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# EECS22 LAB WEEK3

10/15/12 Weiwei Chen

## Feedback on Assignment 1

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- Most of the submissions are very good!
- Several suggestions
  - Code indentation
  - Use of functions
  - Use of global variables
  - A little bit too many control flow hierarchies

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## Assignment 2

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- A manual driven digital image processing (DIP) program.
- Using function calls for image inputting / outputting, image processing, and testing.
  - Function declaration, function definition, function call
  - Function parameters, argument.
  - Scope of the variables.
- Two-week assignment. Plan the schedule of your work. Start it early!
  - Week1: Setup the working environment. Design the user menu. Build up the frame of the operation functions. Try 1~2 operations on the image?
  - Week2: Complete the operations. Test your program?
- Use the web browser to view your image.

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## Image with pixels

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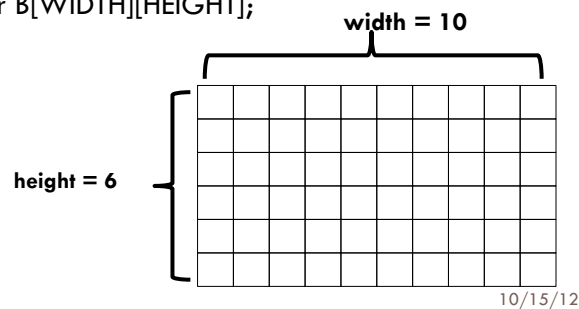
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## How to operate a picture

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- The data structure to represent a picture in computer
  - Two-dimensional arrays for the intensities of each pixel
    - unsigned char R[WIDTH][HEIGHT];
    - unsigned char G[WIDTH][HEIGHT];
    - unsigned char B[WIDTH][HEIGHT];



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## RGB Color Model

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- Three components for one color
- 3-tuple (R, G, B)
  - R: intensity of red
  - G: intensity of green
  - B: intensity of blue
  - Basically, the range of the intensity is [0, 255], use **unsigned char** to for each intensity
- Color Examples
  - **Red** (255, 0, 0), **Green**(0,255,0), **Blue**(0,0,255),
  - **Yellow**(255,255,0), **Cyan**(0,255,255), **Magenta**(255,0,255)
  - **White**(255,255,255), **Black**(0,0,0)

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## Pause and reflection

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- What are the colors of the pixels in the image which is represented as following in the computer
  - ▣ unsigned char R[3][2] = {{0, 0}, {255, 255}, {255, 0}};
  - ▣ unsigned char G[3][2] = {{255, 0}, {255, 0}, {255, 0}};
  - ▣ unsigned char B[3][2] = {{0, 255}, {0, 0}, {255, 0}}
- Color Examples
  - ▣ **Red**(255, 0, 0), **Green**(0,255,0), **Blue**(0,0,255),
  - ▣ **Yellow**(255,255,0), **Cyan**(0,255,255), **Magenta**(255,0,255)
  - ▣ **White**(255,255,255), **Black**(0,0,0)



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## How to operate a picture

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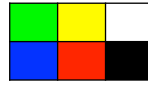
- Use two for-loops to scan all the pixels in a picture
  - ▣ Inner loop: fix the number of the column, iterate the pixels in the same column with different row numbers
  - ▣ Outer loop: iterate all the columns.

```
int x, y;
for (x= 0; x < WIDTH; x ++){
    for(y=0; y<HEIGHT; y++){
        operations for pixel(x,y);
    }
}
```

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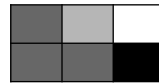
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## DIP Operations



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- Black & White
  - ▣ Get the average value of the three color channels for each pixel  $(x,y)$ .
  - ▣ Set  $R[x][y]$ ,  $B[x][y]$  and  $G[x][y]$  to be the average value.



- What are the values in the pixel arrays after the *B&W* operation?
- Please write down the C program for the *B&W* operation.

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## DIP Operations



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- Negative
  - ▣ Subtract  $R[x][y]$ ,  $B[x][y]$  and  $G[x][y]$  from 255 and set the new value back.



- What are the values in the pixel arrays after the *Negative* operation?
- Please write down the C program for the *negative* operation.

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## DIP Operations



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- Flip horizontally
  - ▣ Swap pixel  $(x,y)$  and pixel  $(width-1-x, y)$
  - ▣ Scan half of the picture
- Flip vertically?
  - ▣ Swap pixel  $(x,y)$  and pixel  $(x, height - 1 - y)$
  - ▣ Scan half of the picture



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## DIP Operations



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- Mirror horizontally
  - ▣ copy pixel  $(x,y)$  to pixel  $(width-1-x, y)$
  - ▣ Scan half of the picture
- Mirror vertically?
  - ▣ copy pixel  $(x,y)$  to pixel  $(x, height - 1 - y)$
  - ▣ Scan half of the picture



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## Assignment 2 Tips

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- Test your program
  - AutoTest() function
  - Call all the other operation functions together in the program.
  - Be careful with the arguments for each functions.
  - Sample function calls are listed in the assignment.
- Global constants
- Scope of the variables
- Pass by reference when using array parameters.
- Function prototypes mentioned in the assignment are very helpful hints.

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## It's time for coding

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- Please raise your hand if you need help!!
- Before you leave today, please
  - Write down one thing that you feel confusing about C programming.
  - Write down your idea about how does the lab run
    - Too much discussion, need more time working on your own?
    - Not enough discussion, need more time to talk?
    - Other suggestions?

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## DIP Operations



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### □ Black & White

- Get the average value of the three color channels for each pixel  $(x,y)$ .
- Set  $R[x][y]$ ,  $B[x][y]$  and  $G[x][y]$  to be the average value.



### □ Negative

- Subtract  $R[x][y]$ ,  $B[x][y]$  and  $G[x][y]$  from 255 and set the new value back.



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