

# Workshops in Creative Computing 2: Computer Vision Module



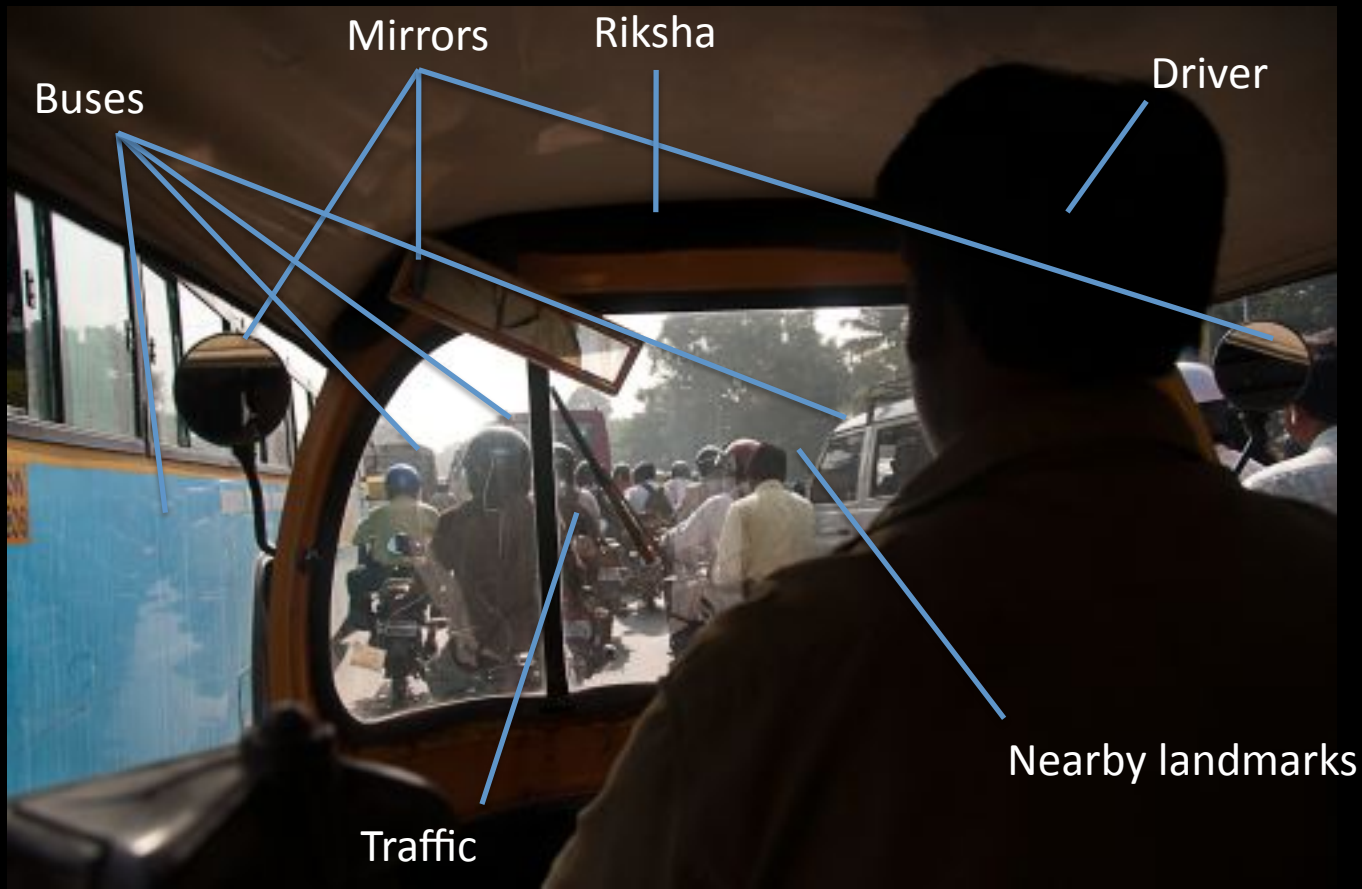
## Lecture 1: Introduction to Computer Vision

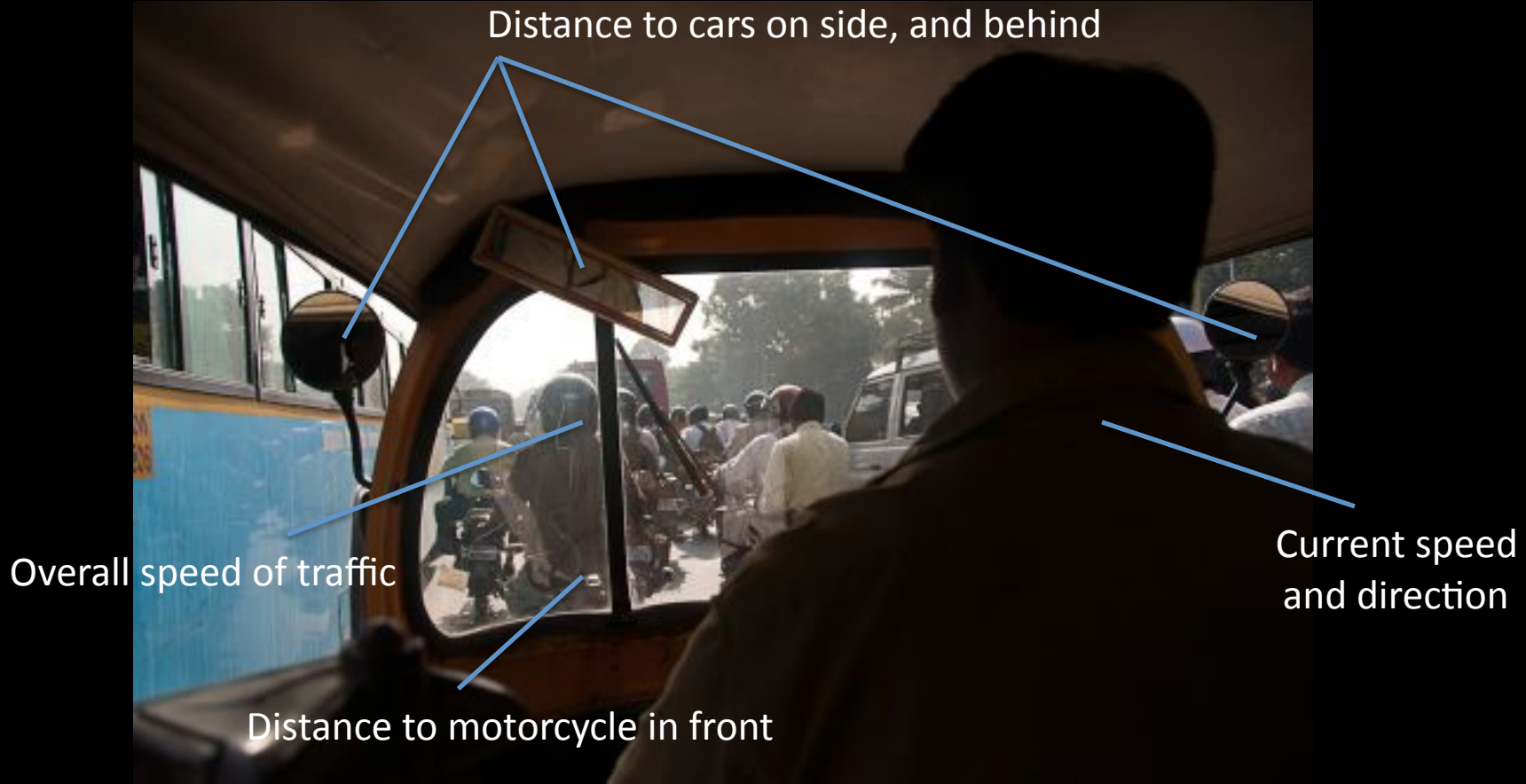
Wednesday Feb 20, 2013

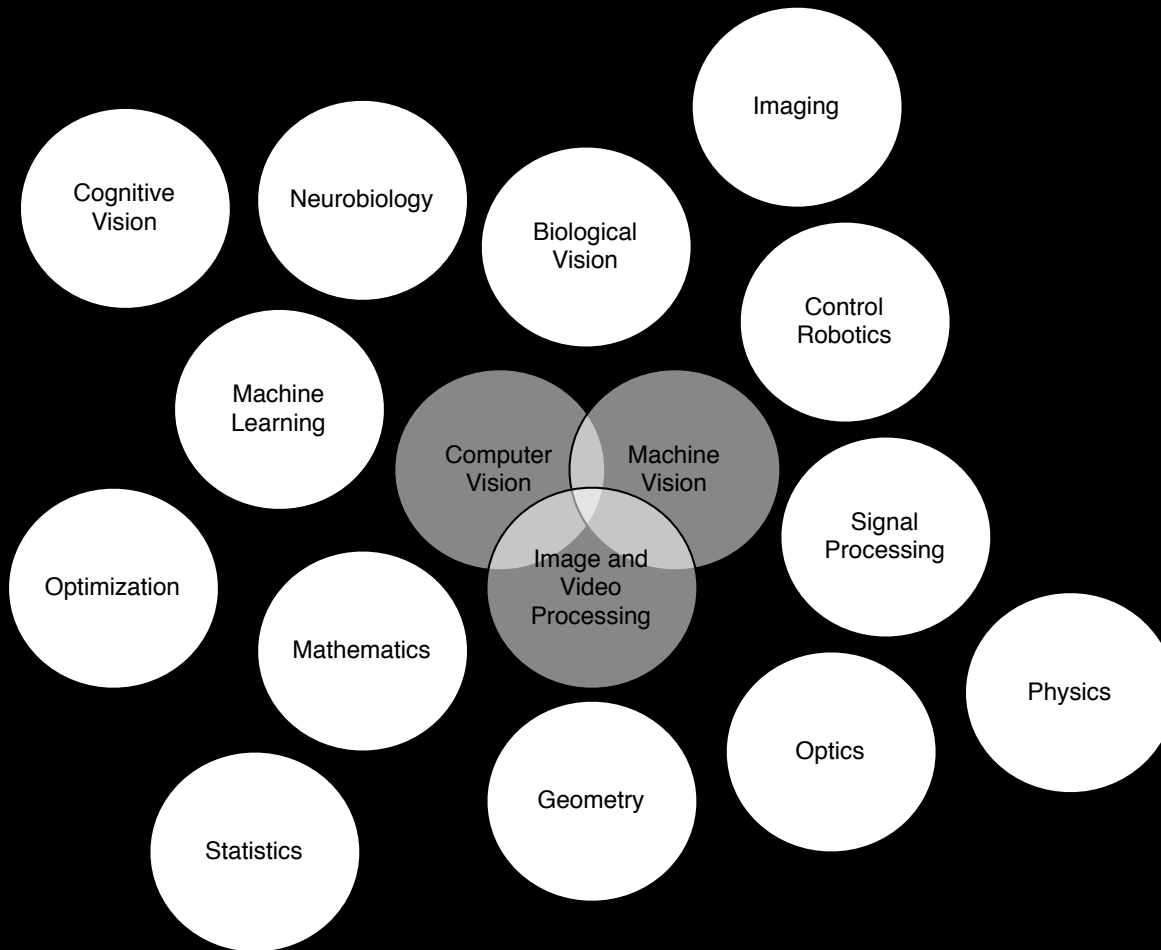
Parag K Mital

# Assignment 1: Solve computer vision.



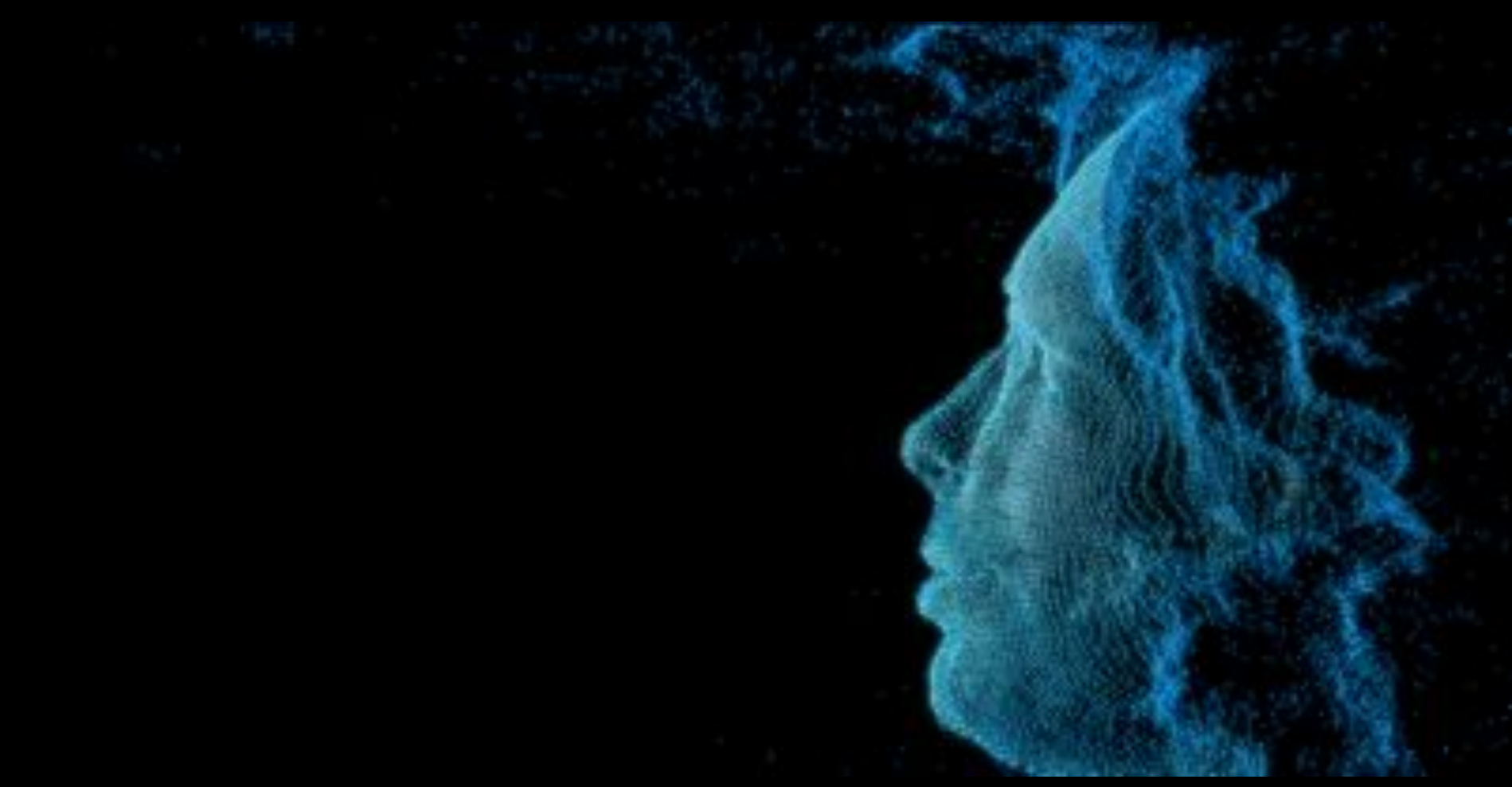




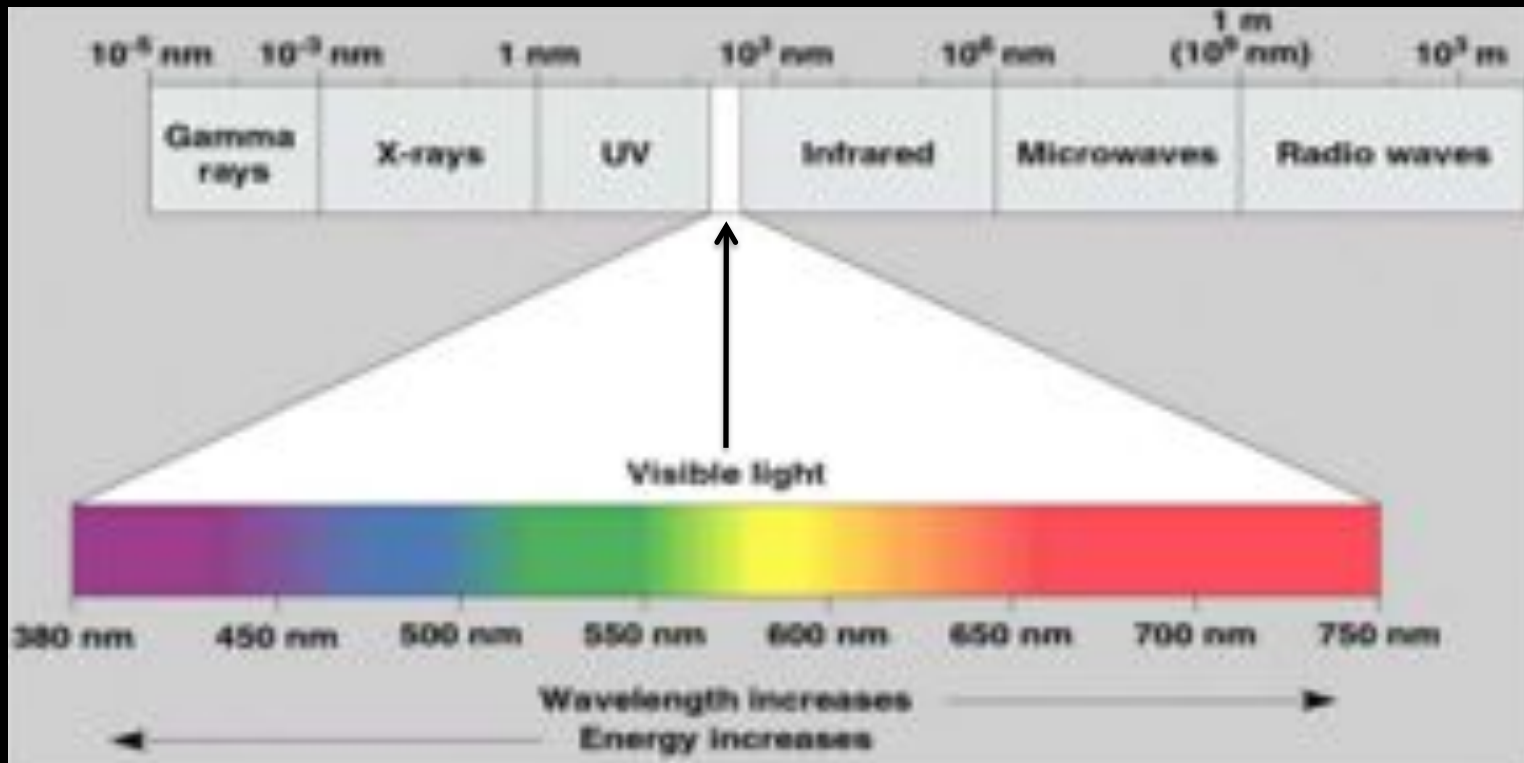


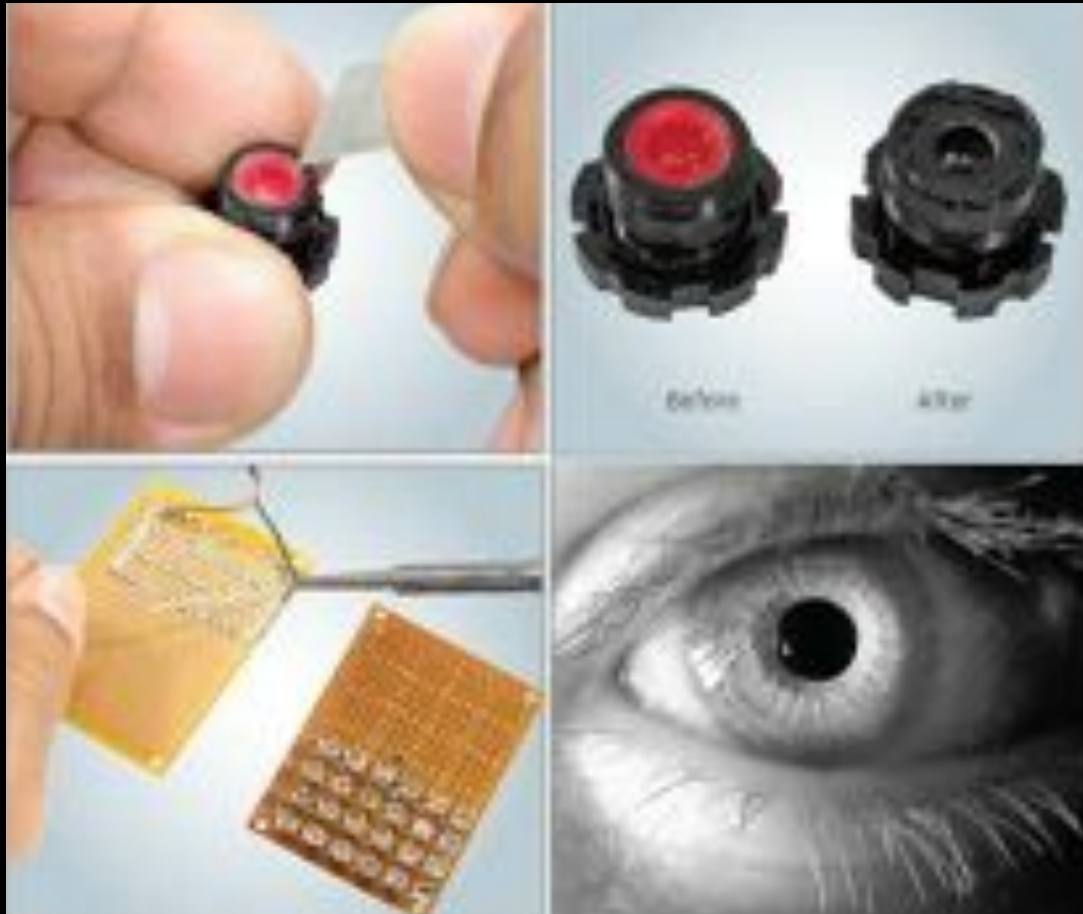
# Image Acquisition

<b>Depth</b>	<b>LIDAR; Kinect; Structured Light; Stereo Vision</b>
<b>Infrared/ Thermal/ Spectral</b>	<b>Satellite; Heat detection</b>
<b>Light Field</b>	<b>Synthetic Camera Control</b>









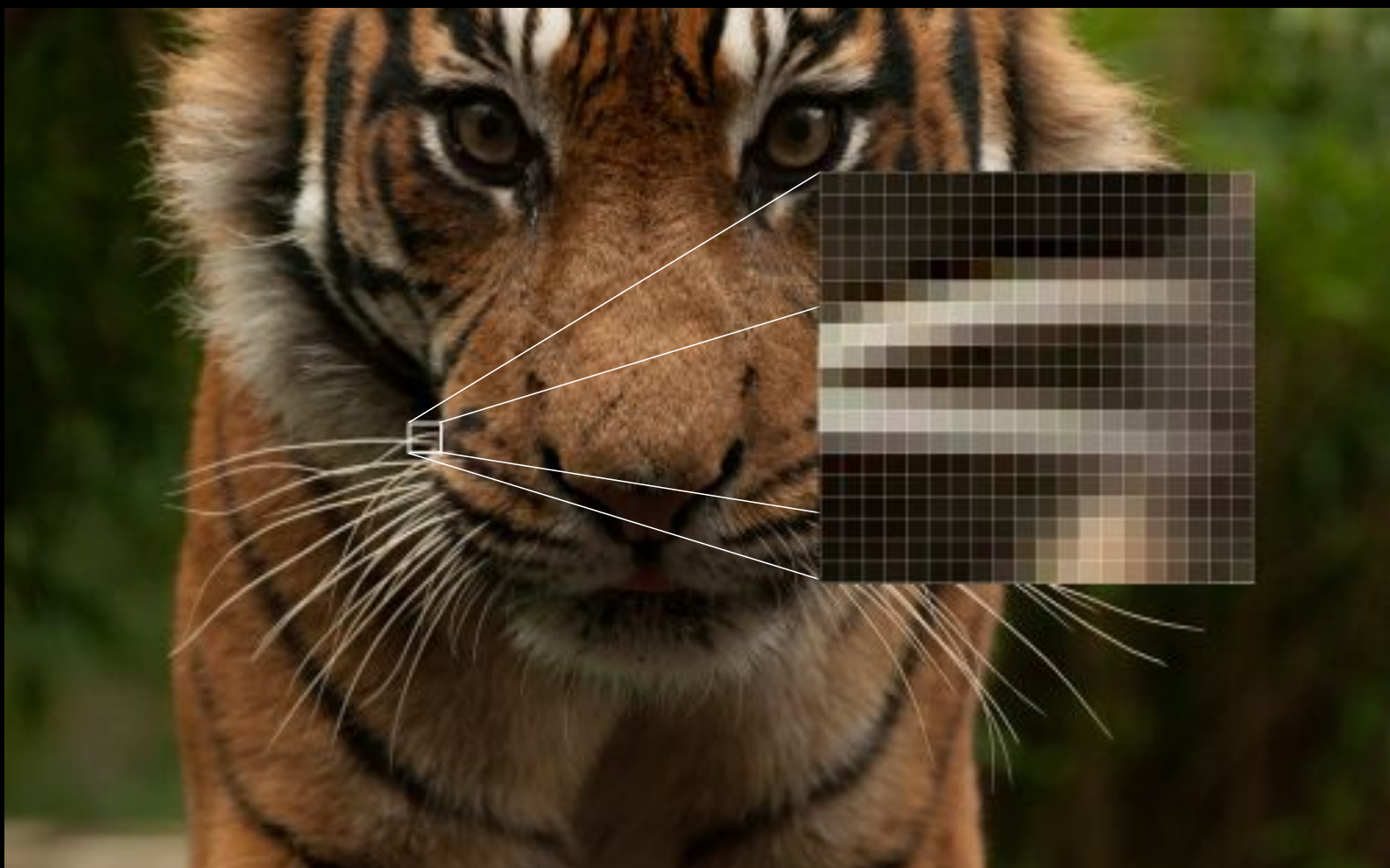


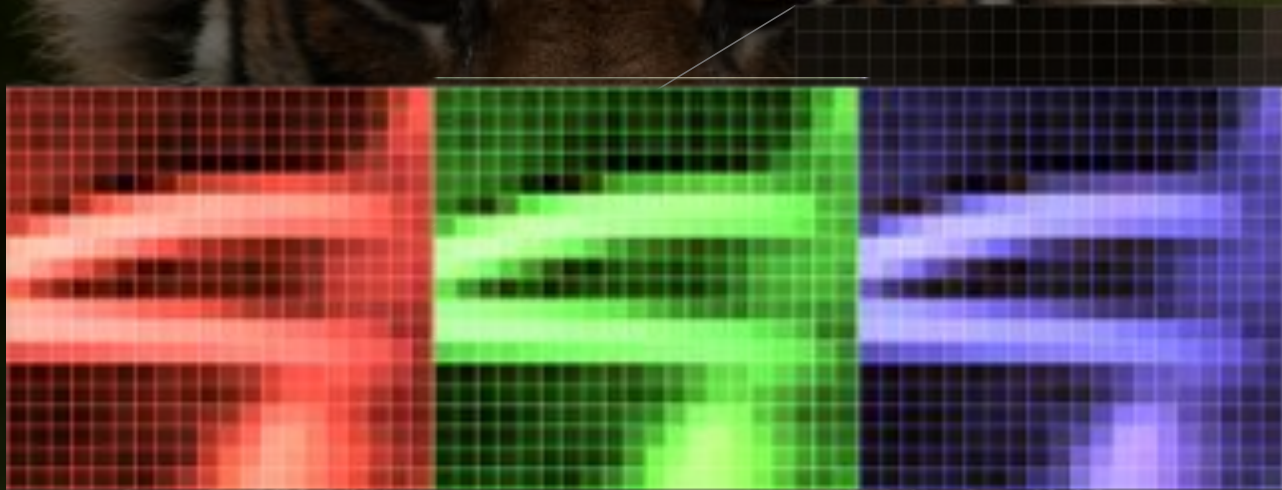




# Pixel Descriptions

<b>RGB</b>	<b>Red, Green, Blue</b>
<b>HSV</b>	<b>Hue, Saturation, Value</b>
<b>L*a*b*</b>	<b>Perceptually uniform color distribution (CIE1976)</b>
<b>CMYK</b>	<b>Cyan, Magenta, Yellow, Black</b>
<b>Grayscale</b>	<b>Single channel of a color image; luminance</b>





R

G

B



11

R	G	B	R	G	B	R	G	B	R	G	B
R	G	B	R	G	B	R	G	B	R	G	B
R	G	B	R	G	B	R	G	B	R	G	B
R	G	B	R	G	B	R	G	B	R	G	B
R	G	B	R	G	B	R	G	B	R	G	B
R	G	B	R	G	B	R	G	B	R	G	B
R	G	B	R	G	B	R	G	B	R	G	B
R	G	B	R	G	B	R	G	B	R	G	B
R	G	B	R	G	B	R	G	B	R	G	B
R	G	B	R	G	B	R	G	B	R	G	B
R	G	B	R	G	B	R	G	B	R	G	B
R	G	B	R	G	B	R	G	B	R	G	B

4

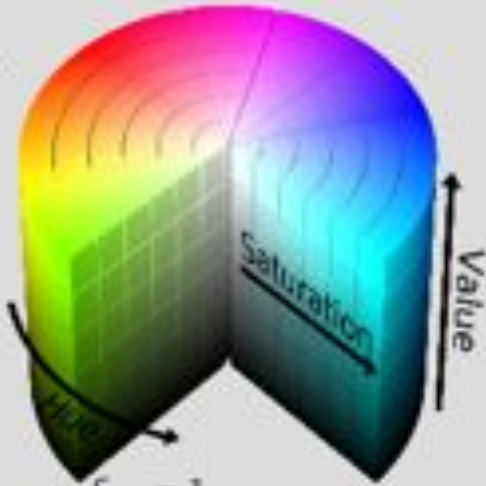
11

L	L	L	L
L	L	L	L
L	L	L	L
L	L	L	L
L	L	L	L
L	L	L	L
L	L	L	L
L	L	L	L
L	L	L	L
L	L	L	L
L	L	L	L
L	L	L	L

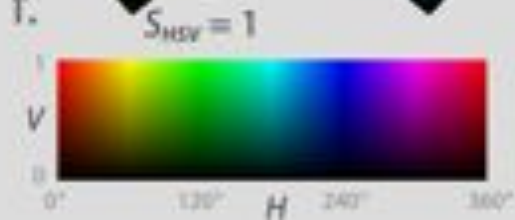
4

# HSV

e.



f.



# Image Descriptions

<b>Pixels</b>	<b>Luminance; Color-spaces; Depth; Heat</b>
<b>Feature Points</b>	<b>SIFT; SURF; Harris Corners; HOG; FAST</b>
<b>Edges/Lists</b>	<b>Sobel; Canny; Hysteresis; Connected Components; Shape Models</b>
<b>Blobs/Regions</b>	<b>Mean-Shift; MSER; Watershed; Graph-Cuts; Background Subtraction; Appearance Models</b>
<b>Maps</b>	<b>Geodesics; Topography; Density</b>







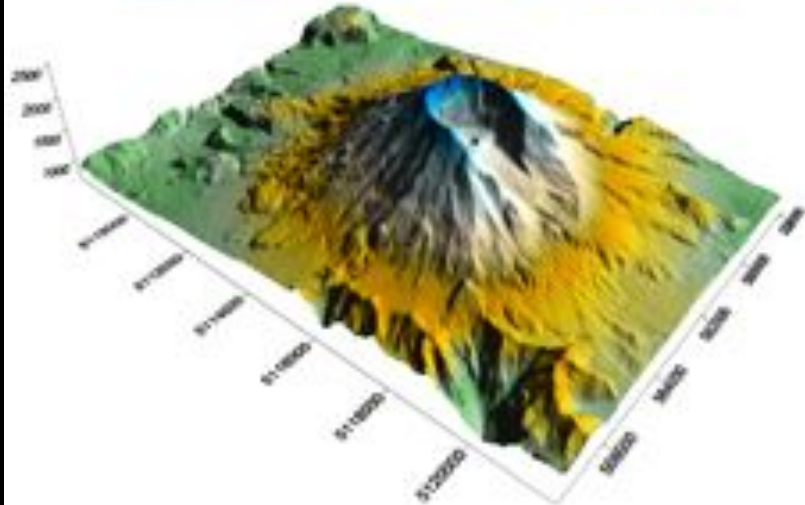
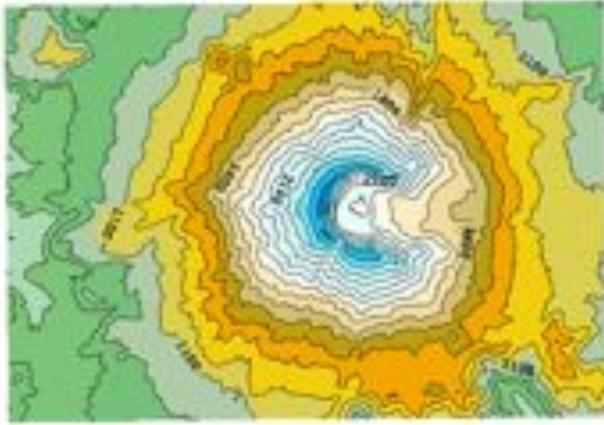












# OpenCV

Insane library for manipulating image/video data

Machine Learning

Regression

Classification

GUI

Image/Video Acquisition (talks to many types of hardware)

File I/O, Management

Feature Tracking

Object Detection

Pattern Recognition

...

# OpenCV

Major overhaul from 1.1 to 2.0 from C style to C++ style

Older containers called IplImage and CvMat

Newer ones called Mat

Can convert between all types seamlessly without moving any memory

# ofxOpenCV

Provides very basic interface to using OpenCV

Handles all OpenGL/Texture drawing stuff

Some simple interfaces for commonly used functions

Some extended interfaces for contour tracking and haar finder tracking

Can convert to other basic types in openFrameworks,

e.g. `ofTexture`, `ofImage`, etc...

Access pixels using `getPixels()`

Can use OpenCV without using ofxOpenCV

# ofxOpenCV

Very easy to get the OpenCV container from an ofxOpenCV one.

e.g.:

```
// first declare the object
ofxCvGrayscaleImage myImage;
// then allocate some memory for it in setup()
myImage.allocate(320, 240);
// then if you ever want to access the
// internal OpenCV structure,
IplImage *cvImage = myImage.getCvImage();
```

# OpenCV IplImage \*

Using an IplImage \*, you can easily access the pixel's contents in memory.

```
IplImage *cvImage = colorImg.getCvImage();
for (int i = 0; i < cvImage->height; i++) {
    unsigned char *pix =
        (unsigned char *)cvImage->imageData +
        i * cvImage->widthStep;
    for (int j = 0; j < cvImage->width; j++) {
        pix[3 * j + 0] = rand() % 255;
        pix[3 * j + 1] = rand() % 255;
        pix[3 * j + 2] = rand() % 255;
    }
}
```



# OpenCV Mat C++

Can also use the new OpenCV 2.1+ C++ style container, Mat:

```
IplImage *cvImage = colorImg.getCvImage();  
cv::Mat newCvImage(cvImage);
```

Let's try finding the mean value of this image:

```
cv::Scalar val = cv::mean(newCvImage);  
double firstDimensionsMean = val[0];
```

# Next Week: Tracking

Blob Tracking  
Contour Tracking,  
Face Tracking,  
Generic Object Tracking



