Image Processing & Computer Vision

Unit Intro

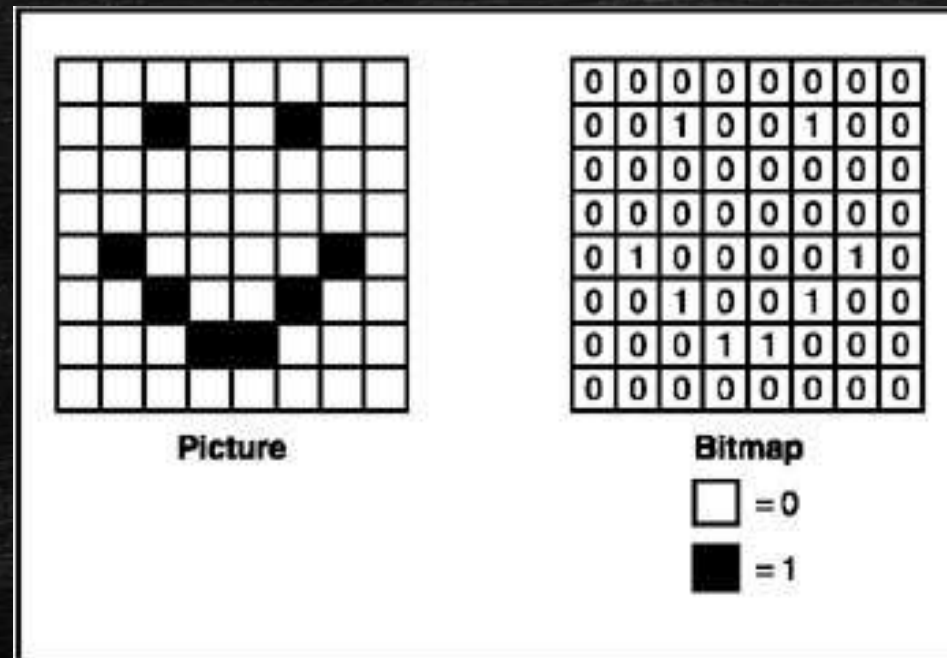First Things First

What is an image?

You see it like this:

But actually…

an image is nothing but a two dimensional array of numbers with each location holding a value/s determining the pixel colour corresponding to that location
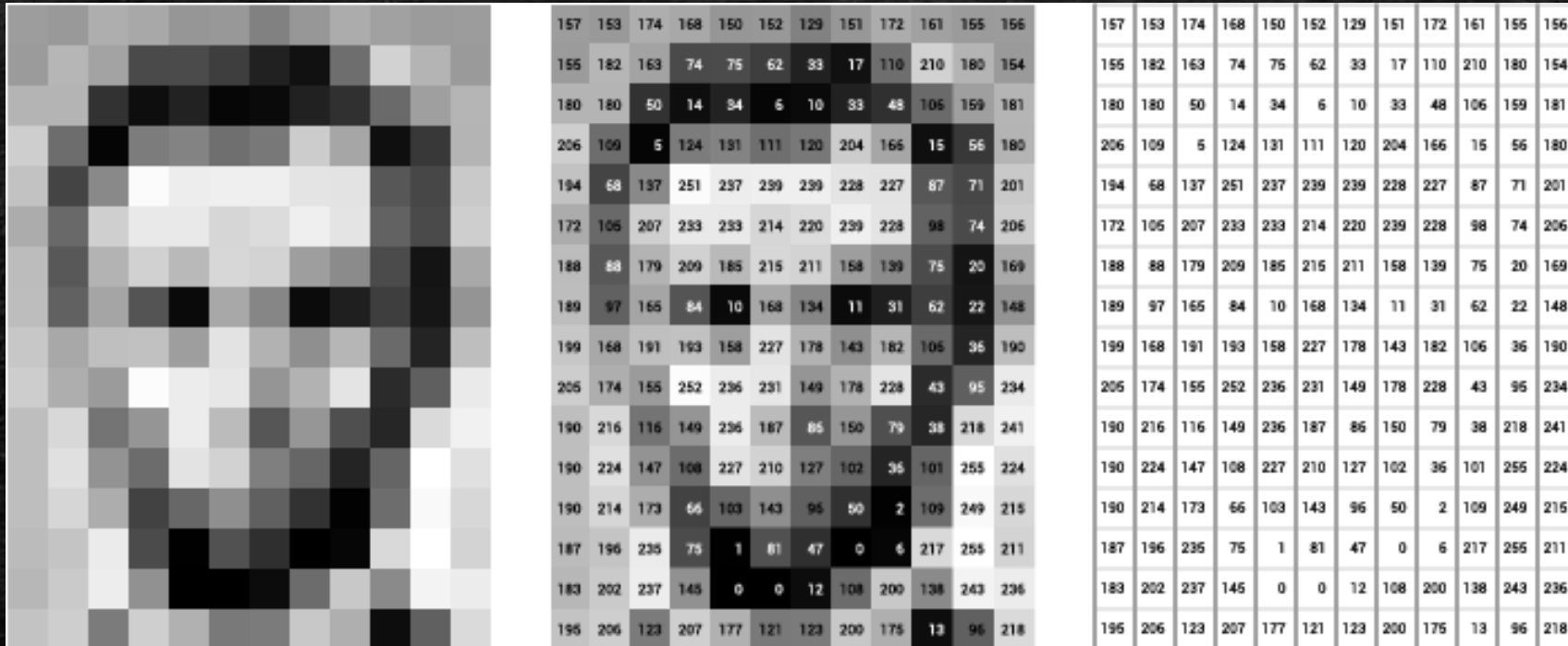
In case of a **binary image**

Each location can hold either 0 or 1, representing white or black


Picture | Bitmap

□ = 0

■ = 1

In case of a **grayscale image**

Each location holds a number from 0 to 255, representing the brightness of the pixel.
(0 means black, 255 means white, values in between are varying shades of grey)

In case of a **colour image**

Each location holds 3 numbers from 0 to 255, representing the R, G, B components of the pixel (depends on colour space used)

Original Color Image

Matlab RGB Matrix
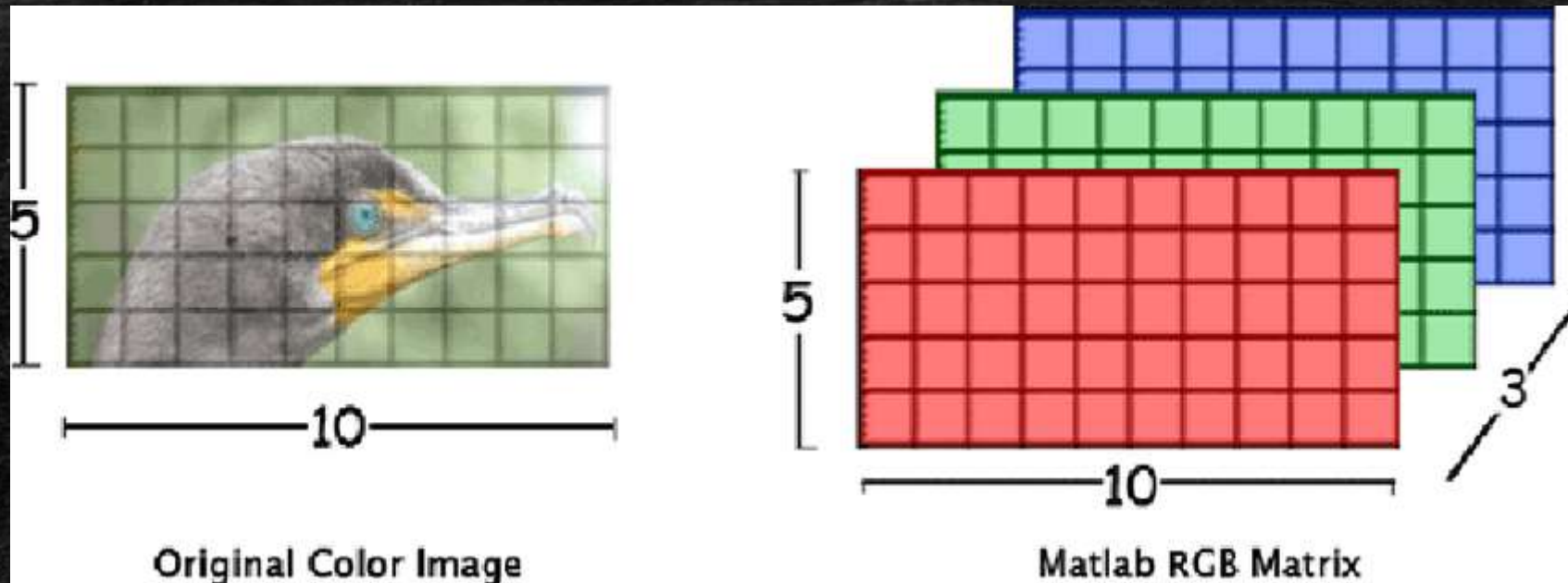
A note on image resolution

Image resolution refers to the number of pixels in an image.

So…

Image Processing is the processing of images; the processing of these number arrays

Think…

Why would we need to process an image?

Some ideas

- Image sharpening

Some ideas

- Image restoration

Some ideas

- Image Compression

Input and Output

- Input is an image

- Output is usually another image but can also be information obtained from input image

Think

How can we process an image?

Image Processing

We can process an image using graphics editing software such as Adobe Photoshop

BUT

To solve problems we need to develop **software that can do this automatically (through code)**

Computer Vision

Image Processing techniques make possible the concept of
Computer Vision

Computer Vision is when image processing techniques are used on an image or a video (sequence of images) to help gain understanding of a scenario or help make decisions.

You can think of Computer Vision as an automated watchman!

For example

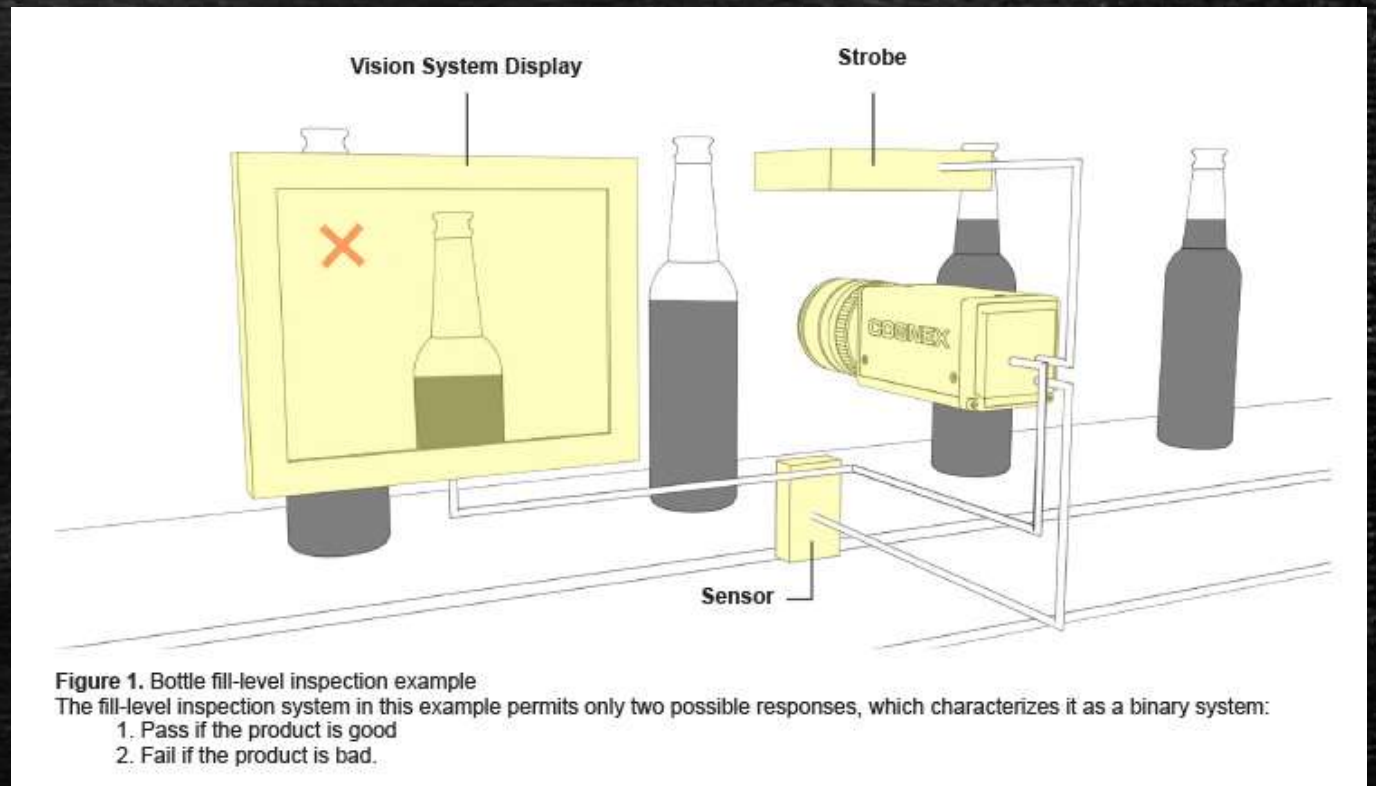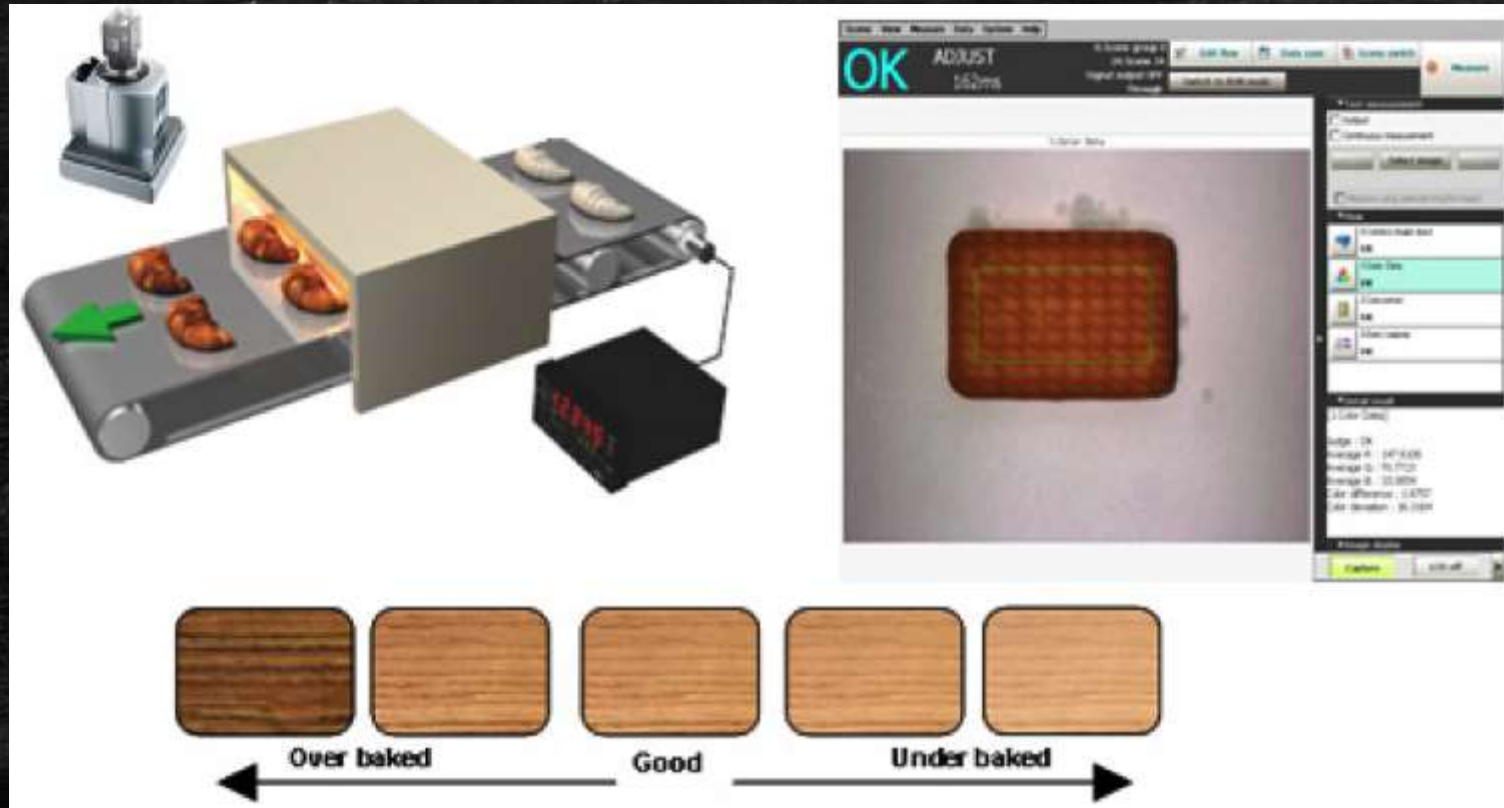- Quality control (bottle level)

Figure 1. Bottle fill-level inspection example
The fill-level inspection system in this example permits only two possible responses, which characterizes it as a binary system:
1. Pass if the product is good
2. Fail if the product is bad.

For example

- Quality control (baking status)

For example

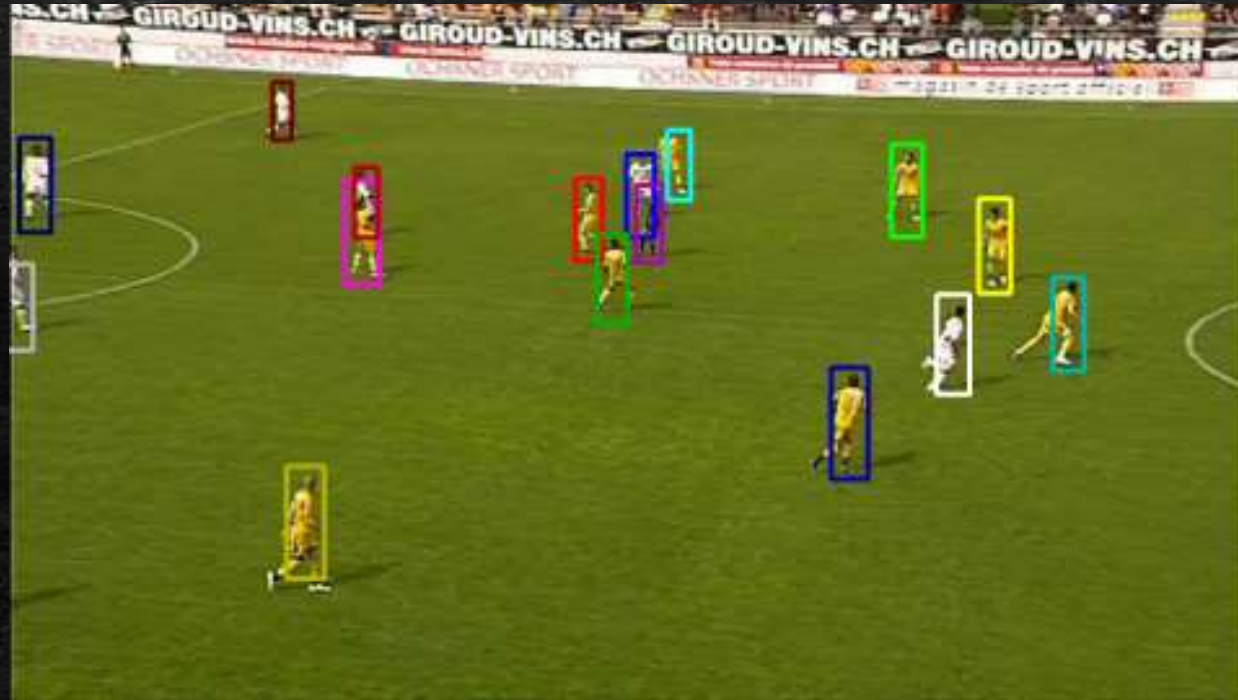- Quality control (medicine capsules)

Outside the factory
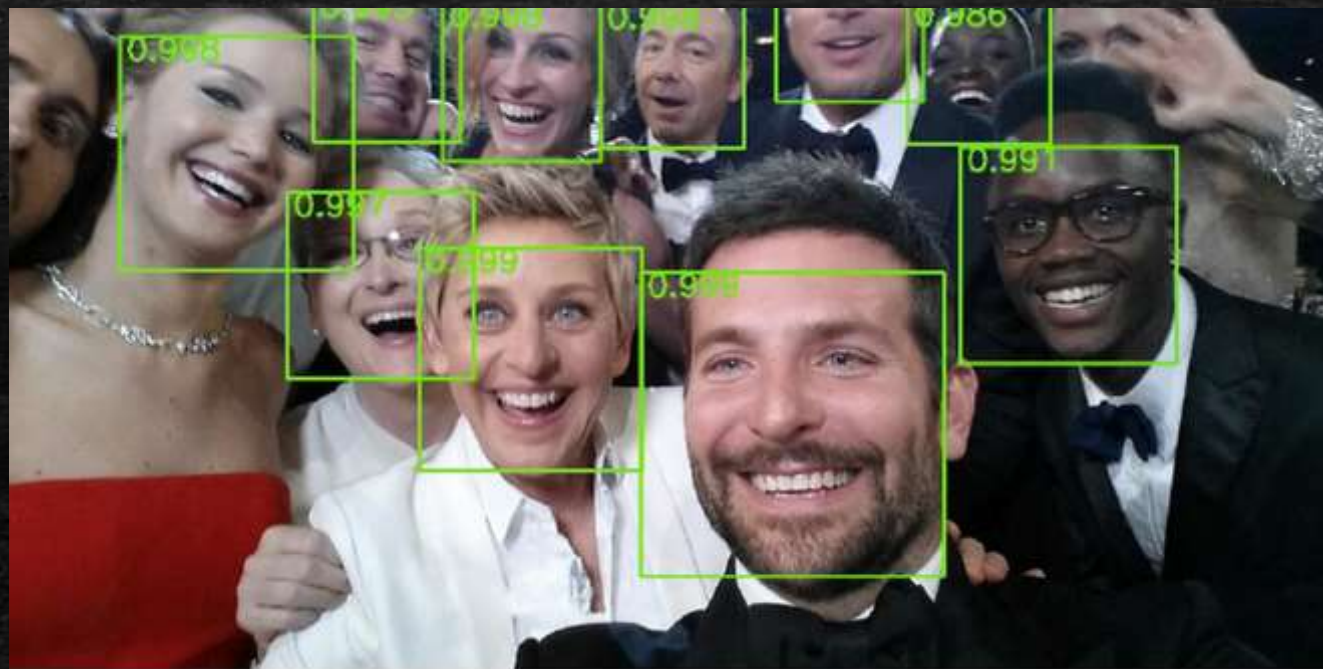
- Automatic reading of number plates

Outside the factory

- Augmented reality sports broadcasts e.g. player tracking

Outside the factory

- Face detection (in cameras for e.g.)
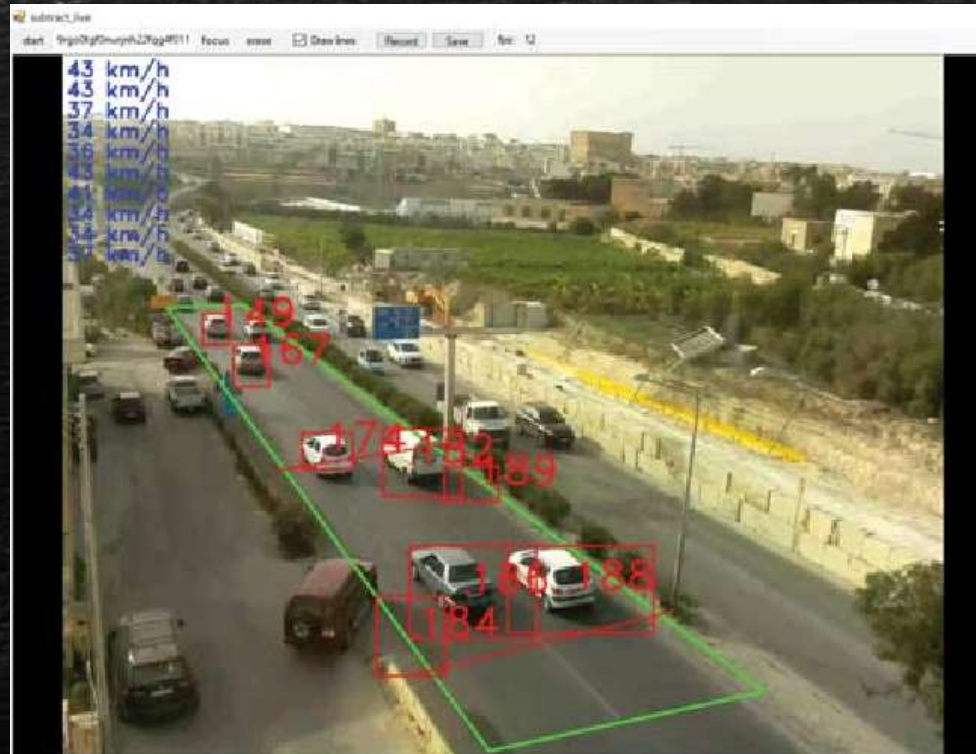- Possibly also face recognition

Outside the factory

- OCR and Translation

Publication within MCAST

- Road traffic flow estimation via public IP cameras by Ricardo Sciberras, Frankie Inguanez

The Concept of Computer Vision

- Began in the 1960s/70s
- Inspired by the capabilities of the human vision system
- They initially thought it would be easy
- But were very wrong!

- We take our vision system for granted
- But it is actually VERY complex!

Human and Computer Vision

What would you conclude if you looked out of the window and saw a swaying tree?

Human and Computer Vision

That it's windy, of course!

Think about the complexity of implementing this in a computer program…

This Unit – two phases

Image Processing	Computer Vision
now - December	December - January
Processing of images	Applications of image processing
Using Octave	Using Python and OpenCV

Assessment via class tasks + home assignment

Questions

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