Artificial vision

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Chapter 1: Introduction to computer vision

Human vision

We see because we have an eye and a brain

Computer vision

What we can do to make computers see ?
Capture device processing device Human vision Computer vision

What is computer vision ?

Every picture tels a story
The goal of computer vision is to write computer software that interpret images.

What is computer vision ?

Computer vision is the science of analyzing images and videos to extract information and Knowledge from them.
Most of the time we deal with real images (Street with cars). the ultimate goal is video and image understanding, understanding means labeling different parts of an image and tracking them as thy move

Computer vision applications

- Optical character recognition
- Object recognition
- Face detection
- Face recognition
- Vision based interaction
- Security and surveillance
- Motion Capture
- Smart cars auto driving car.
- and more ...

Optical character recognition (OCR)

Optical character recognition (OCR)

Licence plate recognation

Optical character recognition (OCR)

bank cheque recognation

Object recognation

Object recognation

in supermarket

Object recognation

Augmented reality (AR)

Face detection

Face recognation

Face recognation

Apple ID

vision based interaction

Microsoft Kinect

vision based interaction

Microsoft Kinect

Security and surveillance

Automotive smart cars

Robotics

Computer vision is hard !

Visual illusion

Computer vision is hard !

visual illusion

Computer vision vs image processing

Chapter 2 : Image processing for computer vision

Images as functions

We can think of an image as a function $I(x, y)$ from R^2 to R. The value of I (amplitude) at a point (x, y) is called the intensity or Gray level of the image at that point. Images of this type are often called **Grayscale** images

Images as functions

A colored image is a **vector-valued** function. The value of I at a position (x, y) is a vector that represents the color at that point.

$$I(x, y) = \begin{bmatrix} r(x, y) \\ g(x, y) \\ b(x, y) \end{bmatrix} \tag{1}$$

Image digitization

in image processing and computer vision we operate on digital (discrete) images

- **Sampling** the 2D space into regular grid.
- **quantization** each sample round to some integer.

Image digitization

A digital image is a **matrix** of integer values

Images in python

in python we use the following packages to manipulate images

- **OpenCv** Originally developed by Intel (real-time computer vision)
- **scikit-image** a collection of algorithms for image processing.
- **numpy** It provides a high-performance multidimensional array object.
- **matplotlib** used for ploting images, function graphs, histograms ...tec.
- **jupyter notbboks** or jupyter-lab for online and in-browser coding

The Open Source Computer Vision Library has >2500 algorithms for real-time computer vision.
https://opencv.org/

scikit-image is a collection of algorithms for image processing. https://scikit-image.org/

Images in python

Numpy

The fundamental package for scientific computing with Python
https://numpy.org/

Images in python

matplotlib

Matplotlib is a comprehensive library for creating static, animated, and interactive visualizations in Python
https://matplotlib.org/

interactive computing across dozens of programming languages.
initialy supported Python,Julia,and R hince the name jupyter
40 programming languages.

Opencv

loading an image

```python
import cv2
# Reading the image using imread() function
image = cv2.imread('image.png')

# Extracting the height and width of an image
h, w = image.shape[:2]
# Displaying the height and width
print("Height = {},  Width = {}".format(h, w))
```