

DIGITAL Image Processing (ELINS / MII 4203)

Lecture 1 : Introduction to Digital Image Processing

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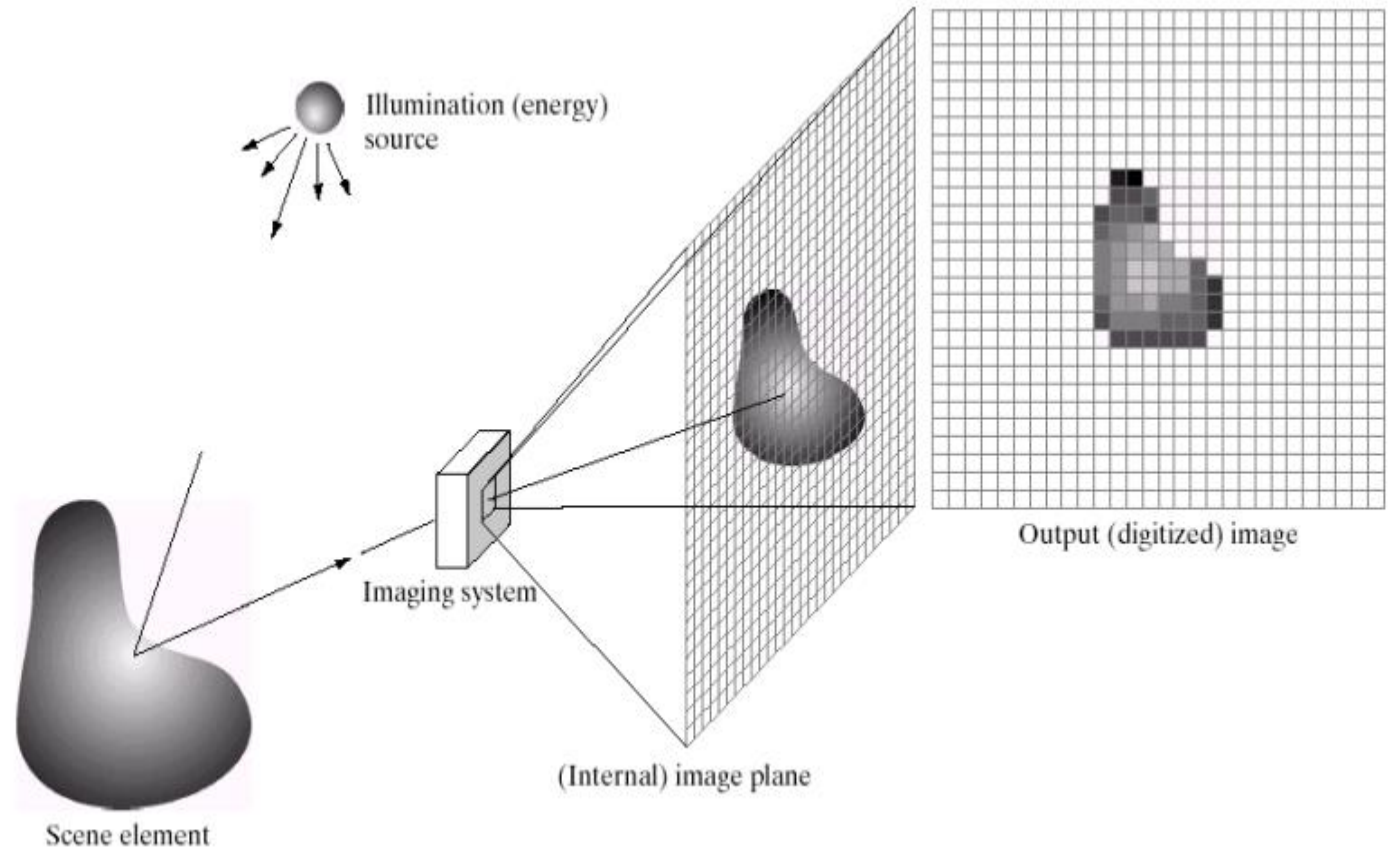
ELECTRONICS AND INSTRUMENTATION

UNIVERSITAS GADJAH MADA



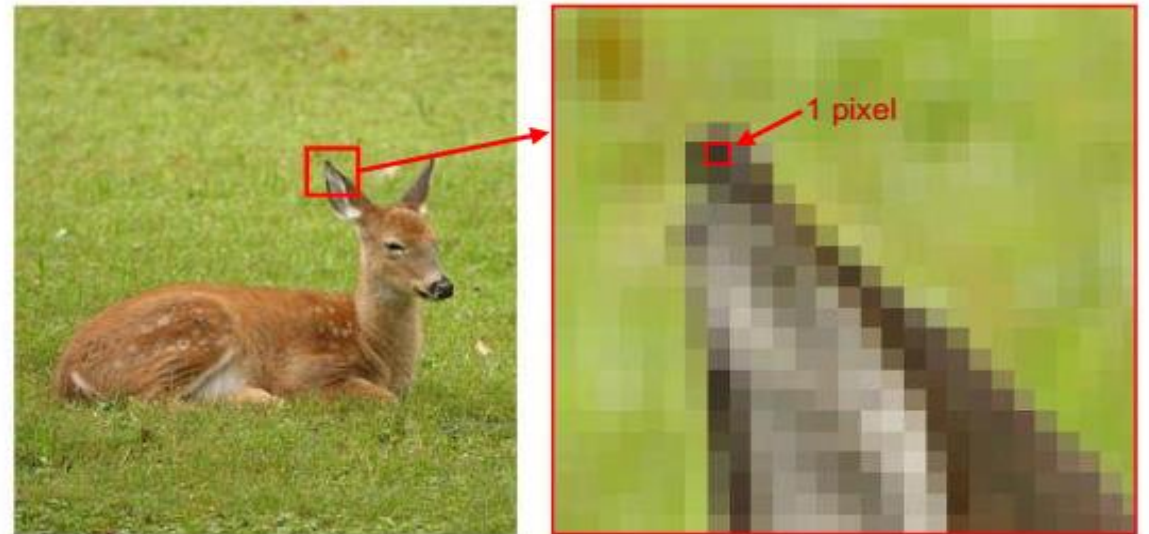
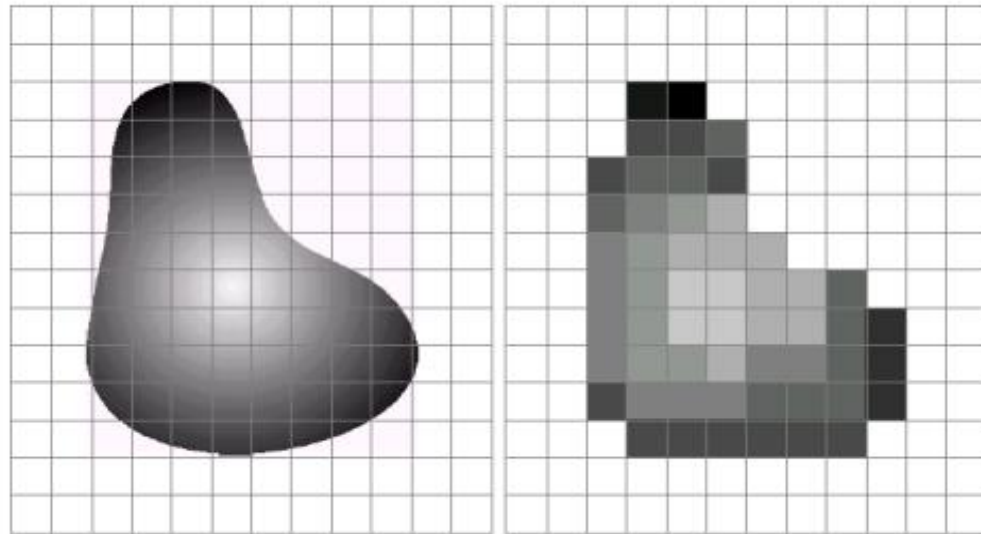
Apa itu citra digital?

- Citra → Sinyal dua dimensi yang dapat diobservasi oleh sistem visual manusia
- Citra digital → representasi dari citra dengan melakukan sampling terhadap waktu dan suatu bidang 2 dimensi, berisi kumpulan nilai digital yang disebut dengan elemen gambar / pixel



Apa itu citra digital? (lanjt..)

- Nilai Pixel Merepresentasikan derajat keabuan (gray level), warna, lebar, opacities (keburaman)
- Proses Digitasi (Digitization) → citra digital dipetakan mendekati scene aslinya



Contoh Citra Digital

A. panorama

B. citra sintetis

C. poster

D. screenshoot

E. citra black n white (BW)

F. Barcode

G. sidik jari

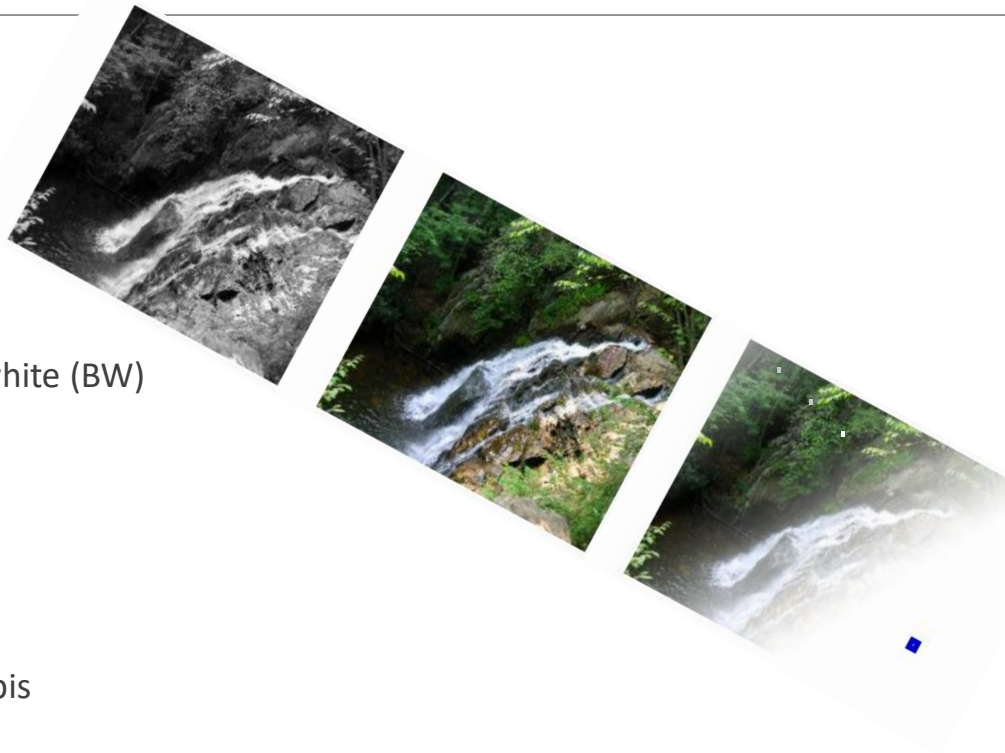
H. X-ray

I. citra mikroskopis

J. satellite

K. radar

L. astronomi



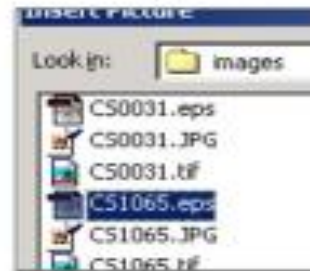
(a)



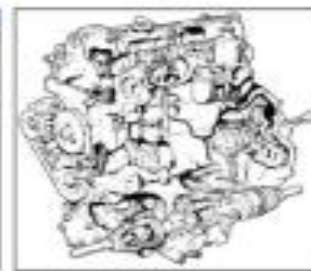
(b)



(c)



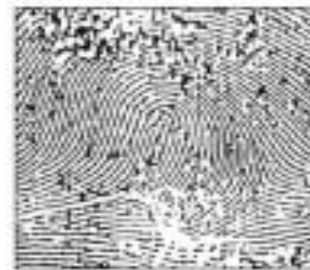
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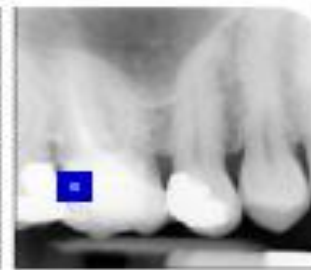
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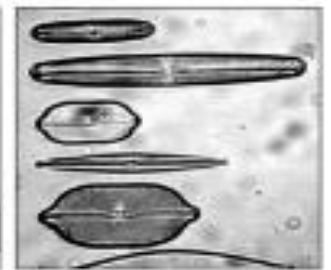
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(g)



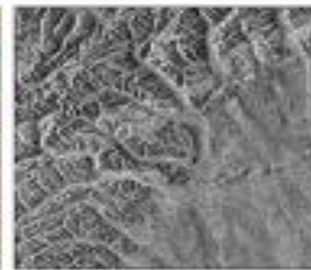
(h)



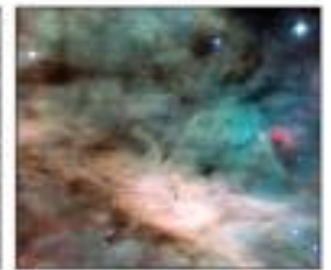
(i)



(j)



(k)



(l)

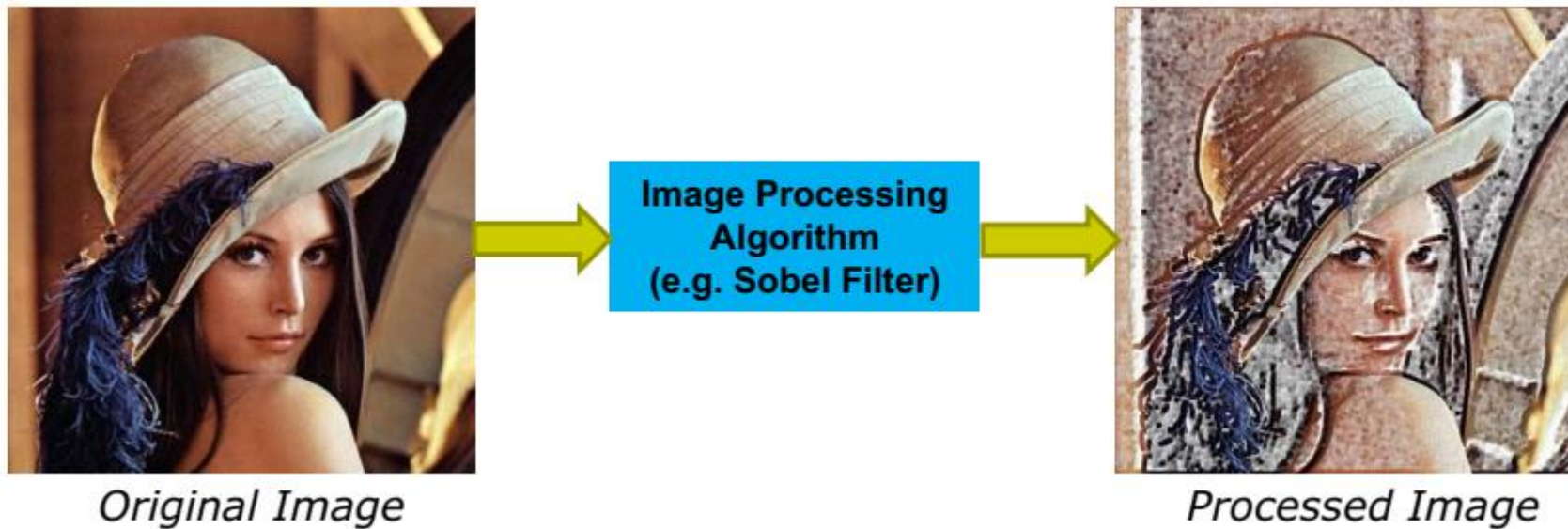
Apa itu Digital Image Processing?

■ DIP berfokus pada 2 hal:

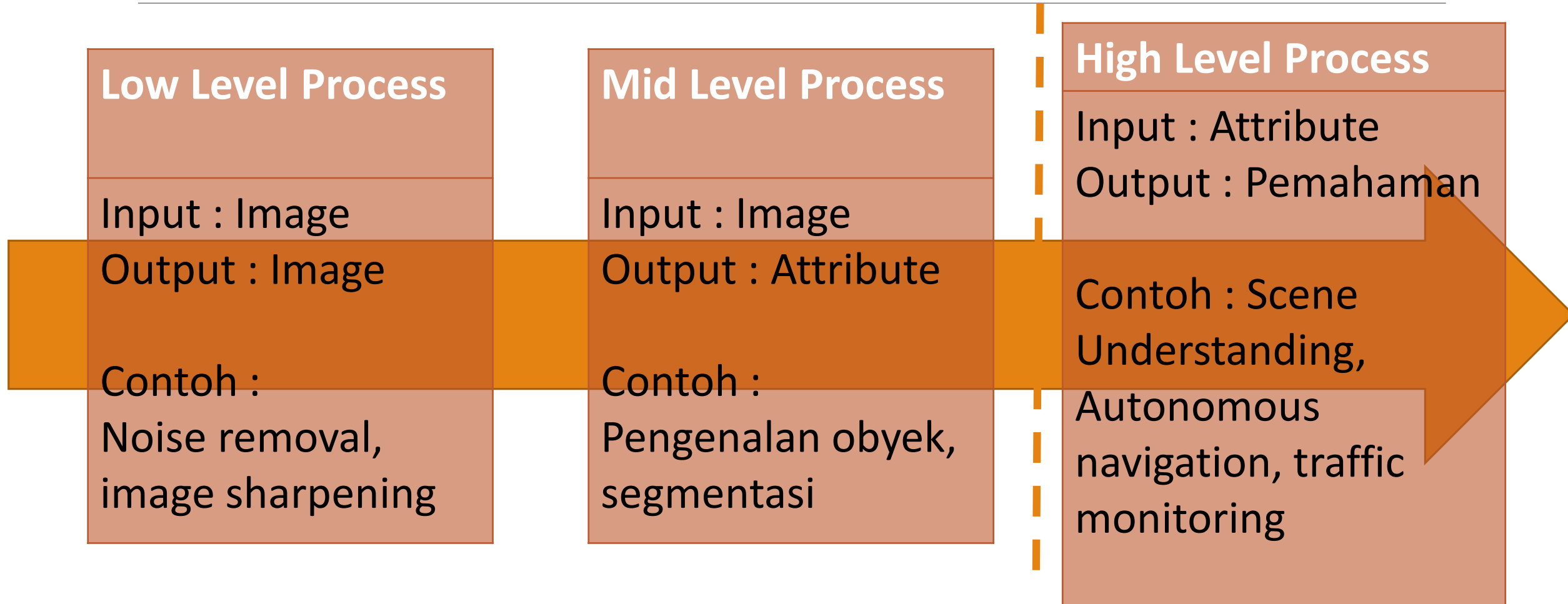
1. Meningkatkan informasi yang terkandung dalam citra untuk interpretasi manusia
2. Memproses data citra untuk disimpan, ditransmisikan, dan representasi yang digunakan pada autonomous machine perception

“Saat proses image processing selesai, maka ranah lain seperti image analysis dan computer vision dimulai ”

Apa itu Digital Image Processing?

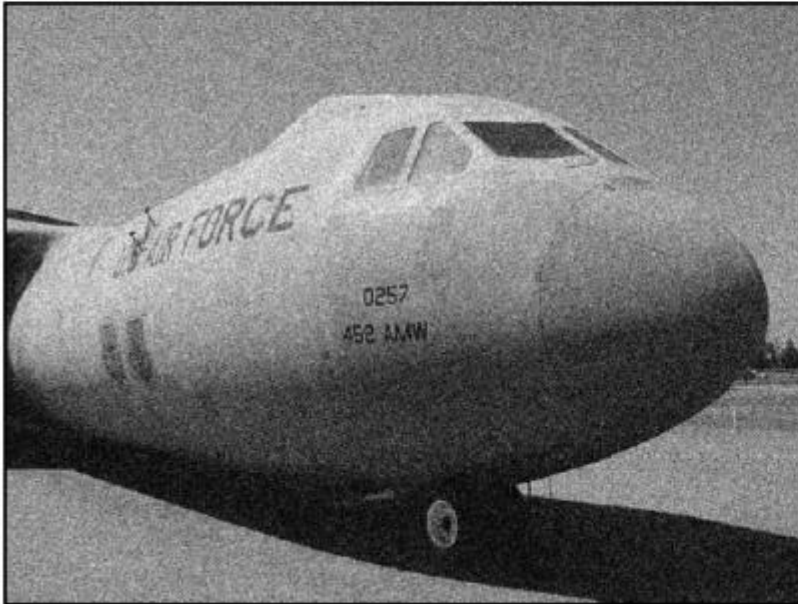


Apa itu Digital Image Processing?



Contoh : Noise Removal

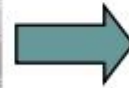
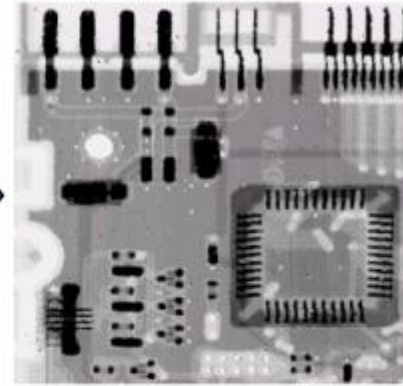
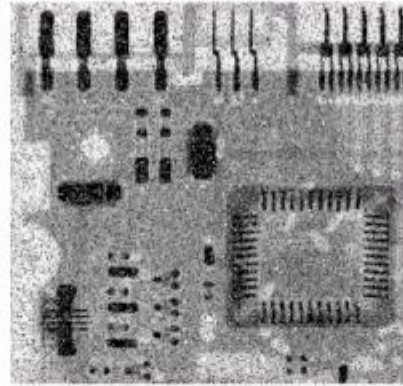
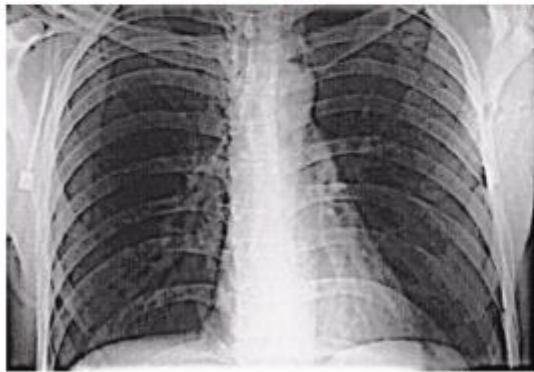
Noisy Image



Denoised Image



Contoh : Noise Removal



Sumber:
Gonzales & woods,
Digital Image
Processing (2008)

Contoh : Contrast Adjustment - Image Enhancement



Low Contrast



Original Contrast



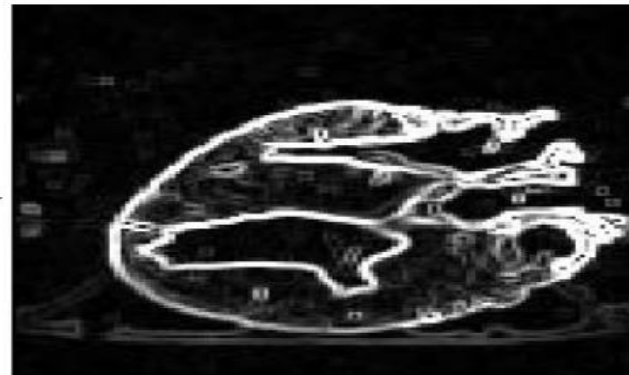
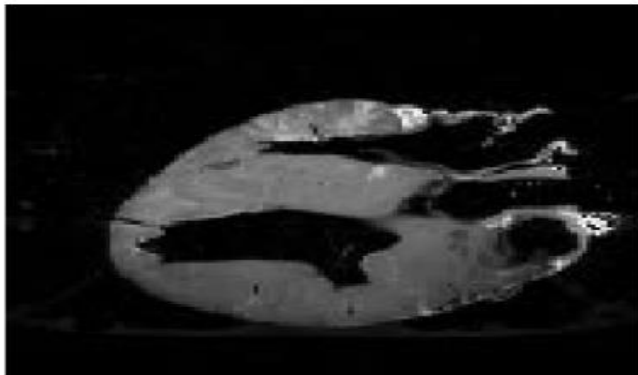
High Contrast

Sumber:
Gonzales & woods,
Digital Image
Processing (2008)

Contoh : Deteksi Tepi



Sumber:
Gonzales & woods,
Digital Image
Processing (2008)

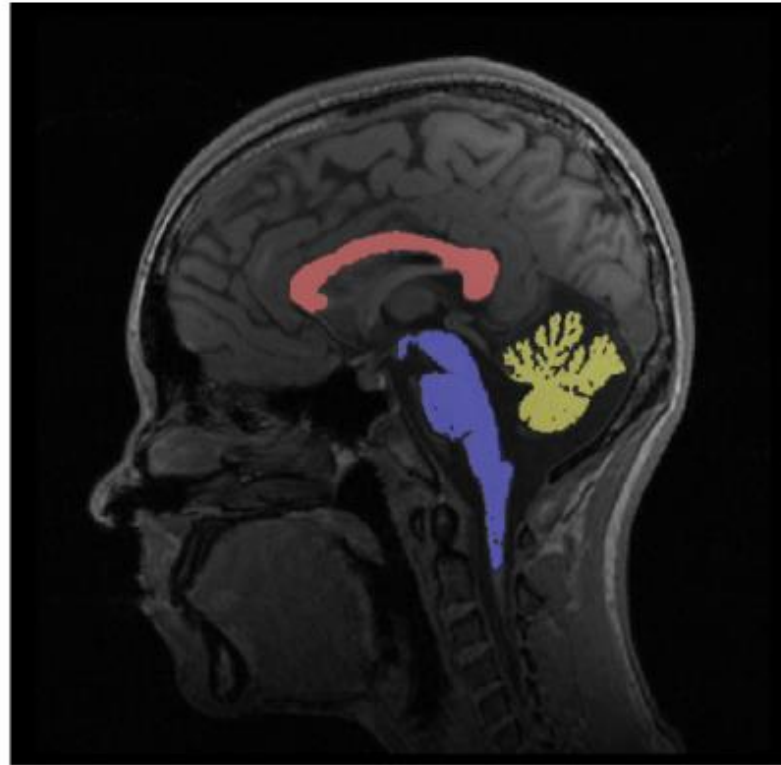
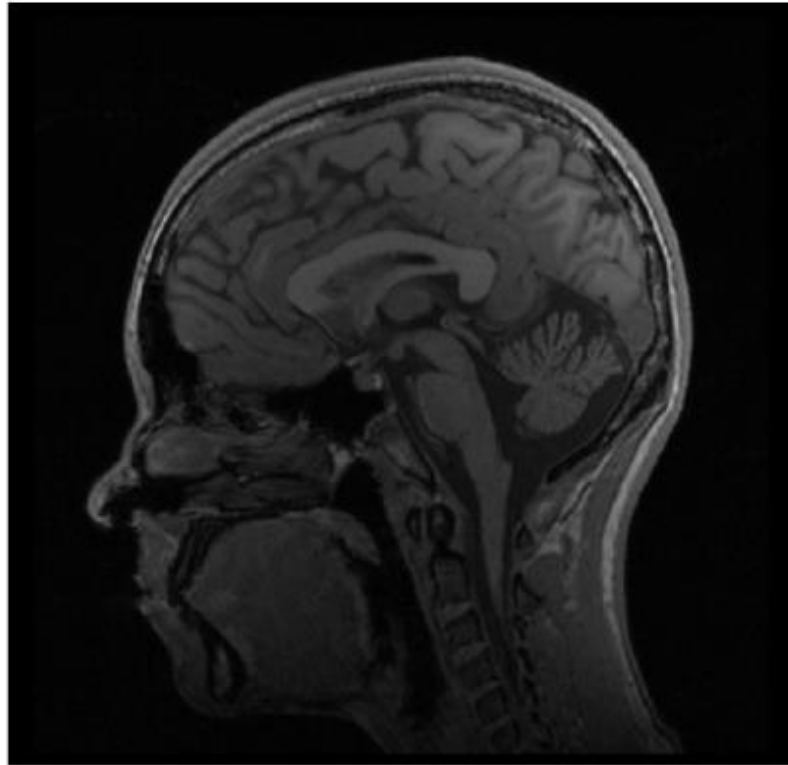


MRI Scan :
menemukan daerah
(boundary) didalam
jaringan

Original MRI Image of a Dog Heart

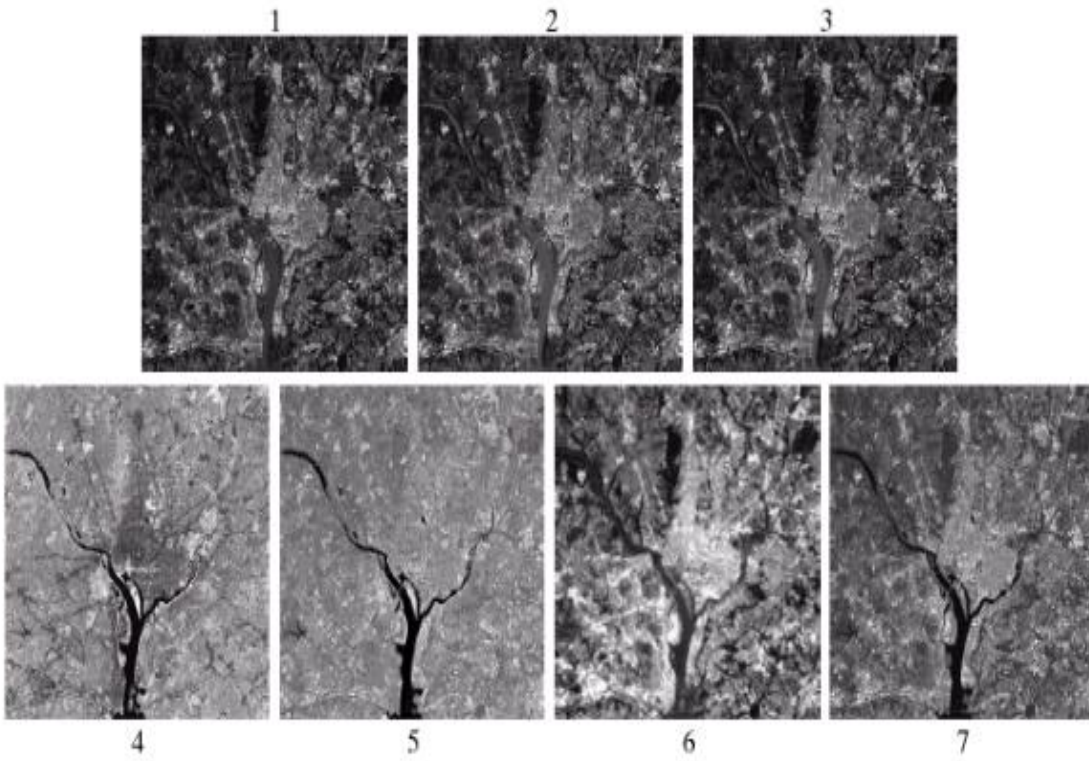
Edge Detection Image

Contoh : Segmentasi



Sumber:
Gonzales & woods,
Digital Image
Processing (2008)

Contoh : GIS



Sumber:
Gonzales & woods,
Digital Image
Processing (2008)

- Klasifikasi jenis tanah
- Meteorologi

Contoh : Image Compression



Original, 2.1MB



JPEG Compression, 308KB (15%)

Sumber:
Gonzales & woods,
Digital Image
Processing (2008)

Contoh : Image Inpainting (Restoration)

Damaged Image

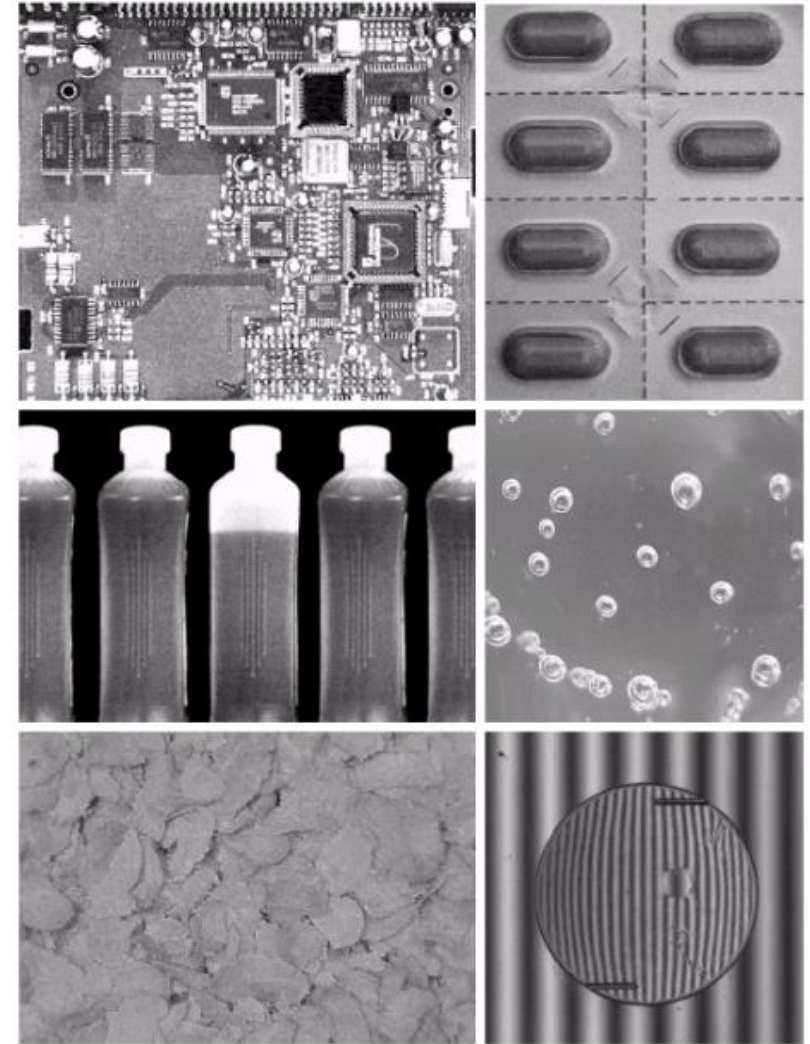


Restored Image

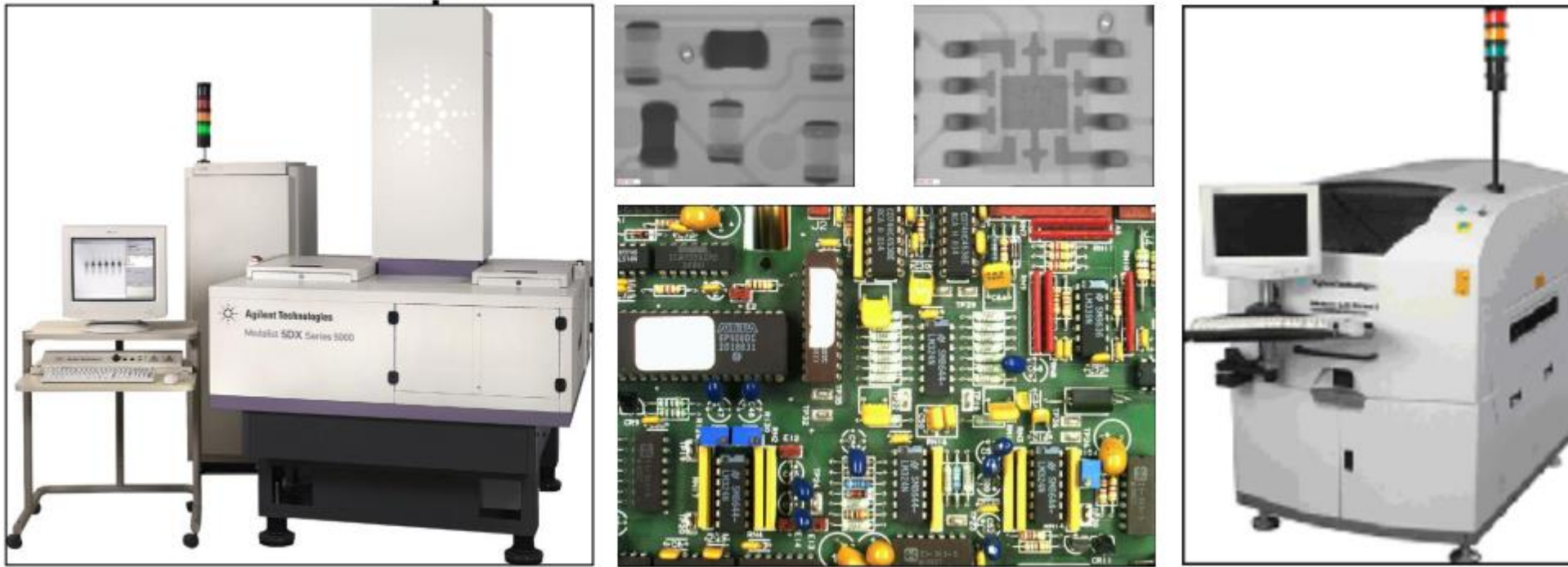


Contoh : Inspeksi Di Industri

- Human dianggap mahal, lambat, dan tidak reliable
- Membuat machine bekerja
- Sistem yang bekerja berdasarkan vision



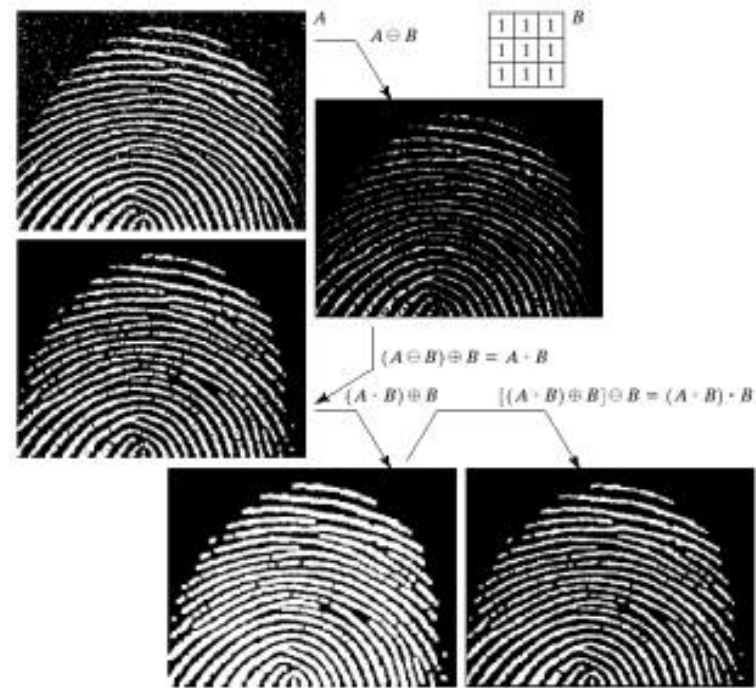
Contoh : Inspeksi PCB



- Memastikan tiap komponen telah terpasang dengan benar

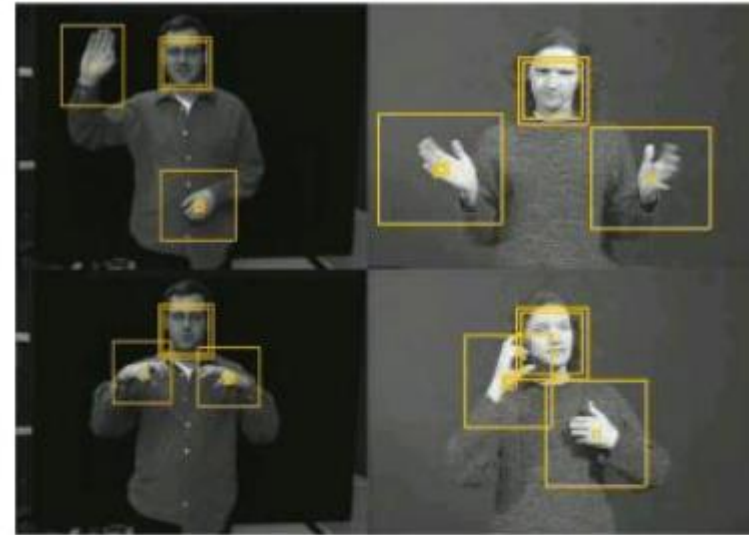
Contoh : Legalitas

- Image processing pada aplikasi yang lebih khusus



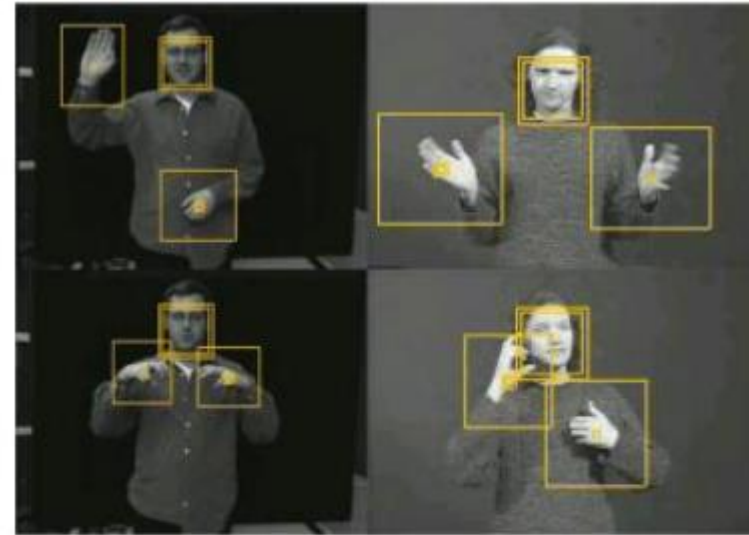
Contoh : HCI

- Face Recognition
- Gesture recognition
- Activity Recognition

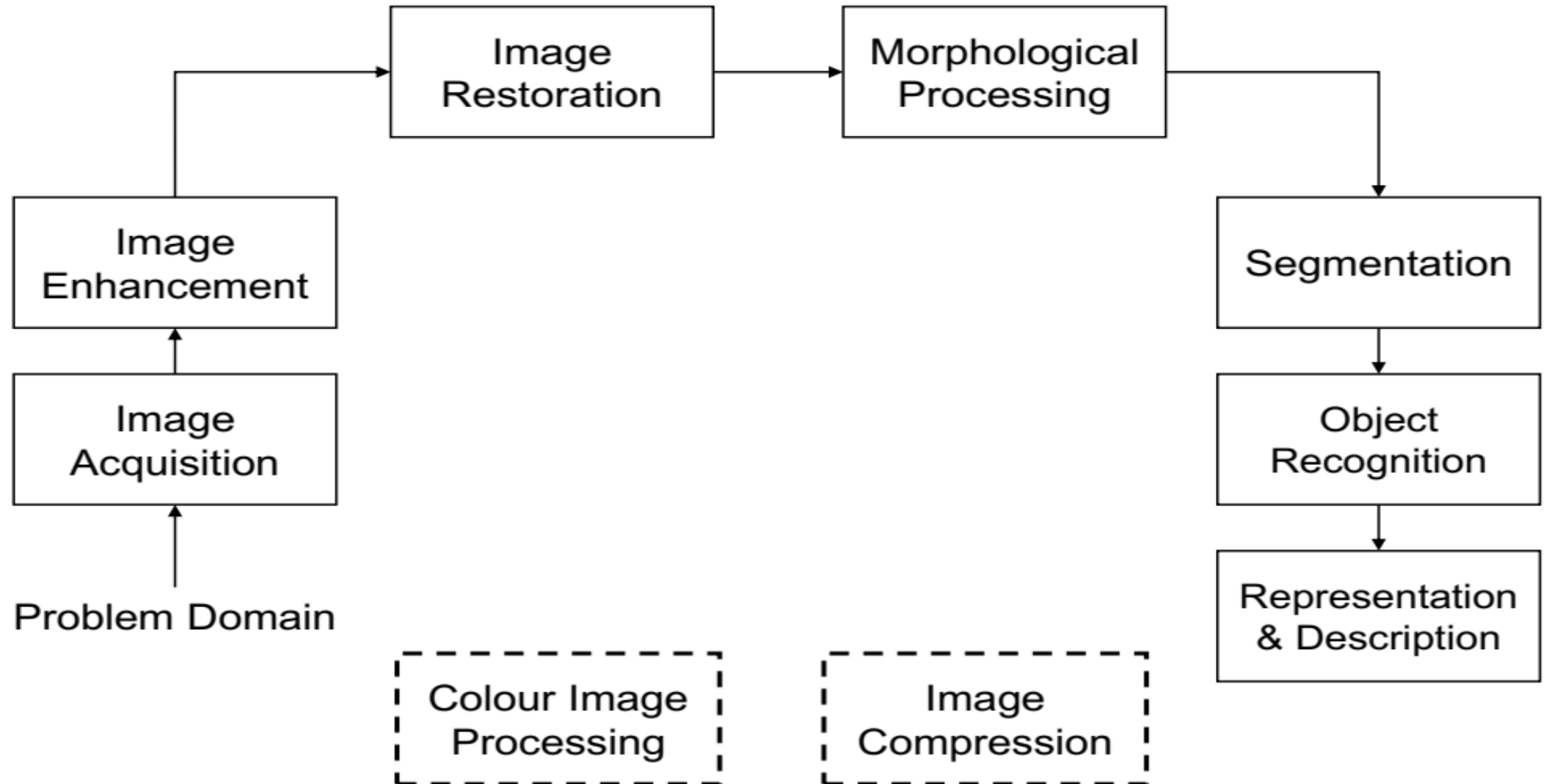


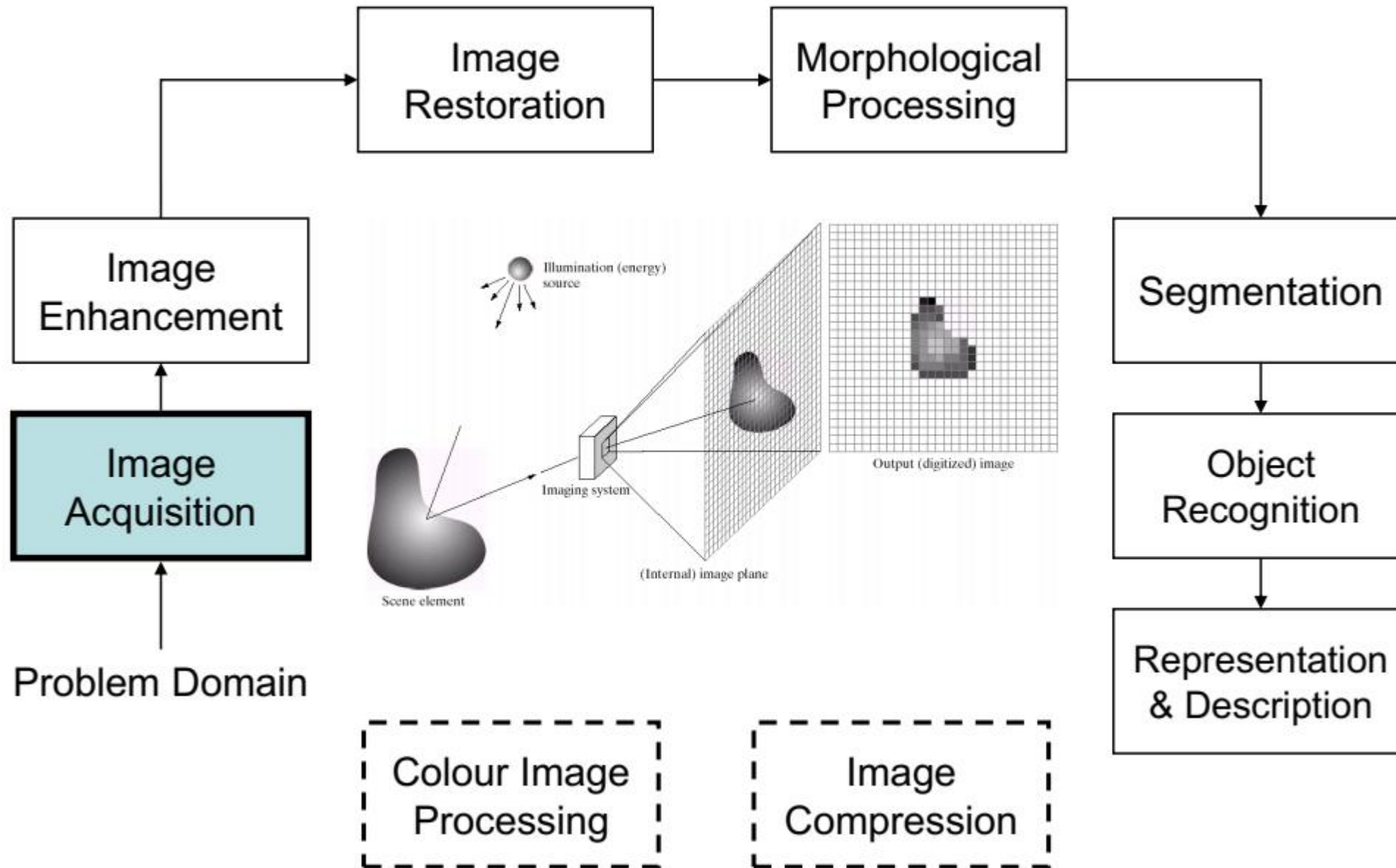
Contoh : HCI

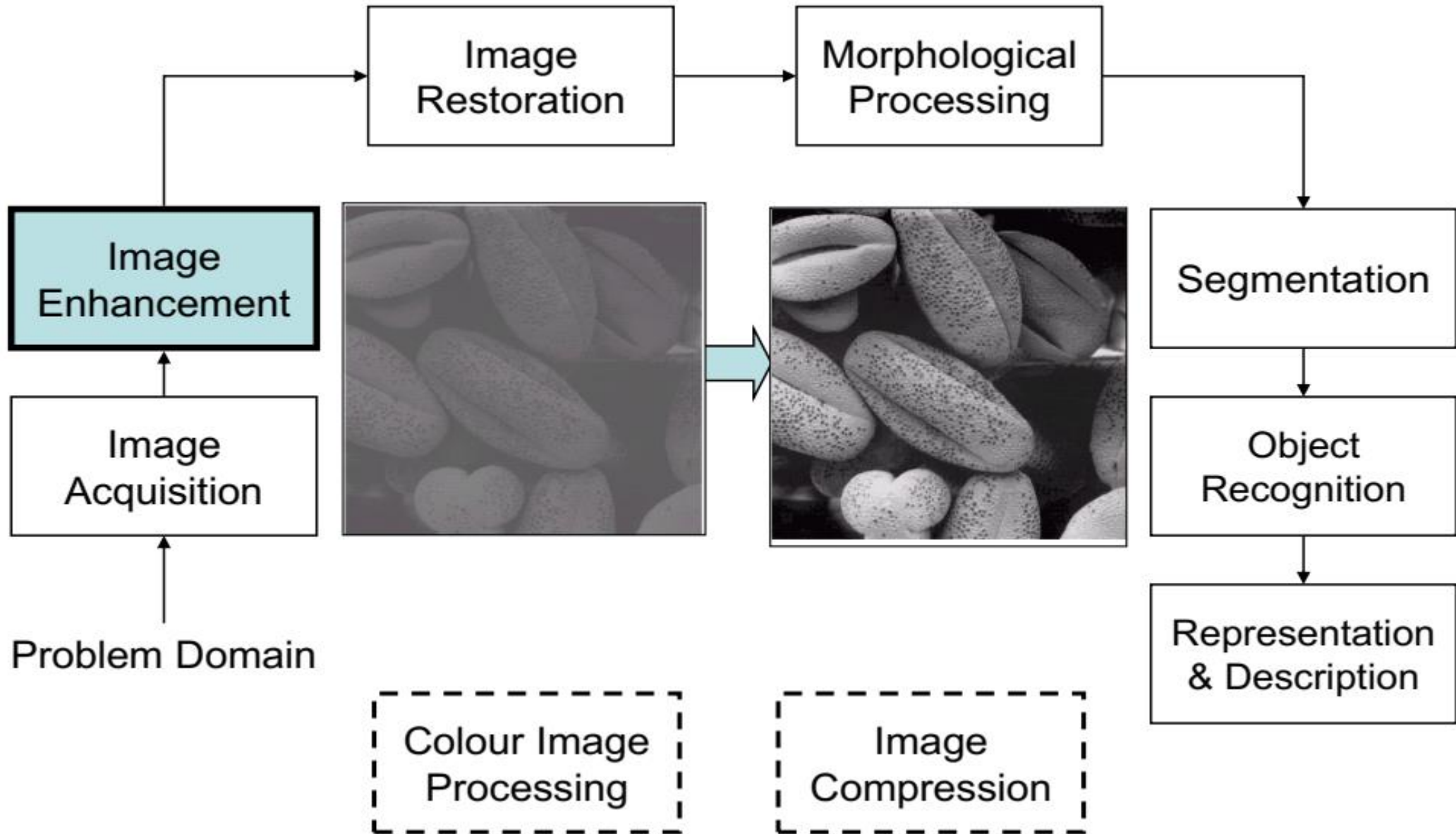
- Face Recognition
- Gesture recognition
- Activity Recognition

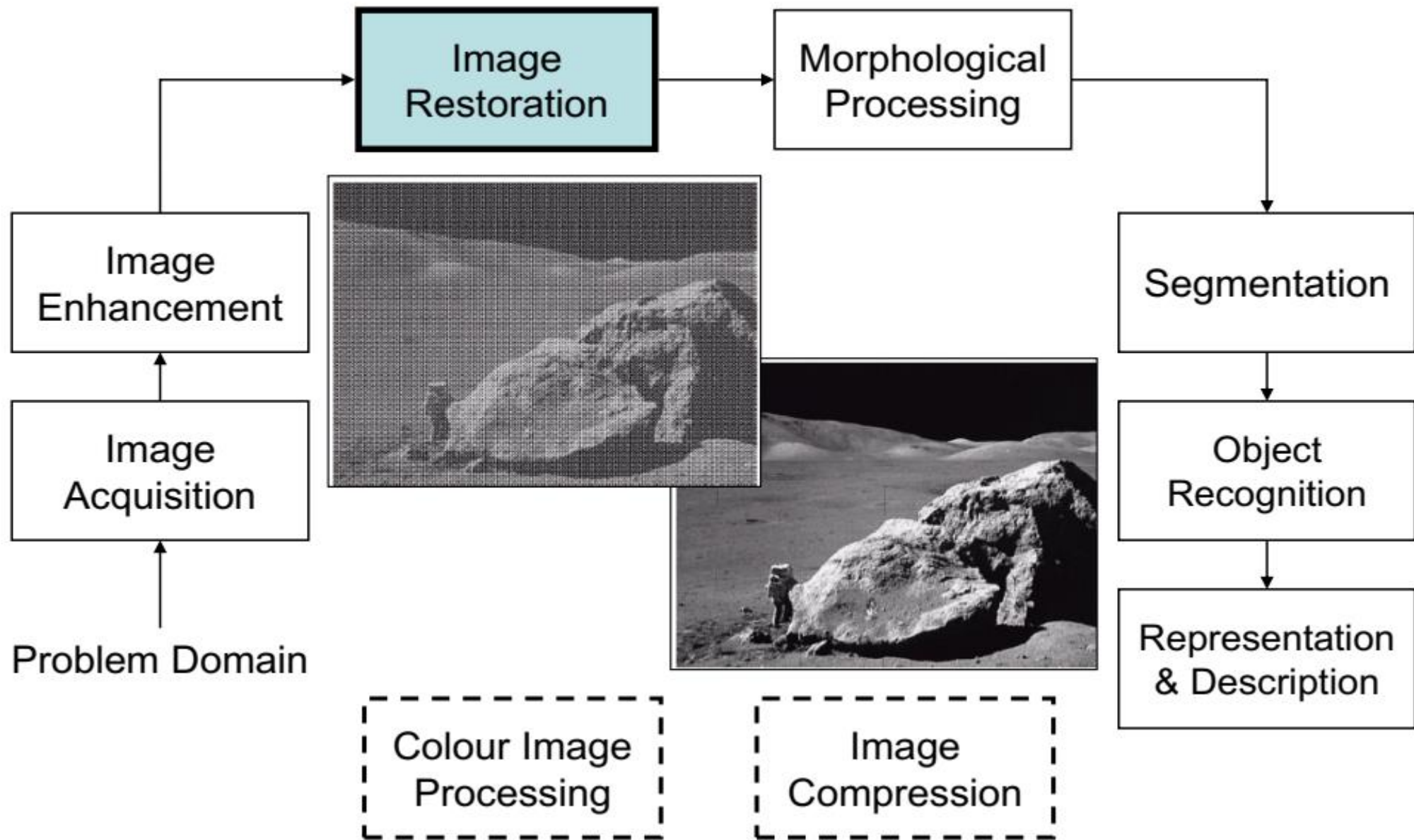


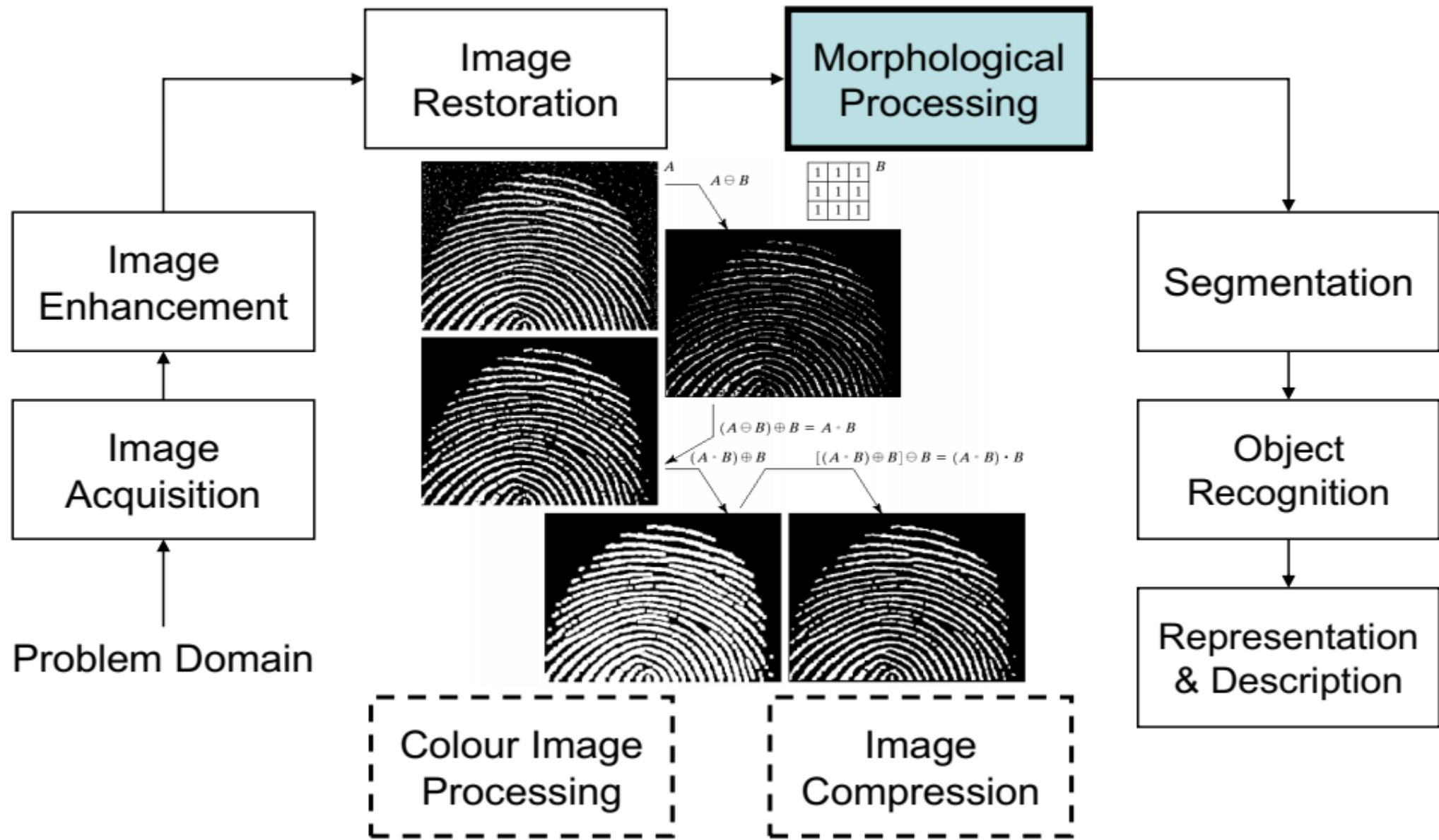
Tahapan Digital Image Processing

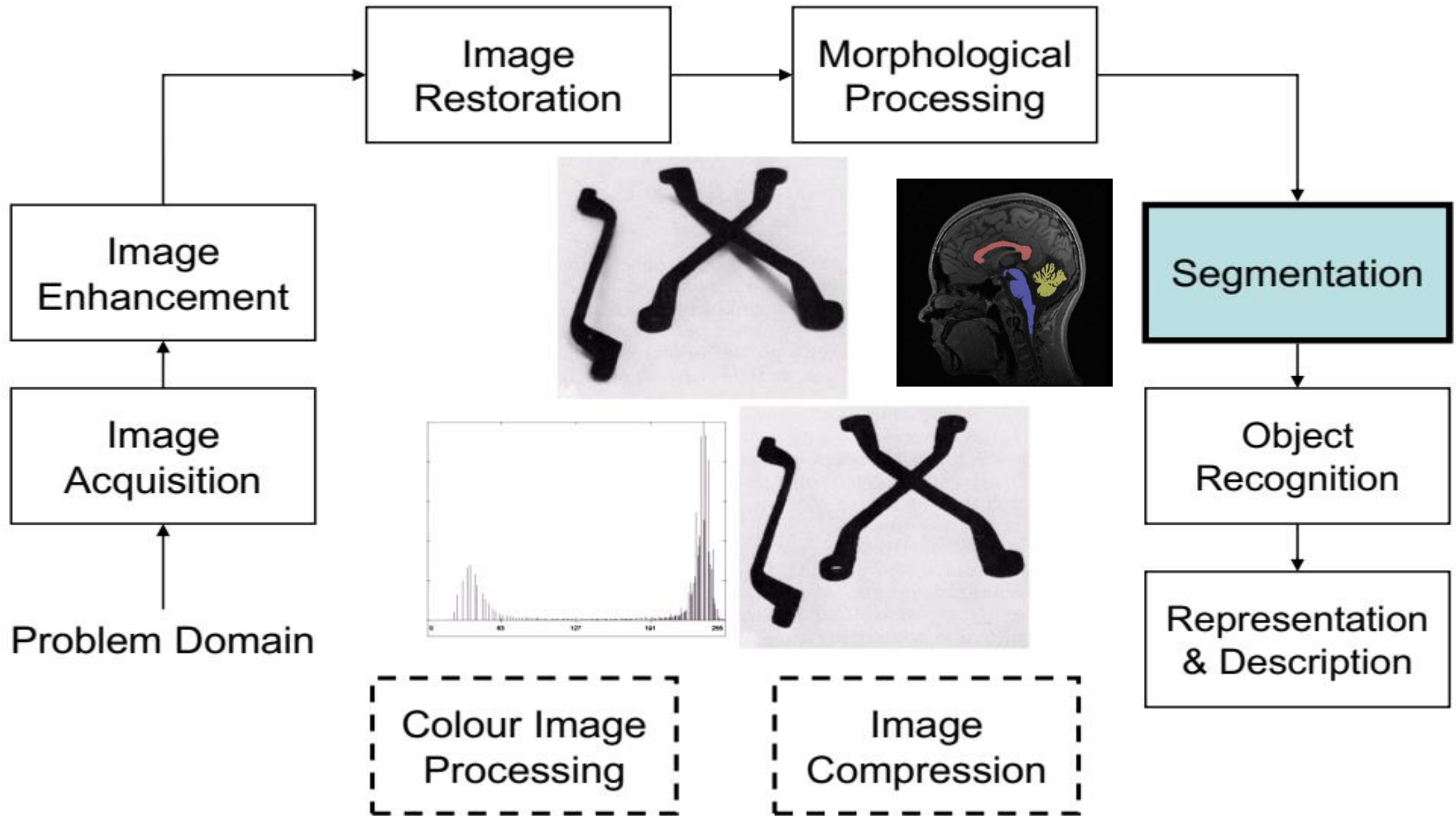


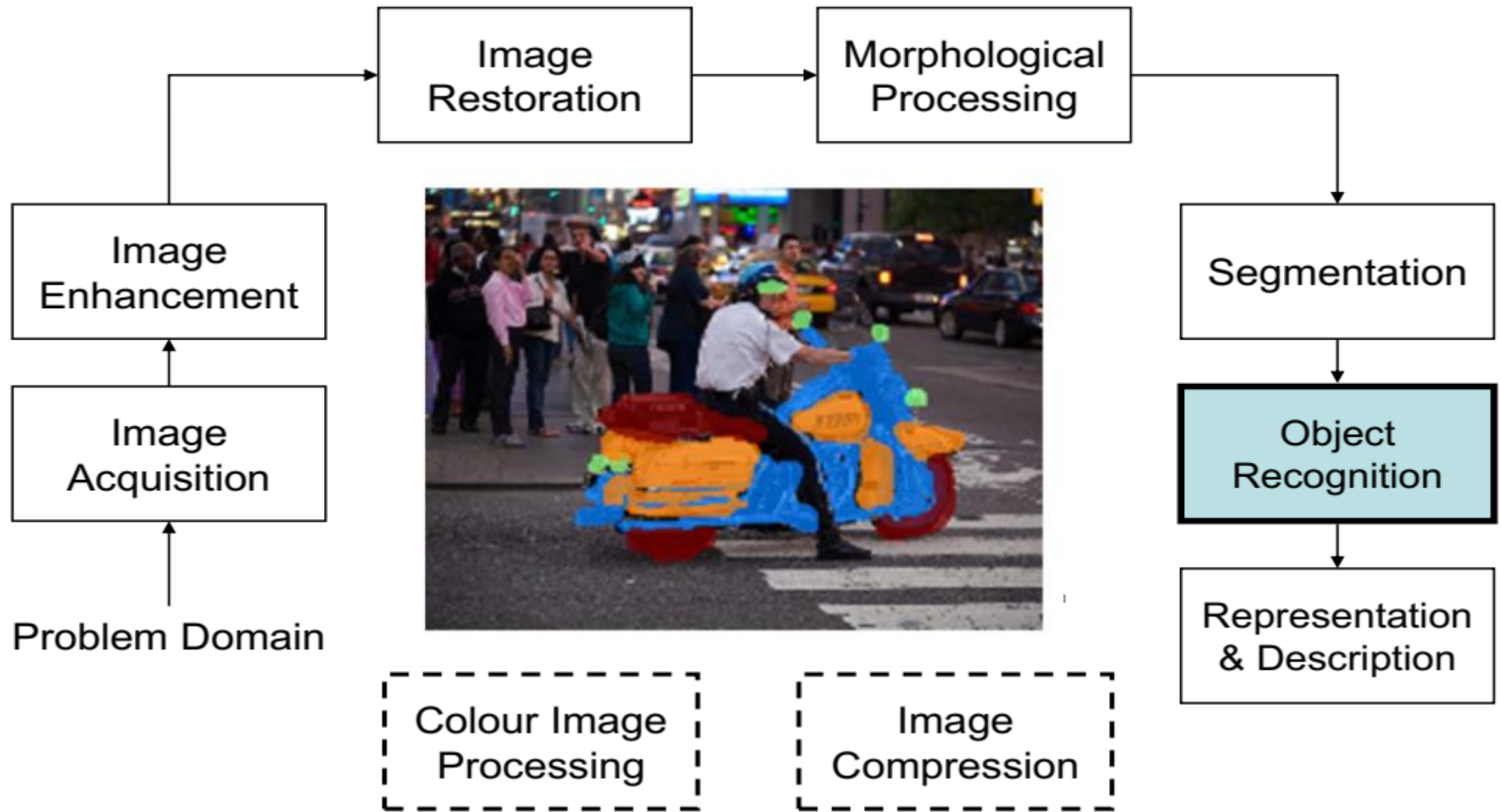


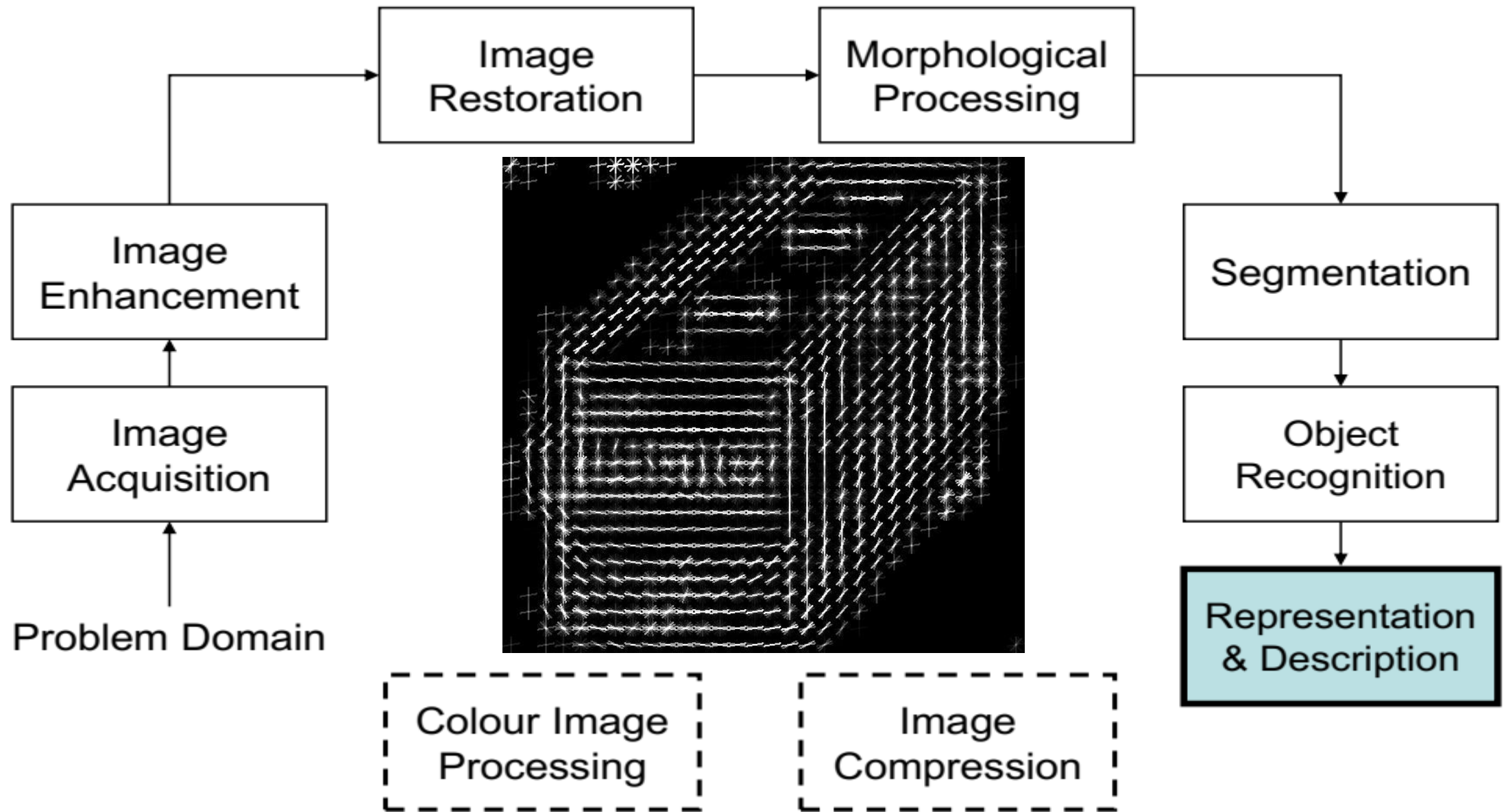


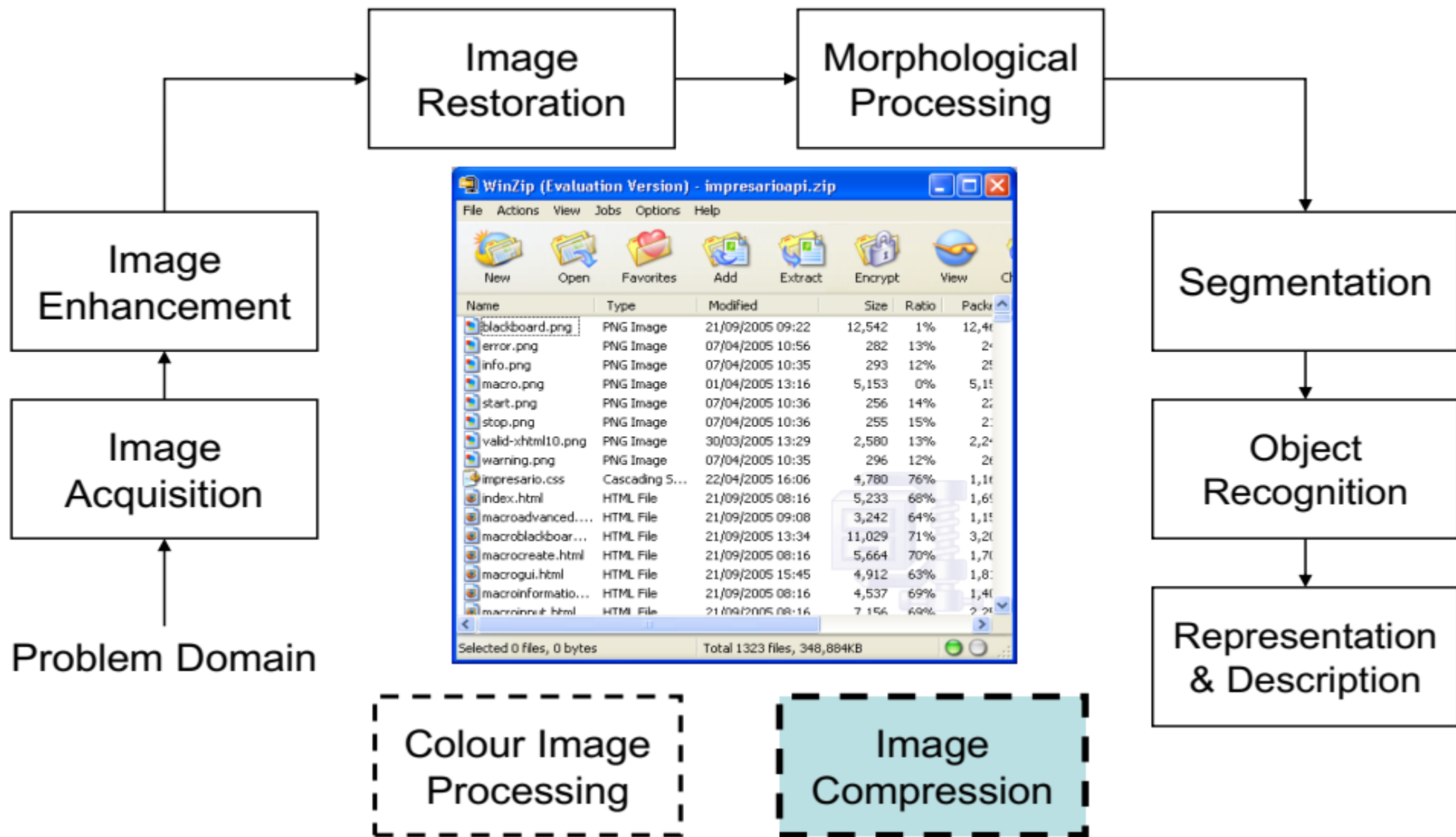


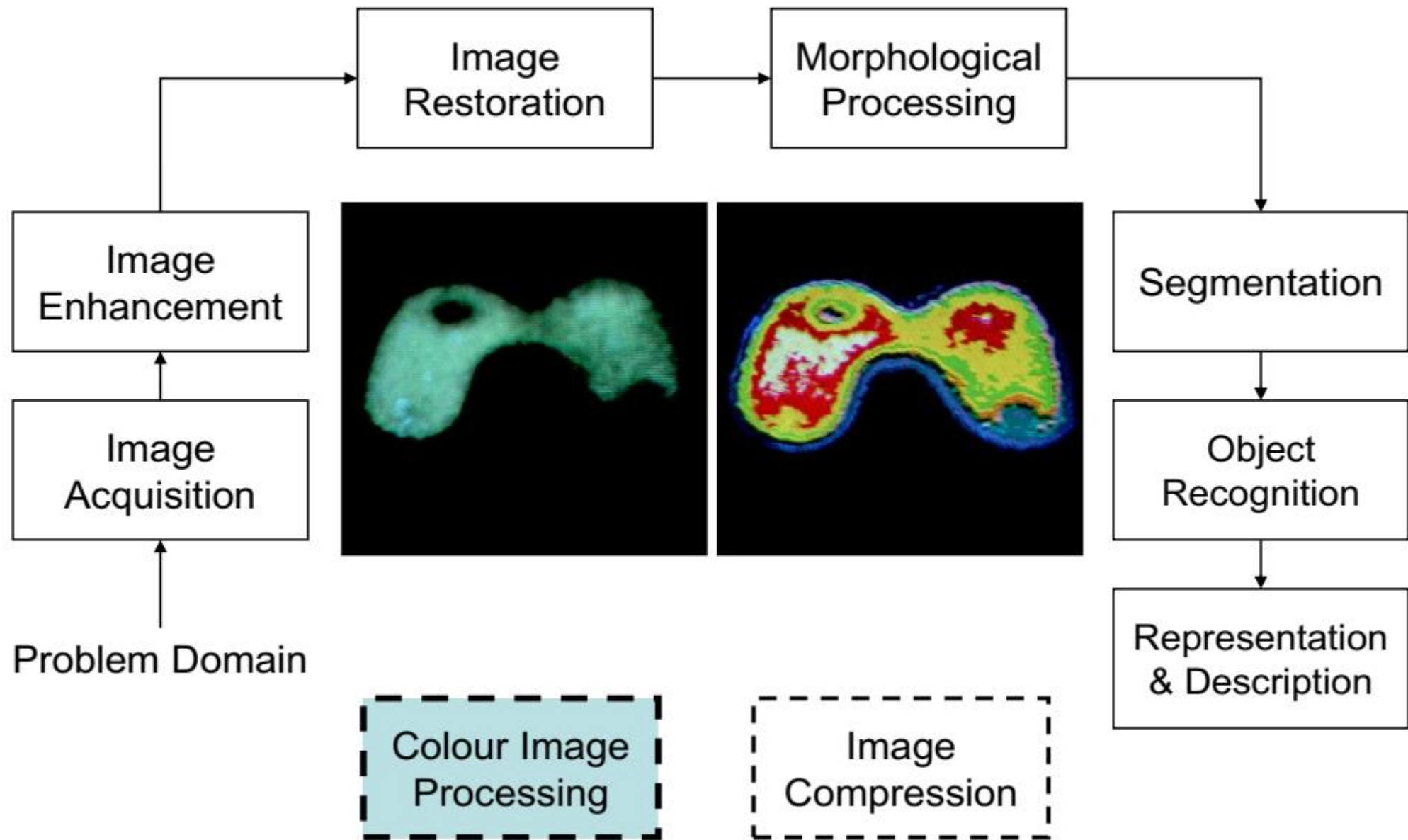












Konsep Matematis dalam Image Processing

- Kalkulus
- Linear algebra
- Probabilistik dan statistic
- PDE dan ODE
- Konsep geometri
- Harmonic analysis (fourier, wavelet, dst)

Konseptual

- - Requirement & Concern:
- Pengetahuan tentang matematis, algoritma, dan kemampuan programming
- Bagaimana mengimplementasikan algoritma
- Bisa mrogram! Java, matlab, c++, opencv
- Linear systems, konsep matematika, dan analisis fourier