the log transform?
Is it possible to see more or less detail after the transform?
A: (1) Given vmath operation(vmath -mlog -scale girl-grey.vx of girl-log.vx) makes the image brighter and details of image more visible. (2) Yes, there is a leaf under the lady's neck and also detail of lady's eye is more visible. (3) It is possible to see more details after the log transform.

3. If more detail is visible, how is this possible? (consider your answer to question 2) (think carefully)
A: Since -mlog will compute the logrithm of all pixel values and less than 0 will be set to zero and values in 0-3 are linearly scaled and -scale command set the range of output pixels from lval to hval. So the image is brighter and contrast between really dark places and other part of image is increased, which makes more visible of details. Such as the leaf under lady's neck and details of her eye is more visible to me.

F. Large Image Display

1. What is the size of the x-ray image?
A: The size of this x-ray image is 2048 * 2048*0.

2. What are the window settings?
A: The window settings for this picture is Window = 4095, Level = 2049, Preset = Auto.

3. What is the range of pixels in the image?
A: The range of pixels in this image is 1~4096.

4. Which interpolation method is the best and why?
   A: No Interpolation for this image to find high contrast boundary is the best. Because we have 3 types of interpolation method: a, No Interpolation, b, Bilinear Interpolation, c, Bicubic Interpolation. No Interpolation is used when displaying a magnified image, image will display faster but it will appear pixelated. Bilinear Interpolation is used when displaying a magnified image, image will be smoothed but it will display slower. Bilinear and Bicubic interpolation are the best, since it boundary is smoothed after zooming in.

G. Segmentation Using Thresholding

1. What is the best threshold for the facsimile image?
   A: When window value is set to 1, the best threshold for facsimile image is level value equals 216.

2. What is your criterion for best threshold?
   A: It should display all the detail of this image. Letters should be readable. Also the outlines should not be so dark which interferes readability.

3. What is the best threshold for the map image?
   A: When window value is set to 1, the best threshold for map image is level value equals 92.

4. What is your criterion for best threshold?
   A: The map still show outlines for all of the streets, which is the main function for a map. Also, we could read some of the small letters on the map.

5. What is the problem in thresholding the map image?
   A: The problem in thresholding the map image is we need a balance between the street readability and letter readability. Since the map image, it is brighter in the center of the image, which I assume the light source comes from above the map. It causes the 4 corners of this image darker. If we increase the level value, the 4 corners (especially upper-left and bottom-left) will be wiped out first. So, I need to do a trade off to maintain the map's function to show all the lines to describe streets while leave some letter readability on the map.

6. How might you get a better result on the map image? (That is, what kind of processing operations might improve the result?)
   A: I will increase the window value to lower the visible contrast in order to offset the brightness contrast caused by the light source on the map.

H. Using vview and vdview, Edge Detection

1. Are all the edges detected by vedge?
   A: No, the railway track foundation edge is not fully detected by vedge.

2. Can you improve the result? (by using different options)
   A: The result can be improved by using vderiche operation.

3. What is an edge? (a) provide a definition for an edge:
   A: An Edge in an image is a sharp variation of the intensity function. In greyscale images this applies to the intensity or brightness of pixels. In color images it can also refer to sharp variations of color. An edge is distinguished from noise by possessing long range structure. Properties of edges include gradient and orientation.

4. Describe what you mean by edges in the context of the caboose image.
   A: Edges in context of the caboose image, it means the small number of pixels of a different intensity between background and the caboose and the track.