Image Processing

Professor Doug Blank
cs.brynmawr.edu/~dblank
dblank@cs.brynmawr.edu

Review: Structure of a Robot Brain

- Read sensors
- Decide what to do
- Make Movement
- Repeat

Review: Structure of a Robot Brain

```
while True:
    left = getLight("left")
    right = getLight("right")
    if left < right:
        turnLeft(1, .4)
    else:
        turnRight(1, .4)
```

Image Processing

- Picture
  - A width and height
  - A list of picture elements, or Pixels
- Pixel
  - There are width * height Pixels in a Picture
  - Each is composed of a Red, Green, and Blue component
  - Knows its location (x, y) in the Picture

Picture

- takePicture()
    - Function which takes a picture on the robot, and returns it
    - pic = takePicture()
- To display picture in a window
    - show(pic)
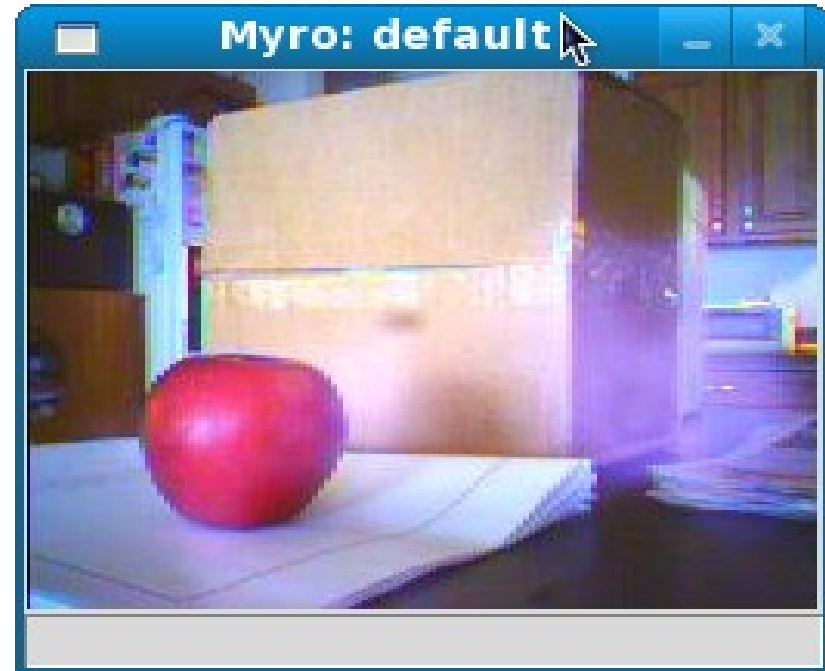- Related functions
    - getWidth(pic), getHeight(pic)

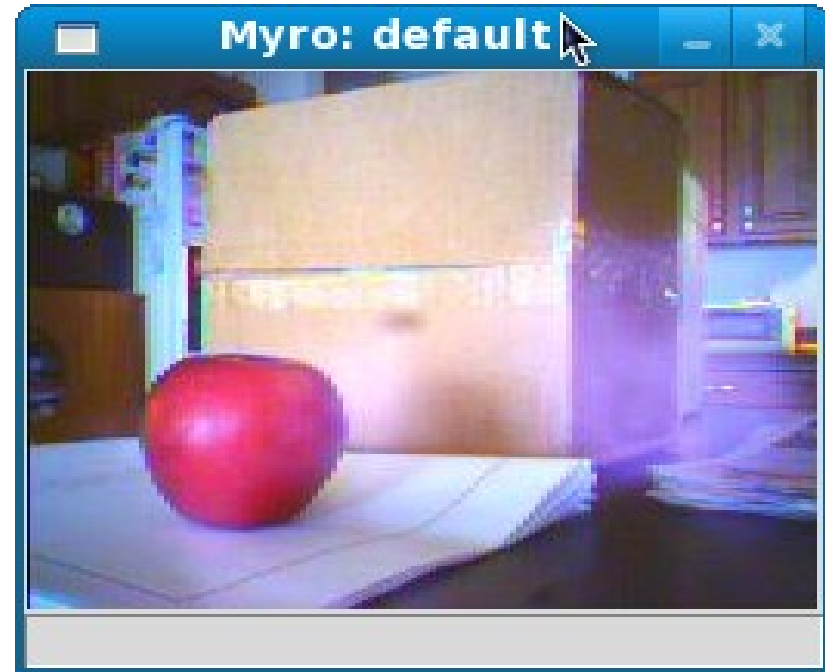# Taking a Picture

```
>>> pic = takePicture()
>>> show(pic)
```

Taking a Picture

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Taking a Picture

>>> pic = takePicture()
>>> show(pic)
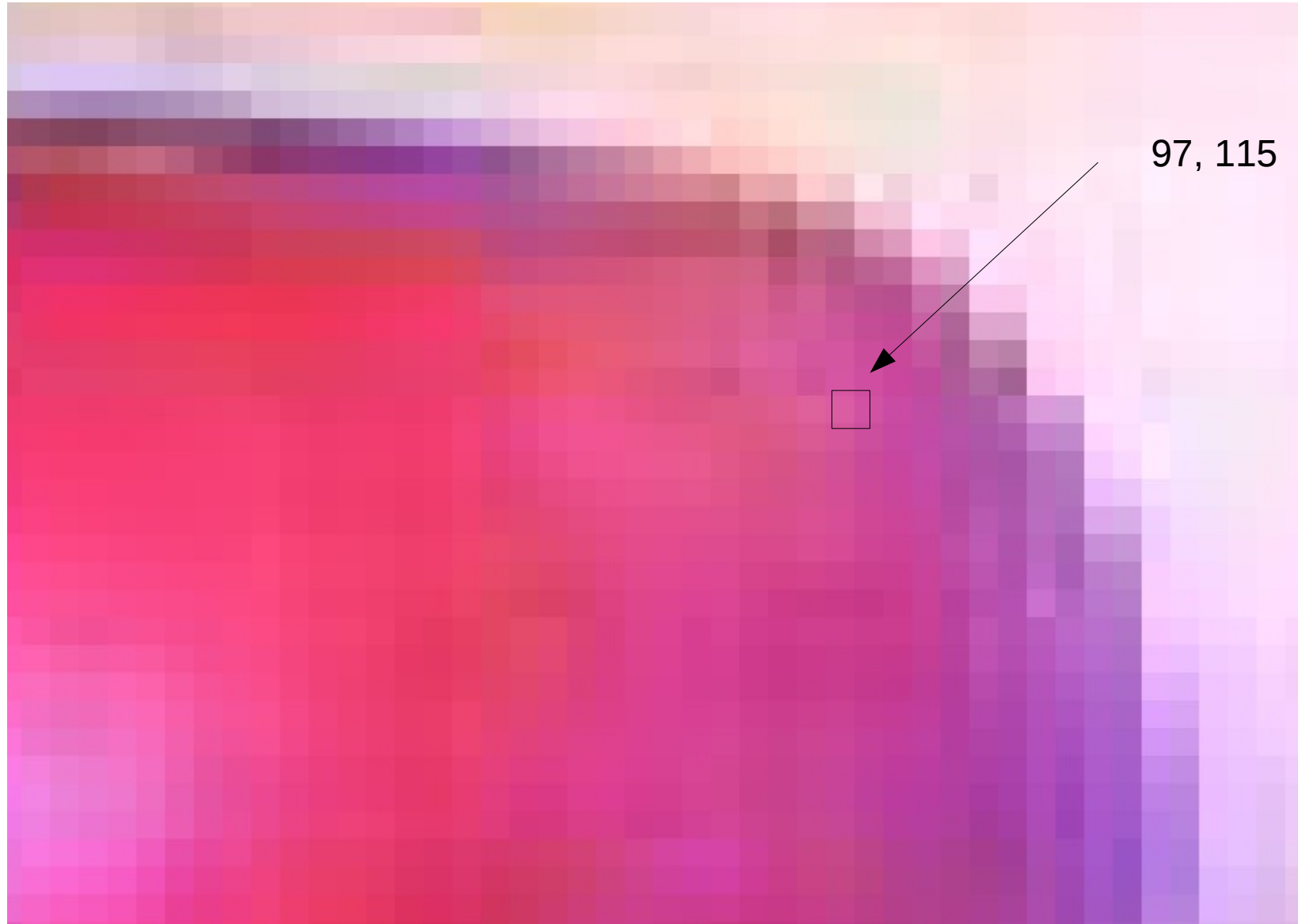>>> getWidth(pic)
256
>>> getHeight(pic)
192

What is a Picture?

- Matrix of pixels
    - getWidth(pic) * getHeight(pic)
- Each Pixel is composed of three components
    - Red
    - Green
    - Blue
- Each component has a value between 0 and 255

What is a Picture?

What is a Picture?

97, 115

Pixels

```
>>> pic = takePicture()
>>> getPixel(pic, 97, 115)
<Pixel instance (r=179, g=85, b=171, a=255) at (97, 115)>
>>> pix = getPixel(pic, 97, 115)
>>> getRed(pix)
179
>>> getGreen(pix)
85
>>> getBlue(pix)
171
>>> getRGB(pix)
(179, 85, 171)
```

Working with Pixels

- getPixel(PICTURE, X, Y)
    - pix = getPixel(pic, 97, 115)
        - red = getRed(pix)
        - green = getGreen(pix)
        - blue = getBlue(pix)
        - r, g, b = getRGB(pix)
- for VARIABLE in getPixels(PICTURE): COMMAND
    ...
- Pixels know where they are in a picture
    - getX(PIXEL), getY(PIXEL)

Working with Pixels

```
pic = takePicture()
for pix in getPixels(pic):
    print getRed(pix)
    print getRGB(pix)
    print getX(pix)
```

Find the Pyramid

How could we use these functions to locate a bright orange Pyramid in a picture?

Finding the Pyramid in a Picture

```
def findCenter(picture):
    X = 0
    for pixel in getPixels(picture):
        R, G, B = getRGB(pixel)
        if BOOLEANEXPRESSION:
            X = X + getX(pixel)
            count = count + 1
    return x/count

pic = takePicture()
x = findCenter(pic)
```