Introduction to Linux VisionX and Image presentation

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Lab 1 Questions

A. General Image Manipulation

1. What is the pixel coordinates of Albert's right eye?
   (148,156)
2. How did you make this measurement?
   Firstly, I selected one focus on the area of right eye and zoomed in;
   Then, I used the rectangle measure way to mark the area of eye;
   Last, I chose the one point that is the left of the geometric center of this rectangle edge (because the density of left part of his eye is more than that of the right part).
3. What is the width of Albert's mustache?
   46.98

4. What are the main issues in making distance measurements on images? Consider and comment on the following:

   Mouse control: *how to decide the point you clicked is the point you want it mark and it is also a tricky to decide that the line you used it the width.*
   Feature visibility: I*t is unclear and unsure of the edge between the mouth and the mustache.*
   Image Size: *The structure of mustache is irregular, so the width is not the same and thus the image size is the cntroversial one.*
   Question ambiguity: *1. The meaning of 'Width' varies from person to person. It could be the vertical length or the horizontal length. As for me, I chose the horizontal length of the mustache. 2. The structure of mustache is irregular and curved. So the actual length of it is difficult to measure precisely.*

D. Image Set Display, Pixel Quantization

1. What does the girl image sequence show?
   It shows as the grey and bop decrease, the edge of the girl and the other things in the picture are becoming vague and the picture gradually lost many details so the clarity of the picture decreases.
2. What do the image parameters printed in the caption of the image mean?
   Grey means greyscale, that is, the color depth of a point in a black and white image.
   BPP means bite per pixel. The number that one pixel could express depends on bpp.
   The maximum number that one pixel could represent is 2^bpp.
3. At what quantization does degradation in image qualit become noticeable?
   It is noticeable when the sixth picture turned to the seventh picture.
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?
   The grey level of a picture can affect the quality of the picture and the bpp can affect the maximum of grey level.

From this image display, I know that the minimum number of grey level is 32. So I will choose 32 as my gray level in a product for general use. Because when these pictures change in turn and grey level decrease to less than 32, we can notice the image quality's degradation and thus 32 is the minimum number of grey level that will not affect the quality and choose the minimum will decrease the storage space of picture and accelerate the processing speed.

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?

According to my search about the sensitivity of human eyes to contrast ratio, human eyes can possibly see over a range of 400 to 800:1 and the eye would not detect any difference above approximately 1000:1 but for dynamic contrast ratio, the range of human eyes is 10 million to one. So if this contrast ratio in the title is not dynamic contrast ratio, such a large range is redundant because human cannot tell the difference. If it is dynamic contrast ratio, then human can tell color contract and thus if the contrast ratio is high, human will find the change of picture's colors are smoother.

E. Terminal command and log enhancement

1. What does the vmath command do?

Vmath perform a function or a set of functions on each pixel of the image data file. The function command will follow the 'vmath', like -log, -log, -scale. Next element of the command will be the file name that we want to calculate. The final element of the command is "of=filename" which means this command will create another file for calculated image and they will be the same format.

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?

（1）It increases the brightness of the picture;

（2）Yes, some parts of image become easier to see, like the flower, the hair and eyes of the woman;

（3）Yes, I think it is possible.

3. If more detail is visible, how is this possible? (consider your answer to question 2) (think carefully)

This question is hard to say. Because the command we executes is '-mlog' which means it will compute the logarithm of all pixel values and then the calculated values less than zero are set to zero abd values in the range 0-3 are linearly scaled. On the one hand, the picture lose some pixel values because we set some calculated pixel value to zero, so we probably will lose more details. On the other hand, the logarithm calculation will increase the difference between some pixels whose difference were supposed to be small. And this will help to make more details clearer. So some part of picture will more visible, some might not be.

F. Large Image Display

1. What is the size of the x-ray image?

*2048 * 2048*

2. What are the window settings?

The window setting of the best contrast picture are Window: 3000, level: 2000

3. What is the range of pixels in the image?

1 - 4096

4. Which interpolation method is the best and why?
   *Bicubic interpolation is the best. Because firstly, from visual observation, this interpolation will make the picture more clear. Secondly, in contrast to bilinear interpolation, which only consider 4 pixels(2*2), bicubic interpolation take 16 pixels (4*4) into account. So the image resampled with bicubic interpolation are smoother.*

G. Segmentation Using Thresholding

1. What is the best threshold for the facsimile image?
   level :228
2. What is your criterion for best threshold?
   Some letters begin to become hard to tell. Above this level the picture become vague and the information cannot be read.
3. What is the best threshold for the map image?
   level: 86
4. What is your criterion for best threshold?
   The dark part of background totally disapears.
5. What is the problem in thresholding the map image?
   If I take the criterion of mine, some letters on the map still cannot tell. But if I use the clarity of letters as, the dark part of bacgroud will cover some lines 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?)
   Maybe we need to change the window value and level value at the same time.

H. Using vview and vdview, Edge Detection

1. Are all the edges detected by vedge?
   No, actuallly many edges do not be detected.
2. Can you improve the result? (by using different options)
   It can be improved by using "VisionX->Edge Operators -> vderiche".
3. What is an edge? (a) provide a definition for an edge:
   An edge of a picture is a colletion of pixels whoes grey level change very sharply around the pixels and it is a boundary between different types of regions.
4. Describe what you mean by edged s in the context of the caboose image.
   Take the car for example. The car's color is darker than its around pixels. So the edge of the car is the collection of points that change very quickly from low pixel value to high pixel value. Also, this collection marks the region of car and can help to divide the car from the background wall.