

# PENGOLAHAN CITRA DIGITAL

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# Rencana Perkuliahan

- ▶ Pertemuan ke-1
  - Pendahuluan
  - Pengertian Digital Image Processing dan aplikasinya
- ▶ Pertemuan ke-2
  - Digitalisasi dan Operasi-operasi dasar dalam PCD
  - Contoh Area Tugas
- ▶ Pertemuan ke-3
  - Intensity Transform
- ▶ Pertemuan ke-4
  - Spatial Filtering
- ▶ Pertemuan ke-5
  - Quiz
- ▶ Pertemuan ke-6
  - Filtering dalam Frekuensi domain
- ▶ Pertemuan ke-7
  - Image restorasi
- ▶ Pertemuan ke-8
  - UTS

# Rencana Perkuliahan

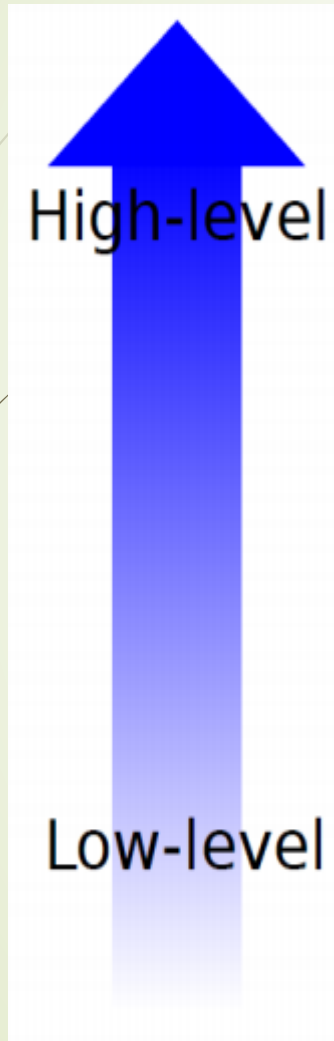
- Pertemuan ke-9
  - Pengolahan Citra Berwarna
- Pertemuan ke-10
  - Morphological Image Processing
- Pertemuan ke-11
  - Image segmentasi
- Pertemuan ke-12
  - Image Compression
- Pertemuan ke-13
  - Object detection and recognition
- Pertemuan ke-14
  - Presentasi Tugas
- Pertemuan ke-15
  - Presentasi Tugas
- Pertemuan ke-16
  - UAS



# Penilaian

Kegiatan	Bobot Nilai (%)
Ujian Tengah Semester	25
Ujian Akhir Semester	25
Tugas	30
Quiz	20

# Relationship with other Fields



## Computer Vision

Object detection, recognition, shape analysis, tracking  
Use of Artificial Intelligence and Machine Learning

## Image Analysis

Segmentation, image registration, matching

## Image Processing

Image enhancement, noise removal, restoration,  
feature detection, compression

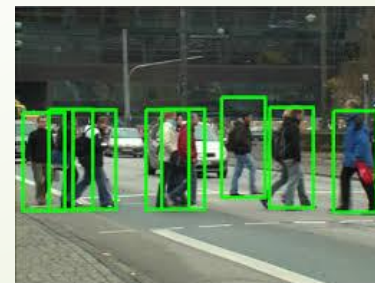


# COMPUTER VISION

# RESEARCH AREA

- Object detection

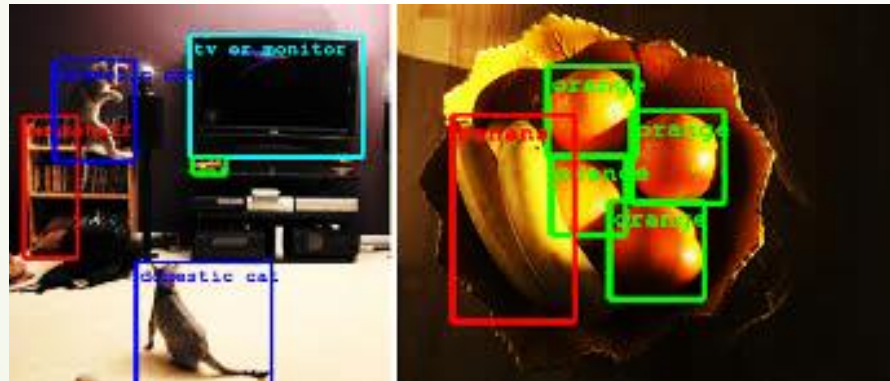
- **Object detection** is a computer technology related to computer vision and image processing that deals with detecting instances of semantic objects of a certain class (such as humans, buildings, or cars) in digital images and videos.



# RESEARCH AREA

## ► Recognition

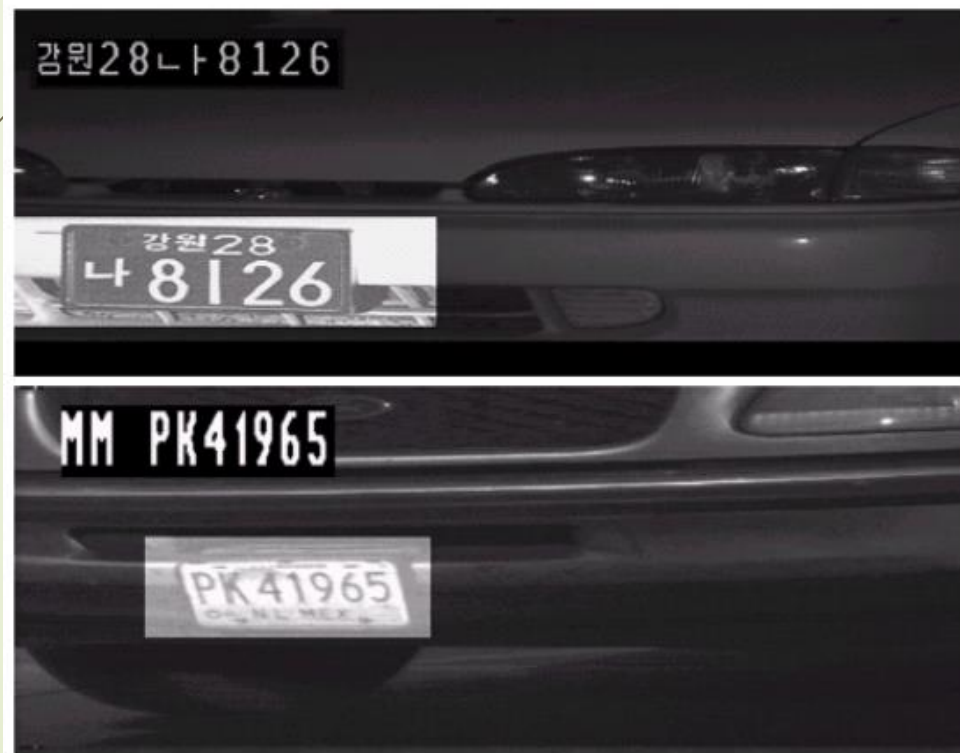
- Recognition is a task (within computer vision) for finding and identifying objects in an image or video sequence.





# DIP Application Law Enforcement

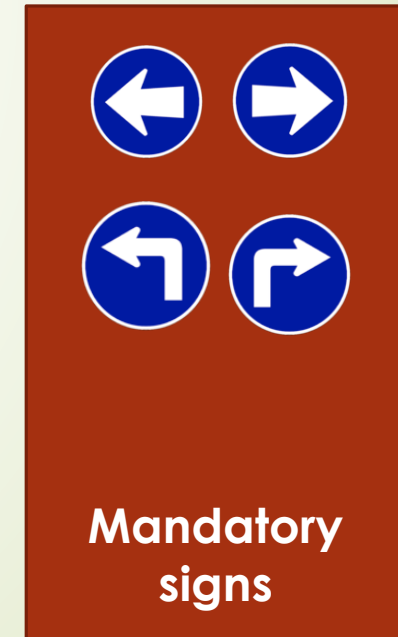
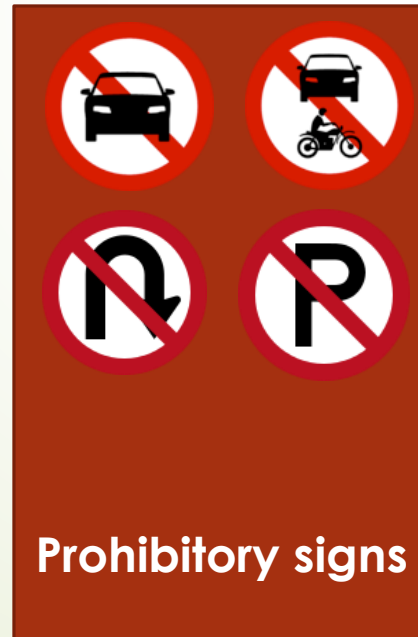
- ▶ Number plate recognition for speed cameras or automated toll systems
- ▶ Fingerprint recognition



# RESEARCH AREA

## ► Shape Analysis

- **Shape analysis** is the mainly automatic analysis of geometric shapes, for example using a computer to detect similarly shaped objects in a database.



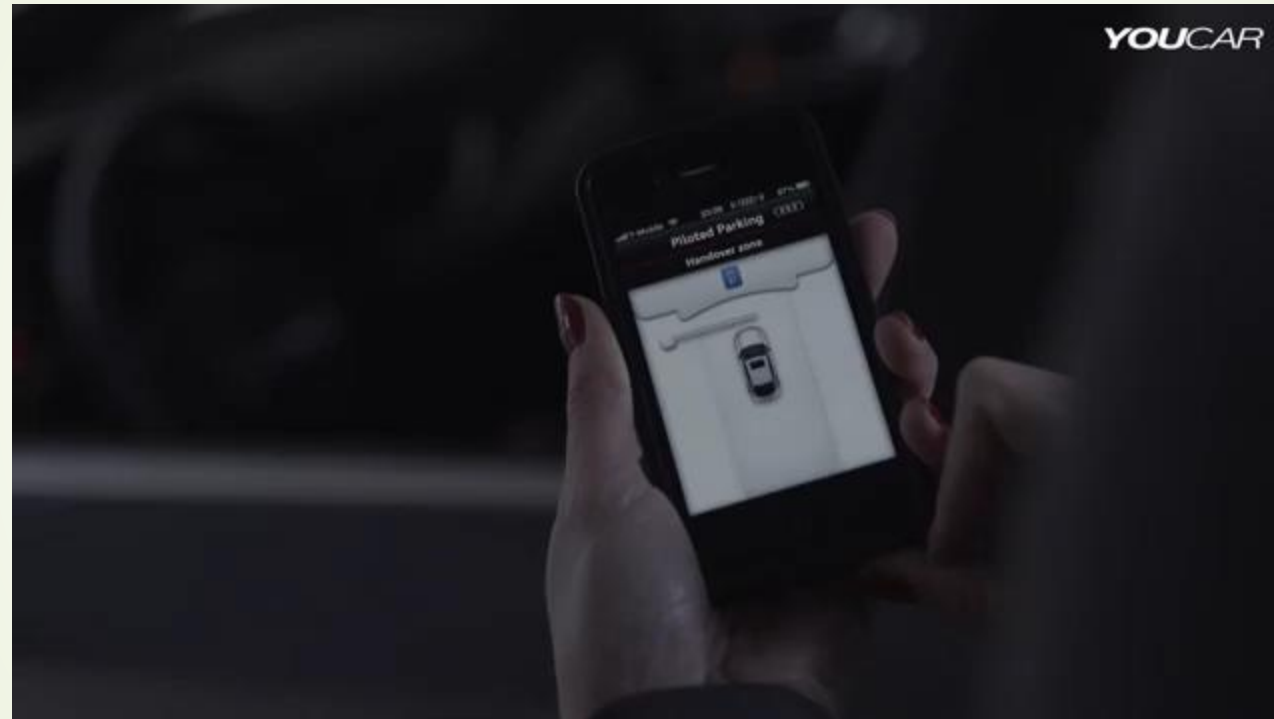


# RESEARCH AREA

- ▶ **Tracking** use of artificial intelligence and machine learning
  - ▶ **Video tracking** is the process of locating a moving object (or multiple objects) over time using a camera.
    - ❖ It has a variety of uses, some of which are: human-computer interaction, security and surveillance, augmented reality.

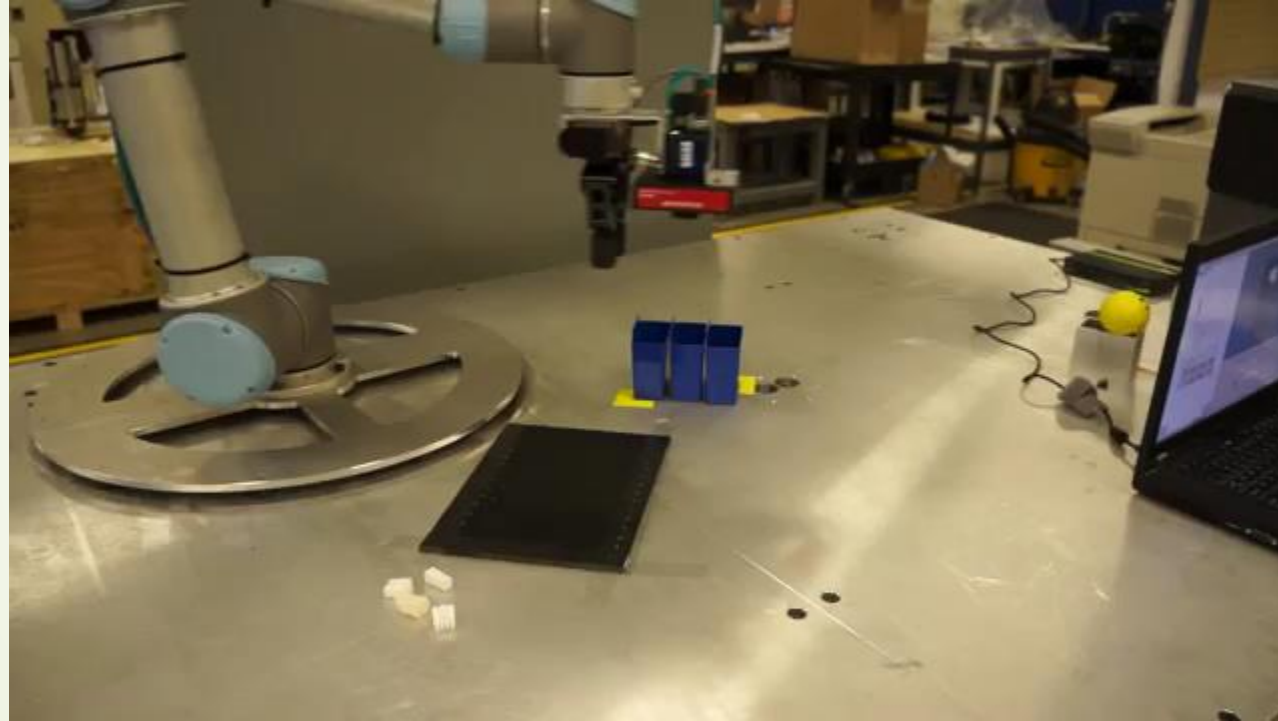
# APPLICATIONS

- ▶ Automated driving for parking from Audi



# APPLICATIONS

## ▶ Robot Vision





# **IMAGE PROCESSING (PENGOLAHAN CITRA DIGITAL)**

# Digital Image Processing (DIP) Application

## ➤ Noise removal



# DIP Application

## Scaling





# DIP Application

## Contrast Adjustment



Low contrast



Original contrast



High contrast

# DIP Application

## Edge detection



# DIP Application

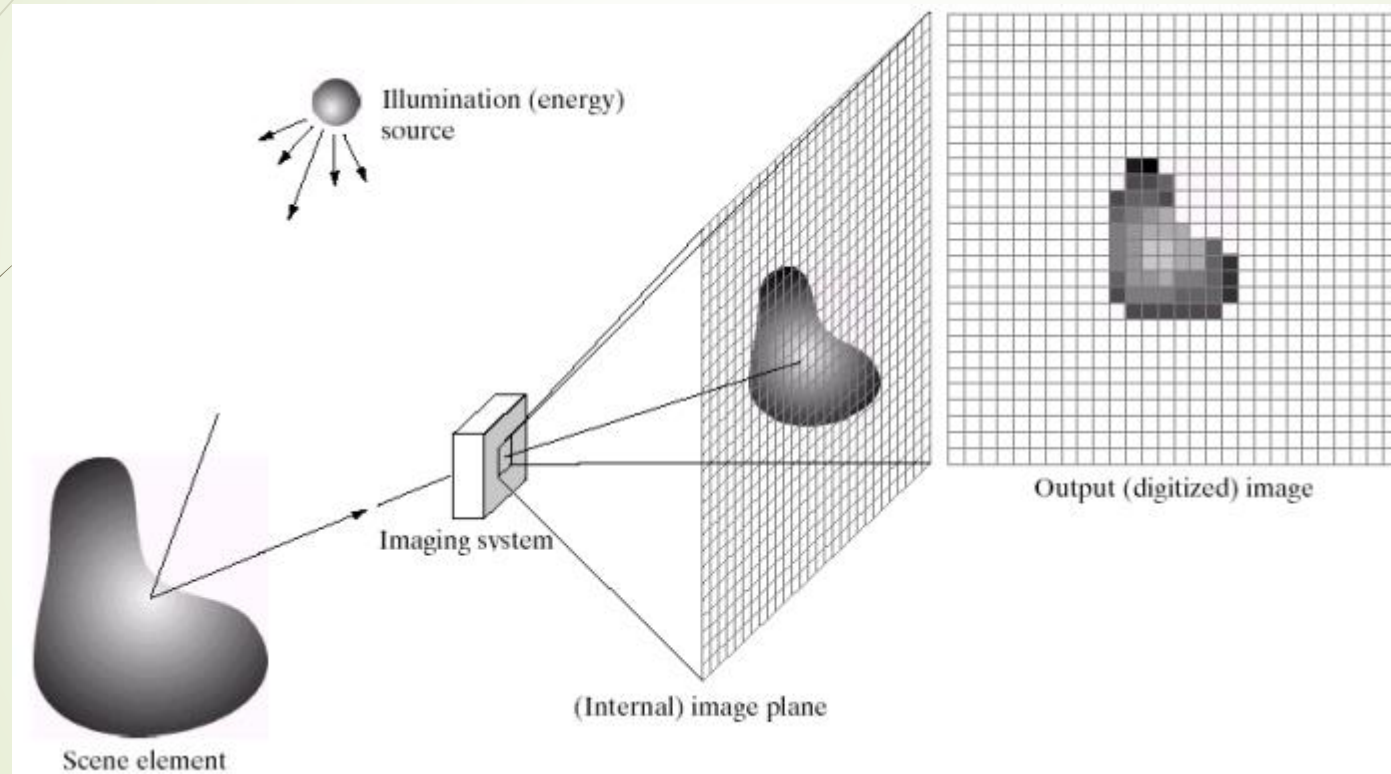


# Digital Image Processing

- ▀ What is an Image?
  - ❖ 2 - dimensional matrix of Intensity (gray or color) values.

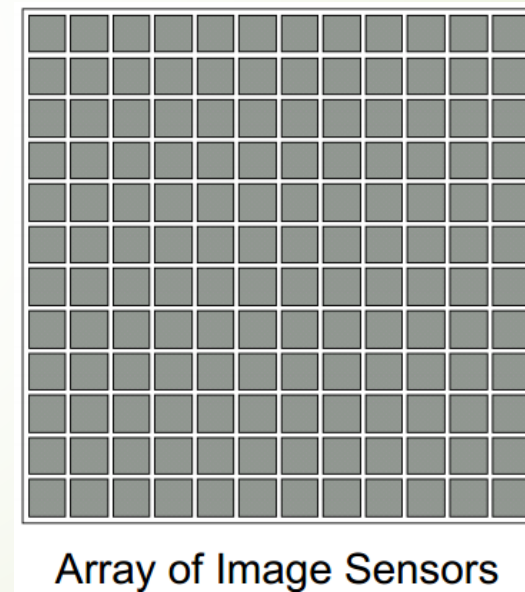
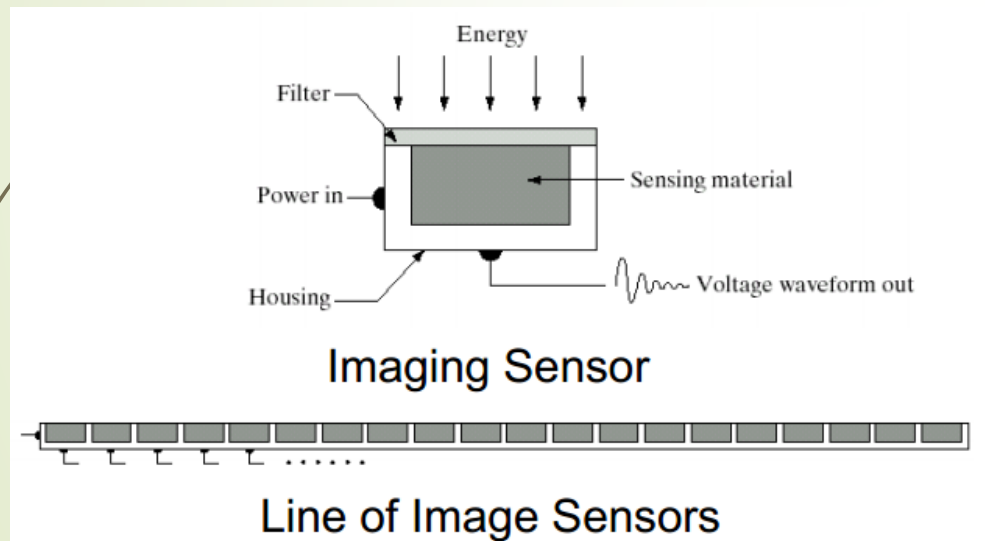


# Imaging System



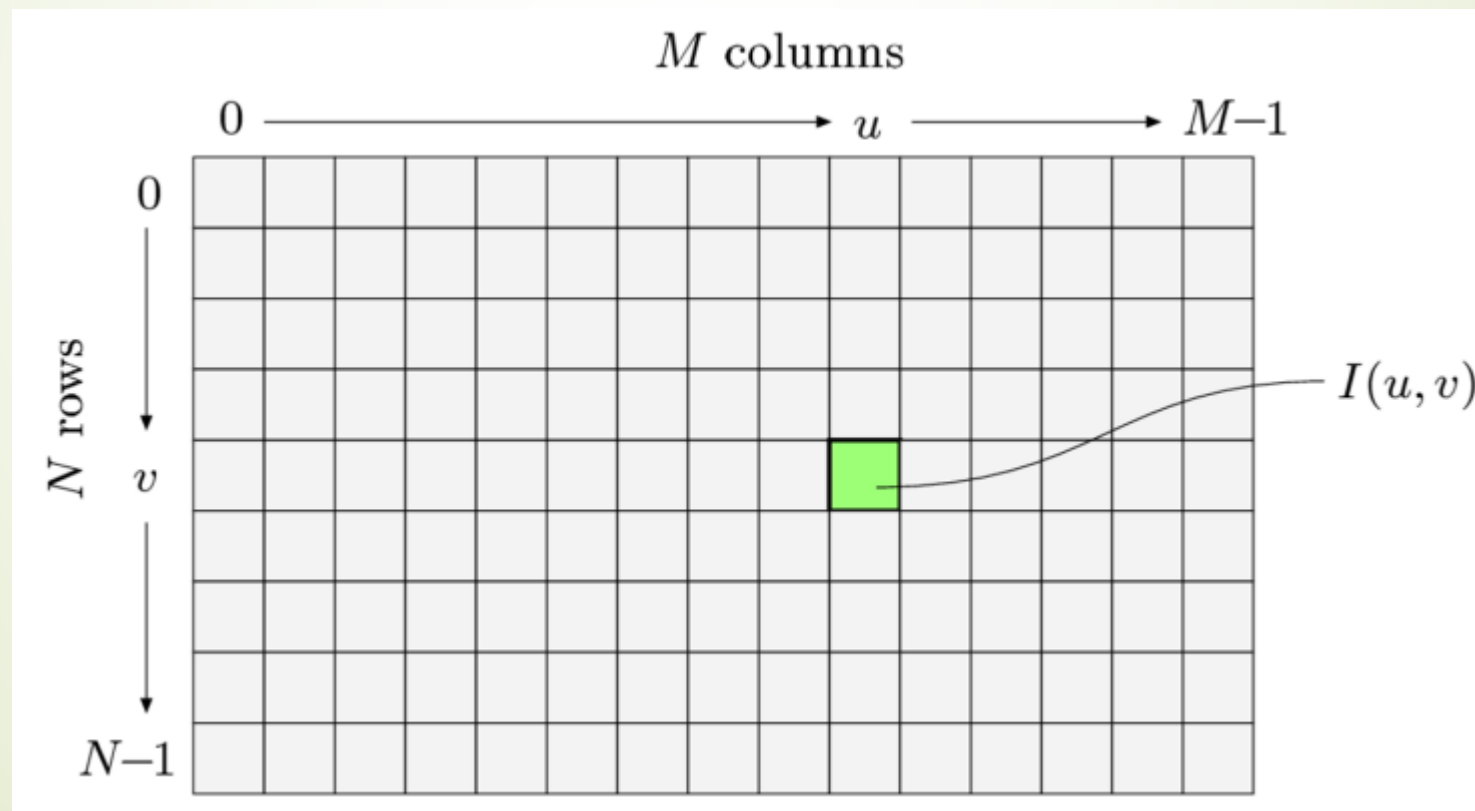
# Image Sensing

- Incoming energy (e.g. light) lands on a sensor material responsive to that type of energy, generating a voltage
- Collections of sensors are arranged to capture images



# Representing Images

- ▶ Image data structure is 2D array of pixel values
- ▶ Pixel values are gray levels in range 0 -255 (8-bit) or RGB colors
- ▶ Array values can be any data type (bit, byte, int, float, double, etc.)

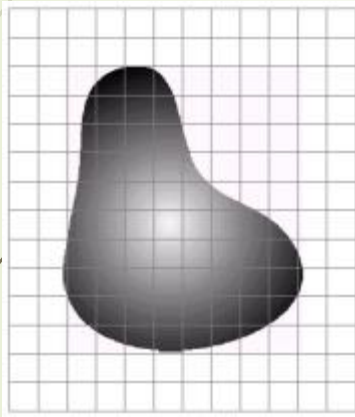




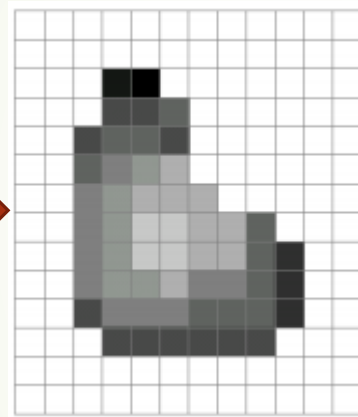


# Digital Image?

- Remember: **digitization** causes a digital image to become an **approximation** of a real scene



Real image



Digital image

(An approximation)



Real image



Digital image

(An approximation)

# Digital Image

- ▶ Common image formats include:
  - 1 values per point/pixel (B&W or Grayscale)
  - 3 values per point/pixel (Red, Green, and Blue)
  - 4 values per point/pixel (Red, Green, Blue, + “Alpha” or Opacity)



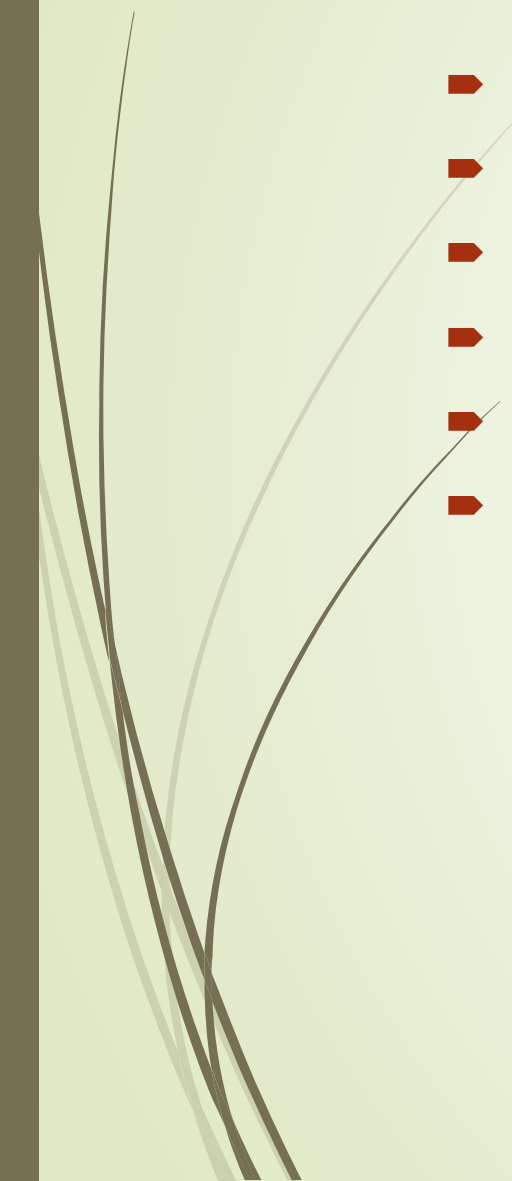


# What is image Processing?

- Algorithms that alter an input image to create new image
- Input is image, output is image
- Improves an image for human interpretation in ways including:
  - Image display and printing
  - Image editing
  - Image enhancement
  - Image compression

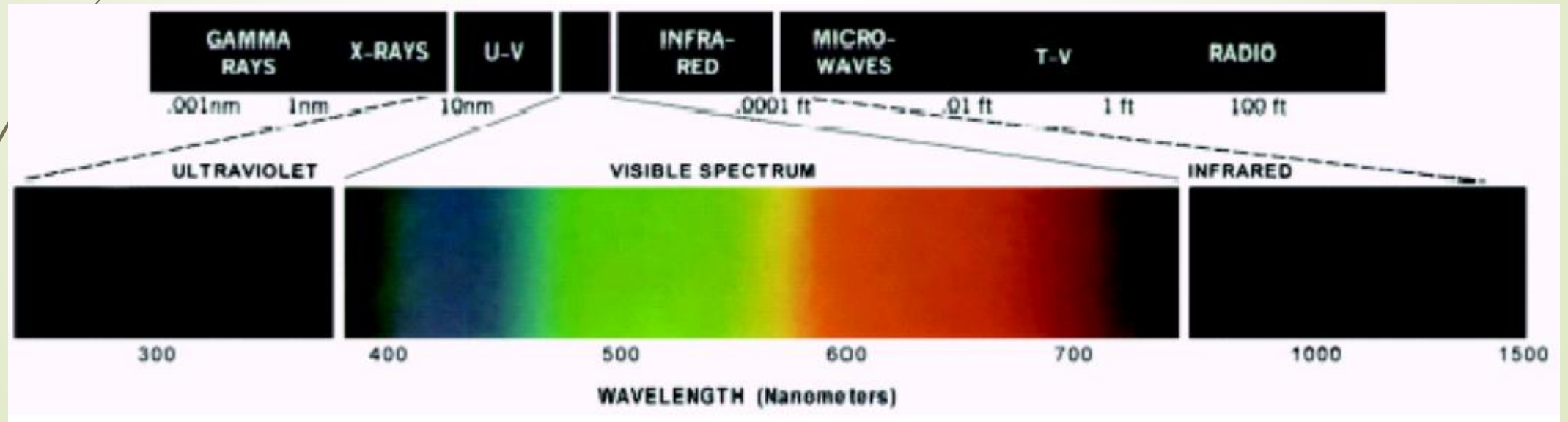


# Mathematics for Image Processing

- Calculus
  - Linear algebra
  - Probability and statistics
  - Differential Equations
  - Differential Geometry
  - Harmonic Analysis (Fourier, wavelet, etc)
- 

# Light And The Electromagnetic Spectrum

- ▶ Light: just a particular part of electromagnetic spectrum that can be sensed by the human eye
- ▶ The electromagnetic spectrum is split up according to the wavelengths of different forms of energy



# Images from Different Radiation

- Radar imaging (radio waves)
- Magnetic Resonance Imaging (MRI) (Radio waves)
- Microwave imaging
- Infrared imaging
- Photographs
- Ultraviolet imaging telescopes
- X - rays and Computed tomography
- Positron emission tomography (gamma rays)
- Ultrasound (not EM waves)



**Untuk selanjutnya**

**Mari kita bermain-main dengan matrik  
data citra digital**

**Semoga menyenangkan....**

