Computer Vision
Homework Assignment

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Homework Assignment

- Homework 01 (2017/10/23), Deadline: 2017/11/06
- Homework 02 (2017/11/20), Deadline: 2017/12/04
- Homework 03 (2017/12/18), Deadline: 2017/01/01

Homework Assignment

Target:

- ✓ Write the main functions by yourself to deep understand the theories of computer vision.
- ✓ Improve your skills about using C/C++ language, Opencv Lib and Visual studio
- ✓ In the future:

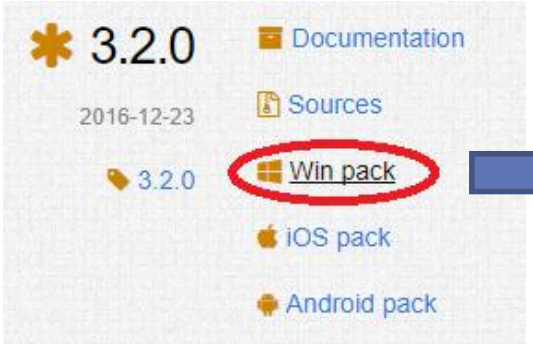
  Develop a new algorithm/method and write main function by yourself.

Overview

- **OpenCV Library**
  - ✓ **Introduction**
  - ✓ **Environment Setting with Visual studio**
  - ✓ **Example**
- **Homework Assignment**

OpenCV Library

- OpenCV (Open Source Computer Vision Library)
- It has C/C++, Python and Java interfaces and supports Windows, Linux, Mac OS, iOS and Android.
- *Opencv 3. and Visual studio*
- Download: *http://opencv.org/releases.html*



opencv-3.2.0-vc14.exe

OpenCV Library

- **Using opencv and Visual Studio**

  ✓ Install OpenCV 2.4.7 using Visual Studio 2010 / 2012

  https://www.youtube.com/watch?v=l4372qtZ4dc

  ✓ Installing OpenCV 2.4.11 with Visual Studio 2013

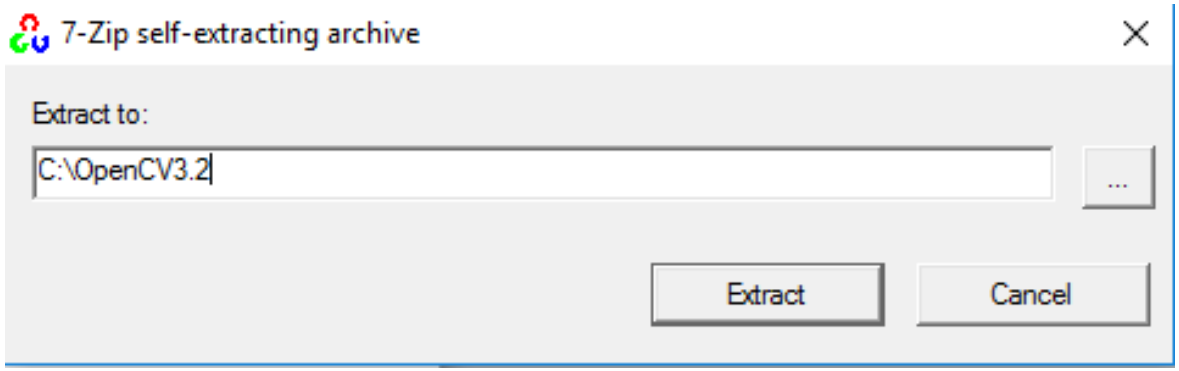
  https://www.youtube.com/watch?v=HN47AljUjq4

  ✓ OpenCV 3 Windows 10 Installation Tutorial

  https://www.youtube.com/watch?v=7SM5OD2pZKY

OpenCV Library

- Extracting Opencv 3.2

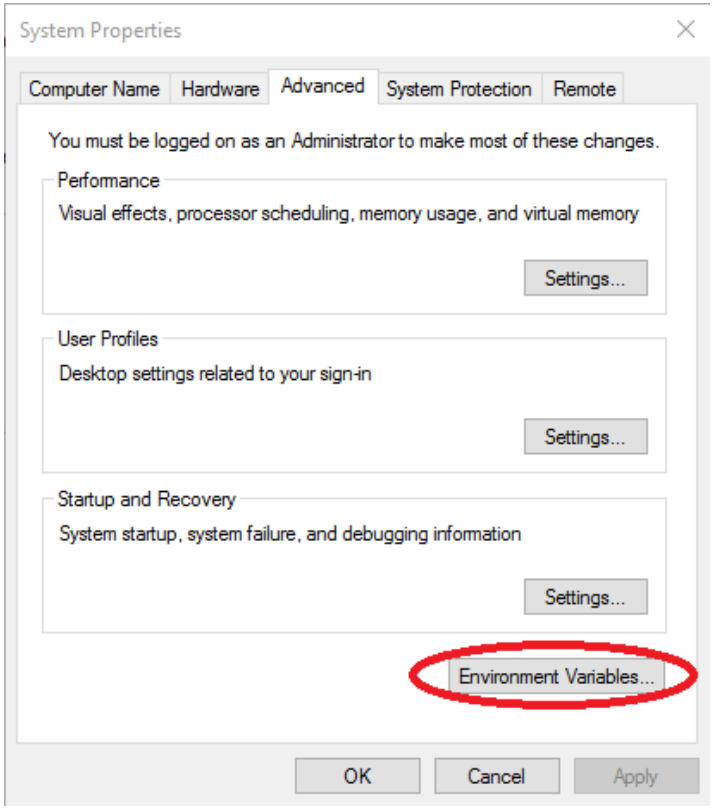


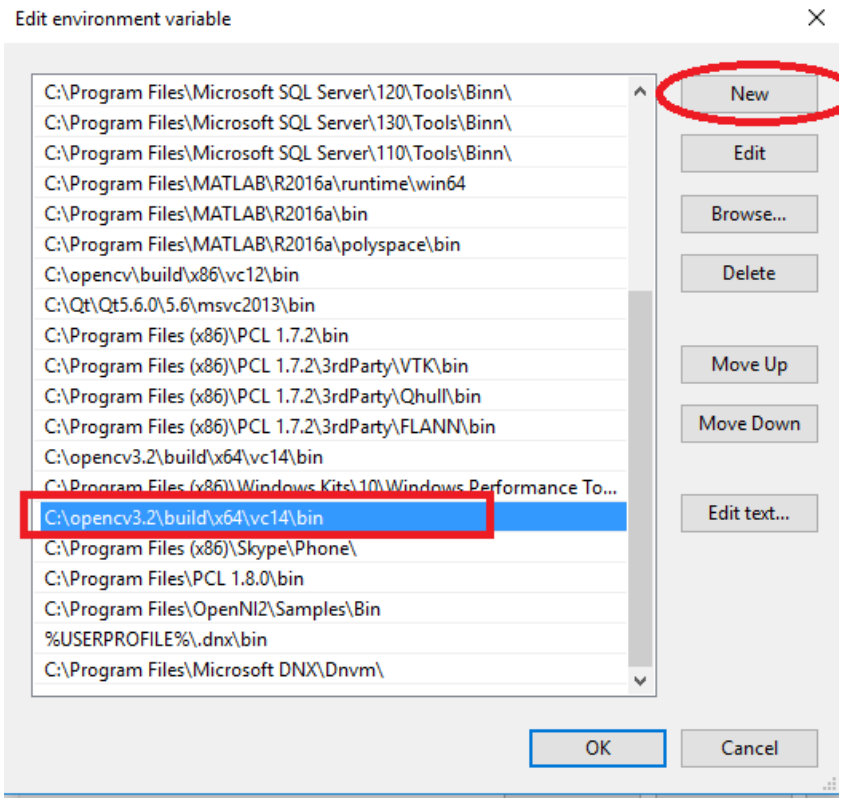
OpenCV Library

- **Environment Setting**

➢ Computer -> Advanced system settings -> environment Variables -> Path->

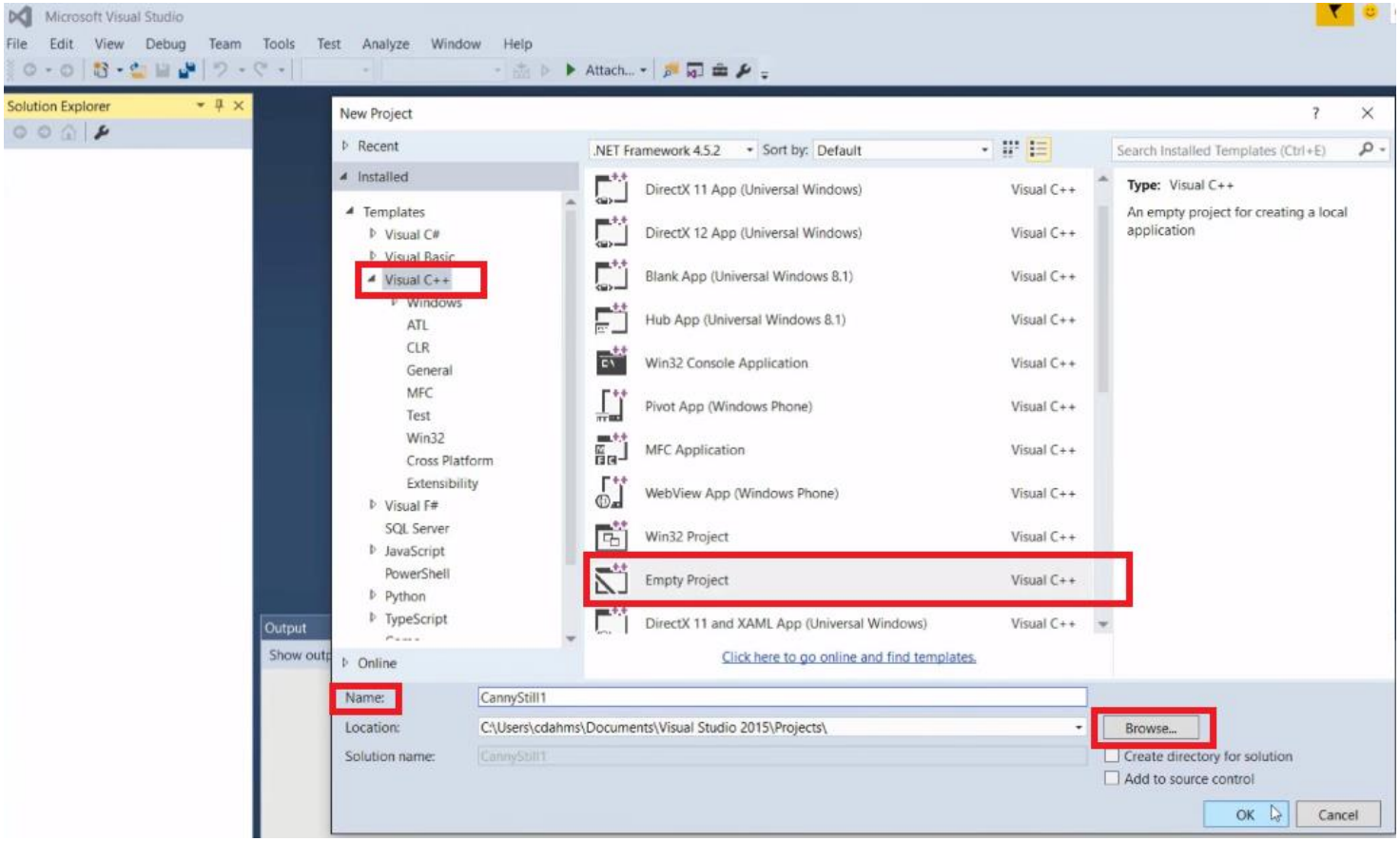
New





OpenCV Library

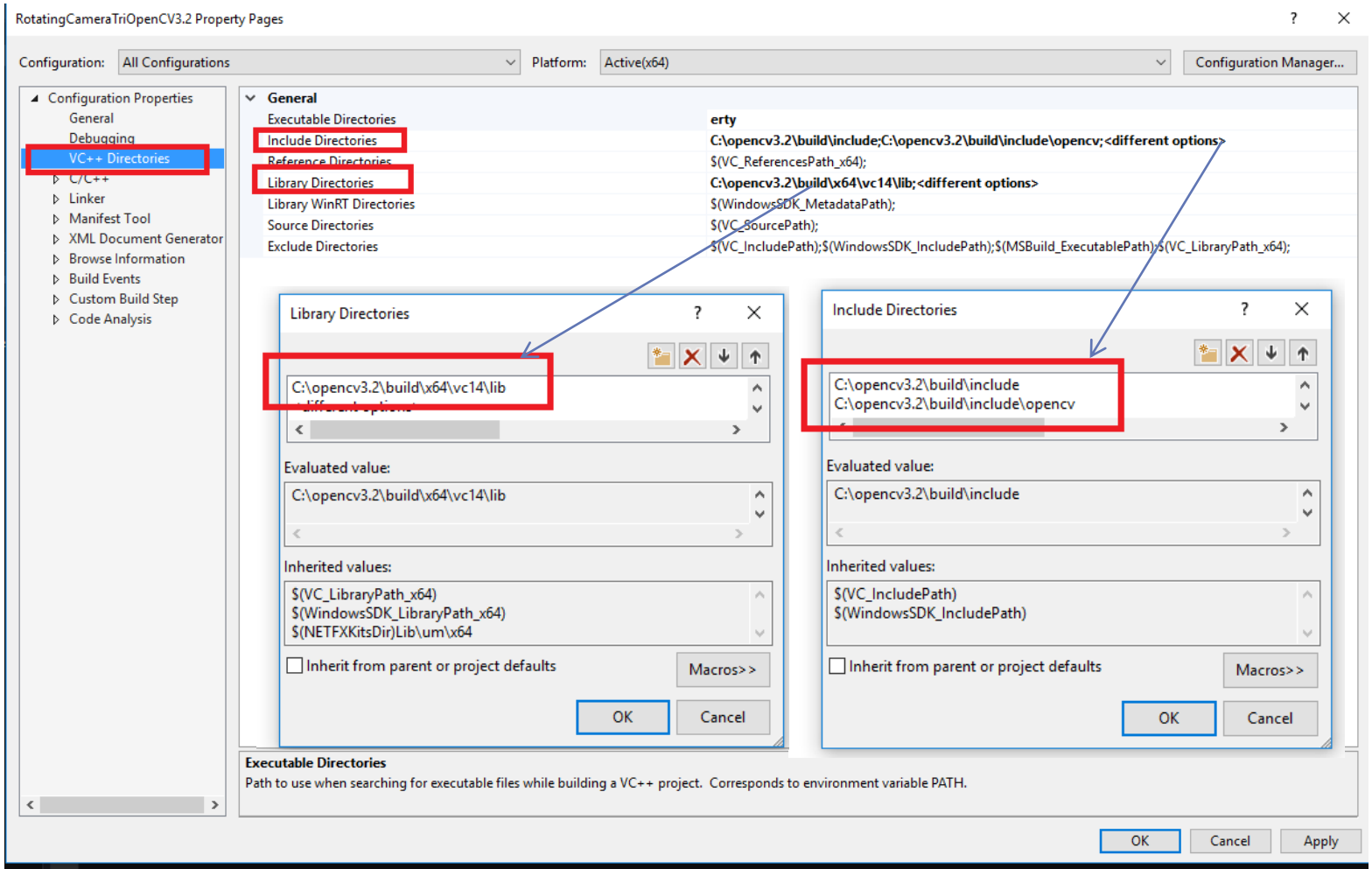
- Create a new project to use



OpenCV Library

- Add openCV for project

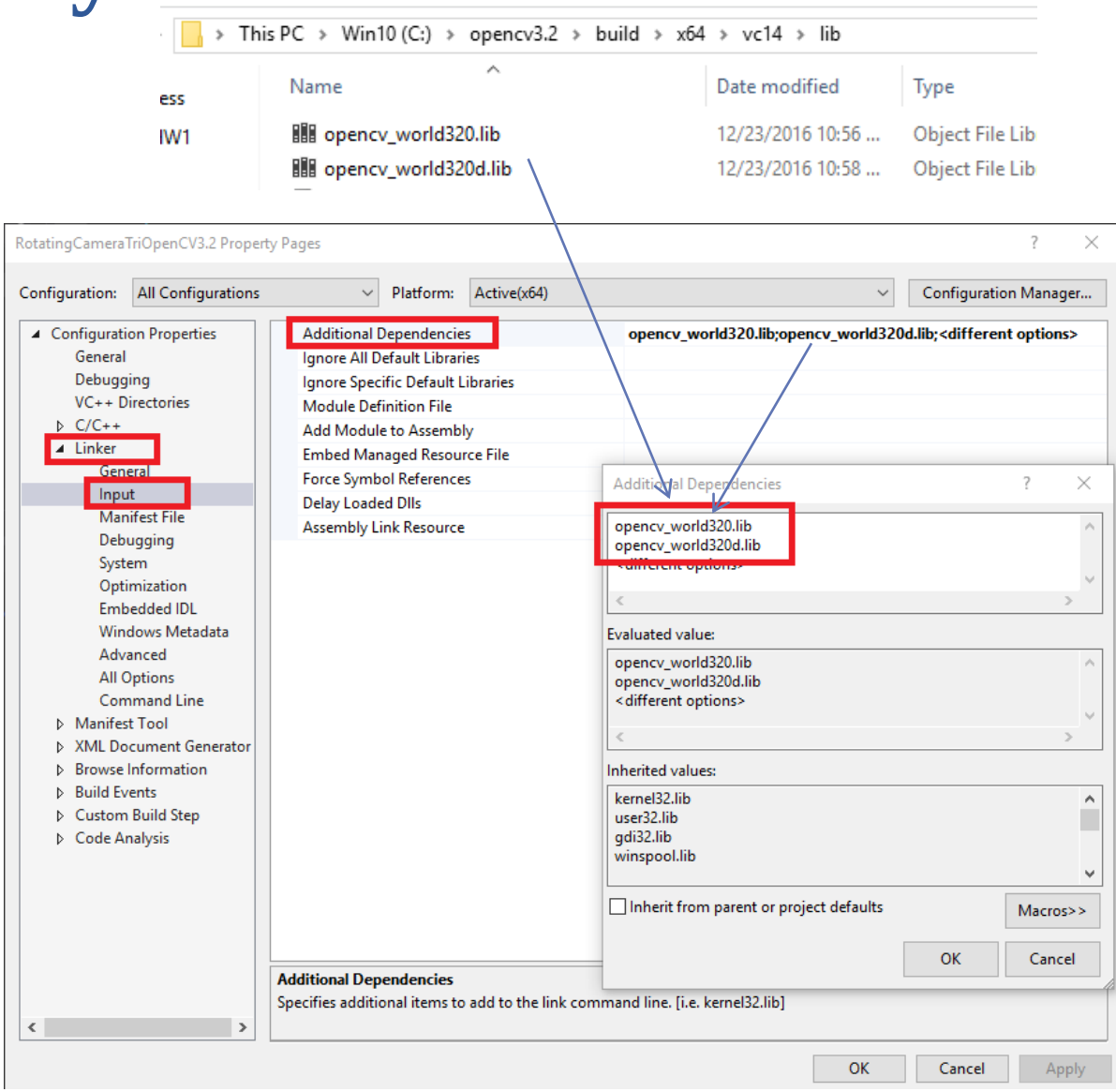
✓ Project property->VC++Derectories



OpenCV Library

- Add openCV for project (cont.)

✓ Link->Input-> additional Dependencies



OpenCV C and C++

❑ C implementation

- **OpenCV 1.x version**
- **Pointer: *IplImage****

✓ IplImage is the original format for storing image data from the old OpenCV1.x interface which is also called the C

❑ C++ implementation

- **OpenCV 2.x, 3.x version**
- **Mat class**

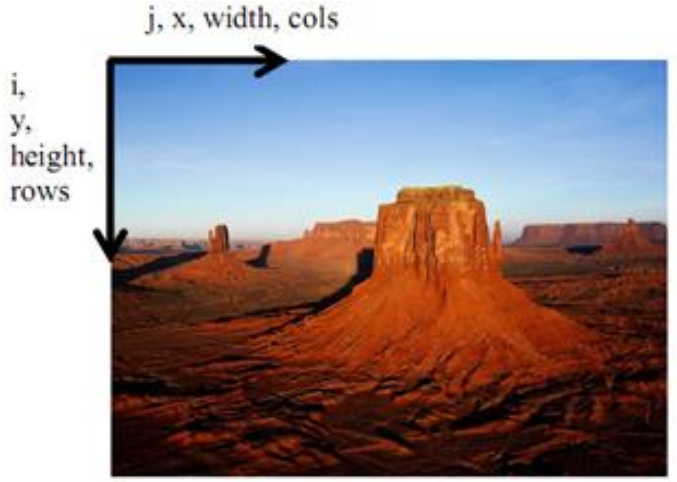
✓ Mat is the newer format from the OpenCV2.x versions and on.

Opencv Lib

- **Accessing the data from an image**
  - ***Access the 3 component color at row i and column j from a color image***

✓ **Mat class**

```
Vec3b pixel = img.at< Vec3b>(i,j);
unsigned char B = pixel[0];
unsigned char G = pixel[1];
unsigned char R = pixel[2];
```



✓ **Pointer: *IplImage****

```
uchar Blue,Green,Red,Gray;
Blue=((uchar*)(inI->imageData + i*inI->widthStep))[j*inI->nChannels + 0];
Green=((uchar*)(inI->imageData + i*inI->widthStep))[j*inI->nChannels + 1];
Red=((uchar *)(inI->imageData + i*inI->widthStep))[j*inI->nChannels + 2];
```

Opencv Lib

- **Pointer: *IplImage****

Opening and Displaying Images using OpenCV with C

```
#include <cv.h>
#include <highgui.h>

int main() {
    IplImage* inputimage = cvLoadImage("Lena.jpg");
    cvShowImage("cvImg", inputimage);
    cvShowImage("image", inputimage);
    cvSaveImage(“save.jpg", inputimage);
    cvWaitKey(0);
    }
```

Opencv Lib

- **Pointer: *IplImage****
- **Example:** Get pixel channel value from *IplImage**

```
...
IplImage* InI = cvLoadImage("Lena.jpg");
IplImage * Inew = cvCreateImage(cvGetSize(inI),8,1);
uchar Blue,Green,Red,Gray;
for( int i=0; i < inI->height; i++ ) {
        for( int j=0; j < inI->width; j++ ) {
            Blue=((uchar*)(inI->imageData + i*inI->widthStep))[j*inI->nChannels + 0];
            Green=((uchar*)(inI->imageData + i*inI->widthStep))[j*inI->nChannels + 1];
            Red=((uchar *)(inI->imageData + i*inI->widthStep))[j*inI->nChannels + 2];
            (Inew ->imageData[i* Inew ->widthStep+j])= Blue;
            ….
      }
}
…
```

Opencv Lib

❑ Mat class

- ✓ **Mat img(rows, cols, type);**
- ✓ Common OpenCV data type codes

type code	data type	used for
CV_8UC1	unsigned char	grayscale image (8bits/pixel)
CV_8UC3	Vec3b	color image (3x8bits/pixel)
CV_16SC1	short	data storage
CV_32FC1	float	data storage
CV_64FC1	double	data storage

- ✓ Example 1 - create a grayscale matrix of size 256x256:
- ✓ Mat img(256,256,CV_8UC1);
- ✓ For Mat class, see the official documentation at: http://docs.opencv.org/2.4.13/modules/core/doc/basic_structures.html#m

Opencv Lib

Mat class

Opening and Displaying Images using OpenCV with C

```
#include <iostream>
#include <cv.h>
#include <highgui.h>
using namespace cv;
int main() {
    Mat img = imread("Lena.jpg");
    imshow("InputImage", img);
    imwrite( "Image.jpg", img );
    waitKey(0);
}
```

Opencv Lib

❑ Mat class

Example: Get pixel channel value from *Mat image*

```
...
Mat img = imread("Lena.jpg");
Mat newImage(Size(img.rows,img.cols), CV_8UC1);
for( int  y = 0; y < img.rows; y++ ){
        for( int x = 0; x < img.cols; x++ ) {
         int B = img.at<Vec3b>(y,x)[0];
         int G = img.at<Vec3b>(y,x)[1];
         int R = img.at<Vec3b>(y,x)[2];
         newImage.at<Vec3b>(y,x)[0] = B;
         ….
         }
}
...
```

Opencv Lib

- **Mat class**

Loads a grayscale image and transforms it into its negative image

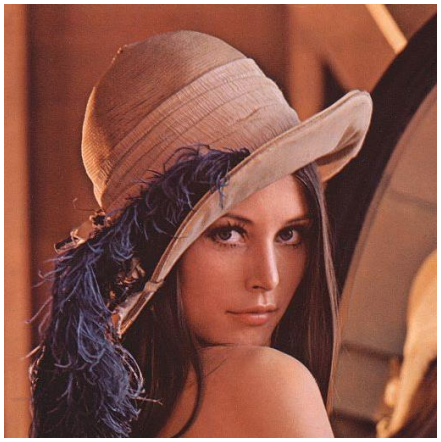
```
void negative_image(){
    Mat img = imread("Images/cameraman.bmp",
                     CV_LOAD_IMAGE_GRAYSCALE);
    for(int i=0; i<img.rows; i++){
        for(int j=0; j<img.cols; j++){
            img.at<uchar>(i,j) = 255 - img.at<uchar>(i,j);
        }
    }
    imshow("negative image",img);
    waitKey(0);
}
```

Homework 01

Q1:

- Input:

  RGB Images



(I1.jpg)

(I2.jpg)

- Finding output Images as follows:
  a) Gray image
  b) Binary image (Threshold=100)
  c) Rotate image (turn right 90 degree)

Homework 01

Testing images

Q2: Image filter (40%)

- a) Mean filter(windows size : 5x5)
- b) Median filter(windows size : 5x5)
- c) Gaussian 2D filter(windows size : 5x5)

Note 01: Let apply an appropriate parameter you think it good for you results and explain it in your report.

Example for the rules in using Opencv Lib

- Allow use
  - Read, load, save, show : cvLoadImage, cvShowImage …
  - Define size of image: cvSize, cvGetSize
  - Define image : IplImage or Mat
- Not Allow use
  - Cannot use the function of Opencv Lib to do the main part of homework.
  - Example:
    - ✓ cvtColor(image, gray, CV_RGB2GRAY); // convert RGB to Gray

Homework 01

Grade

- Program (80%)
  - ✓ Q1: 40%
  - ✓ Q2: 40%
- Report : 20%
  - ✓ Describe the main part of your method
  - ✓ Result images

Homework 01

Require for program

- You just create an **empty project** and write your homework on the **one program** (using class or subprogram)
- Write your report **by English.**

Homework 01

- Please compress your files (program and report)
  - StudentID_hw1(for example: 604415001_hw1.rar)
- Please upload to E-course.
- Deadline: 2017/11/06
- For each hour late, 10% of the total possible points will be deducted.

Thanks for your attention