ROS

- Ros is a complete ecosystem, containing Middleware (connecting components), Libraries and Utilities
- Complete ROS Tutorials 1-6 and 11 http://wiki.ros.org/ROS/Tutorials

ROS Nodes / Topics

- Publish and Subscribe to chatter Data
  - http://wiki.ros.org/ROS/Tutorials/WritingPublisherSubscriber%28c%2B%2B%29

- Amend the code to :
  - Publisher
    - Sends doubles from a Gaussian distribution (0-1) and
  - Subscriber
    - Creates a histogram of the numbers (each bin is 0.1)
    - On 50th number received shows as percentage of numbers received the numbers in each bin
  - Questions:
    - Do you need to change the StdMsg?
      refer http://wiki.ros.org/std_msgs
    - Will you use a container for the histogram?

OpenCV

- http://docs.opencv.org/2.4/doc/tutorials/introduction/linux_gcc_cmake/linux_gcc_cmake.html

- Exercise:
  - Can you create a histogram of grey scale image?

  - Convert color image to grayscale
  - Create a array of length 255
  - Loop though each pixel of and increment the corresponding element
  - Print on screen

OpenCV Help

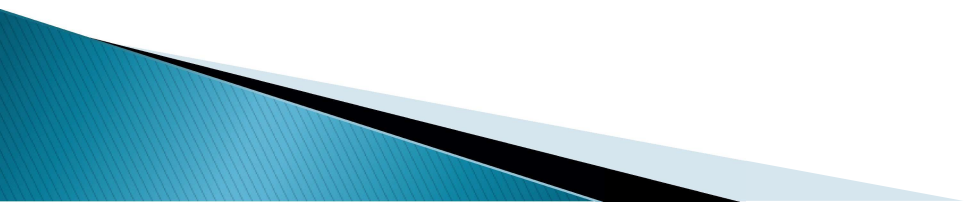
Accessing Pixel Values

```
cv::Mat img = cv::imread("lenna.png");
//Before changing
cv::imshow("Before",img);
//change some pixel value for(int j=0;j<img.rows;j++) {
        for (int i=0;i<img.cols;i++) {
                if( i== j) img.at<uchar>(j,i) = 255; //white
        }
 }
//After changing
cv::imshow("After",img);
```

Library

- Can you refactor your code that produces a histogram to be a library?
  - add_library (histo histo.cpp)
  - target_link_libraries (demo histo)

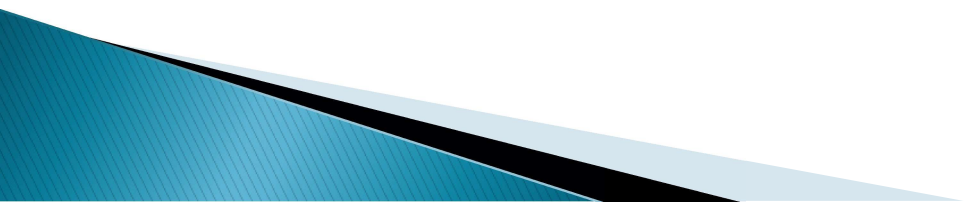
- https://cmake.org/examples/



Using a Library – OpenCV

- Example
  - http://docs.opencv.org/2.4/doc/tutorials/introduction/linux_gcc_cmake/linux_gcc_cmake.html

- Can you compute the edges of an image and display it
  - HINT – Canny Edge
    - http://docs.opencv.org/2.4/doc/tutorials/imgproc/imgtrans/canny_detector/canny_detector.html



OpenCV – ROS

- Create a node that
  - Loads an image
  - Converts it to grayscale
  - Publishes the image on a topic
- Create a node that
  - Subscribes to the image topic
  - Computes an intensity histogram on received image
  - Displays the histogram

- HINTS
  - http://wiki.ros.org/vision_opencv