AASD 4004
Machine Learning - II

Applied AI Solutions Developer Program

Module 09
Image Processing

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Agenda

- Image Processing
- Tasks of Image Processing
- Image Basics
- Drawing Shapes
- Image Math
- Color Spaces
- Image Manipulations

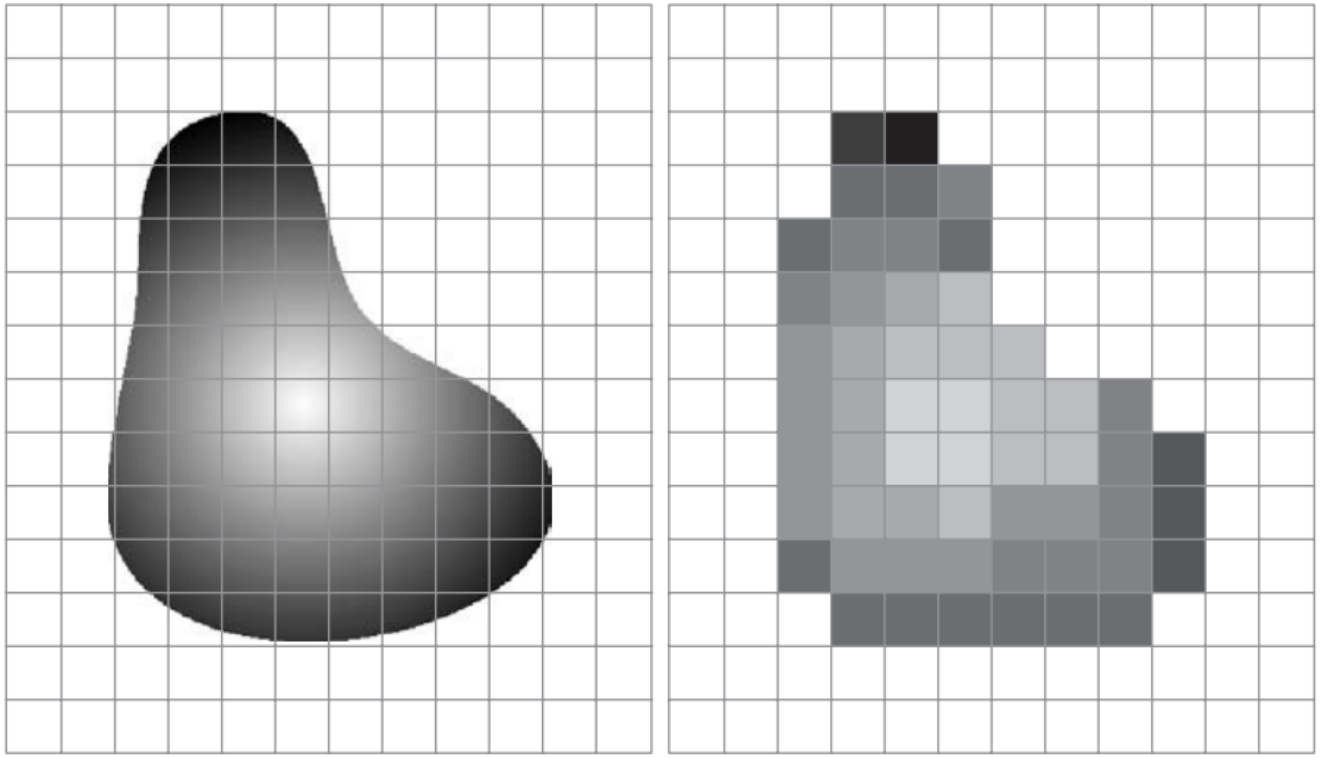
Image Processing

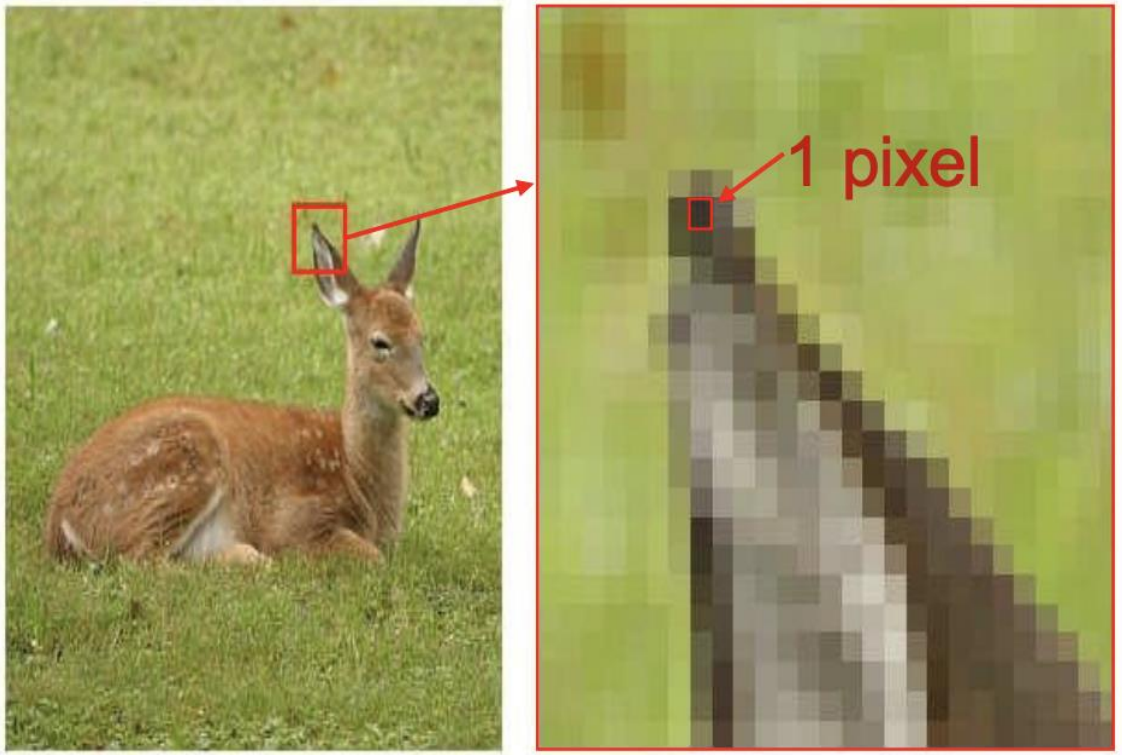
What is it?

Image Processing

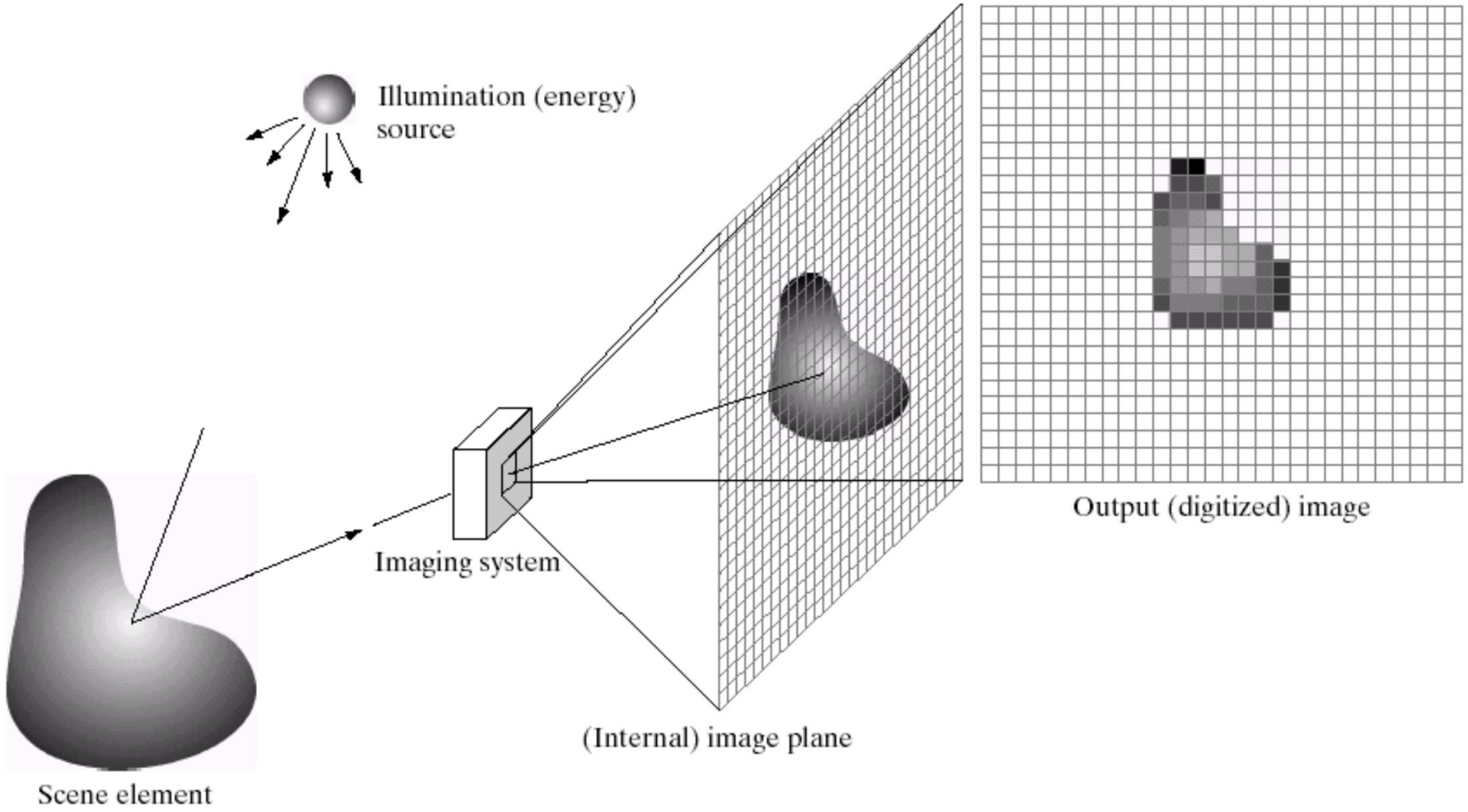
Refers to the task of processing digital images

Image





Digital Image



Digitization (Sampling)

A digital image is a representation of 2-dimensional image as a finite set of digital values – **picture elements** or **pixels**

Pixel values represent gray levels, colors, …

Digitization – an **approximation** of real scene

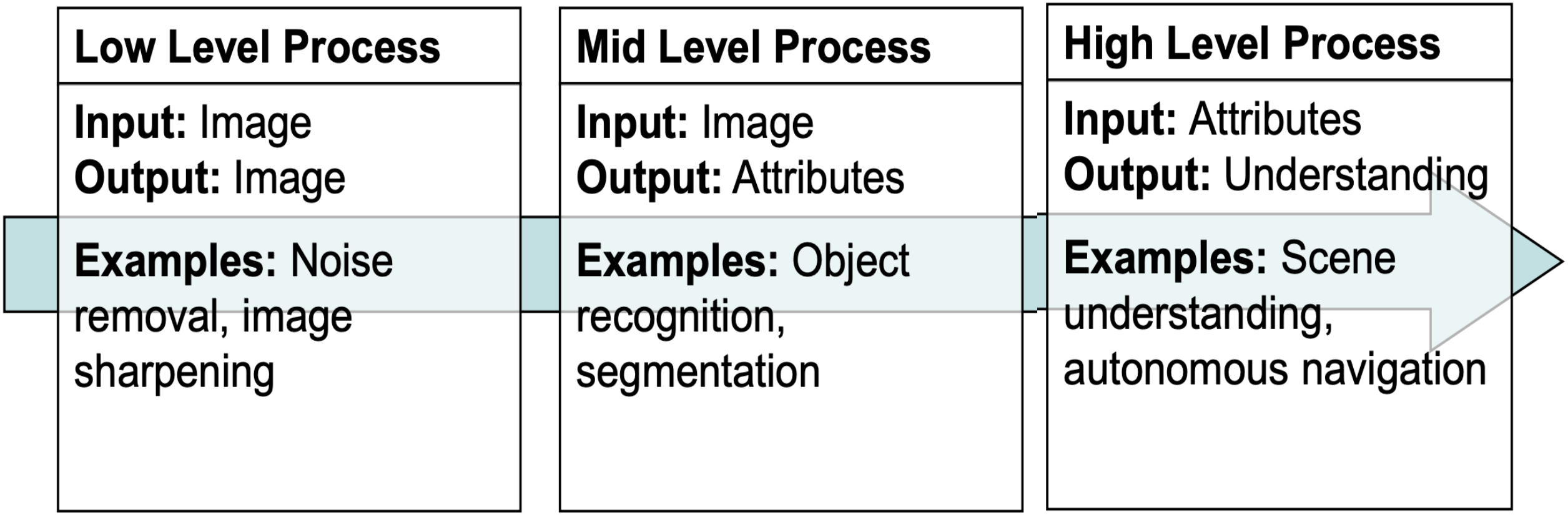
Image formats

Grayscale – 1 sample per point

RGB – 3 samples per point (Red, Green, Blue)

Alpha – 4 samples per point (Red, Green, Blue, Alpha)

Levels of Image Processing



Tasks of Image Processing

Tasks of Image Processing

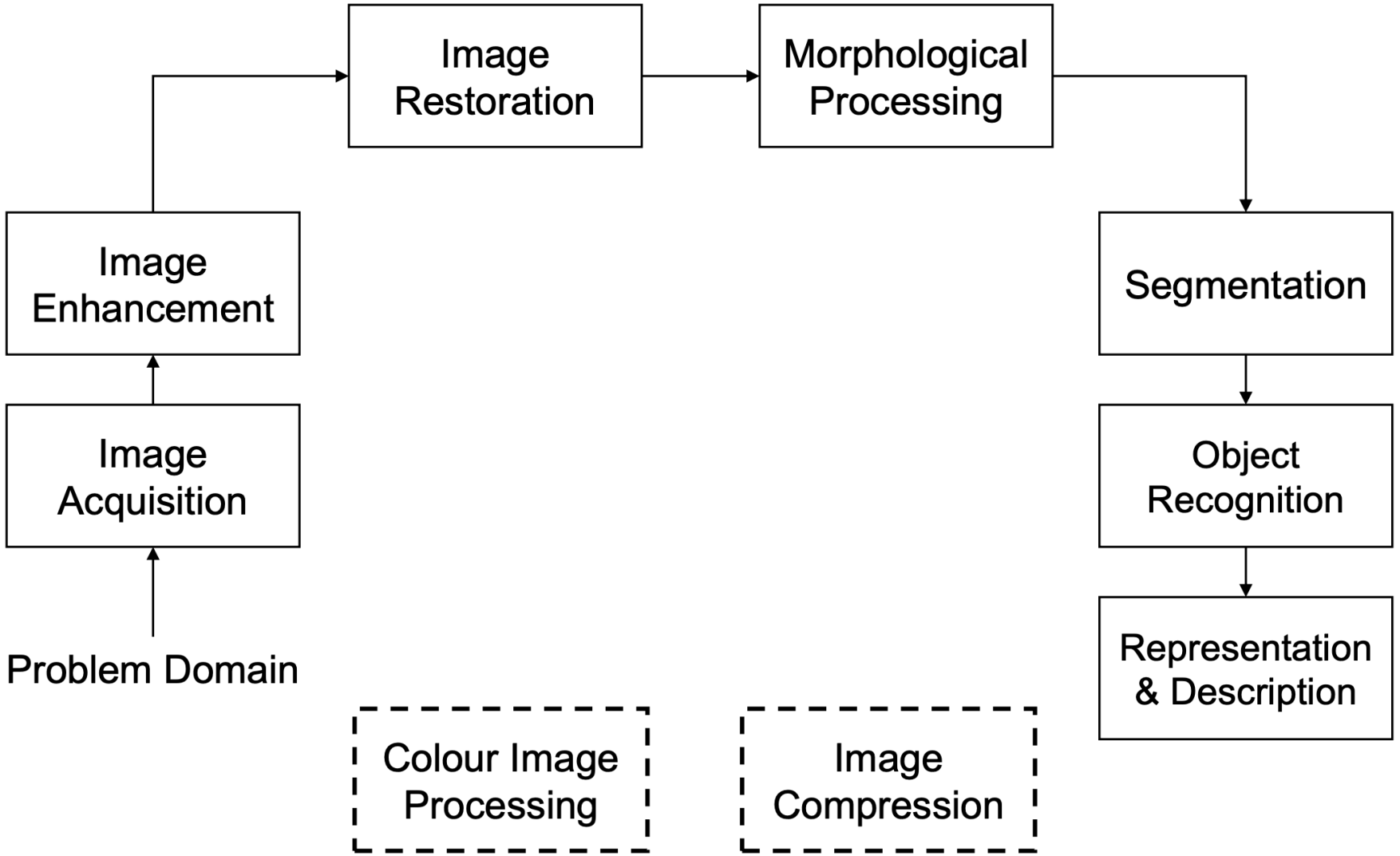


Image Acquisition

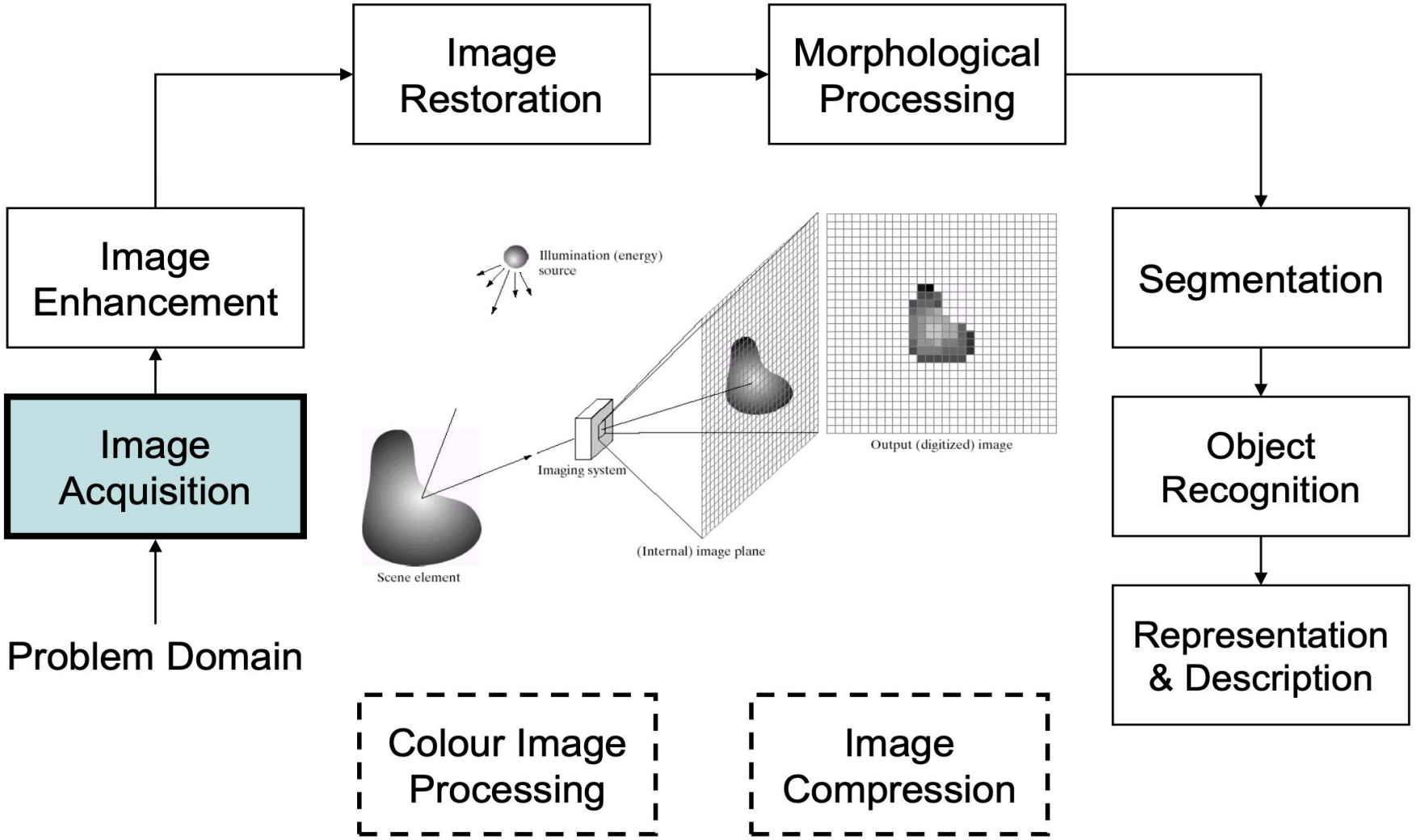


Image Enhancement

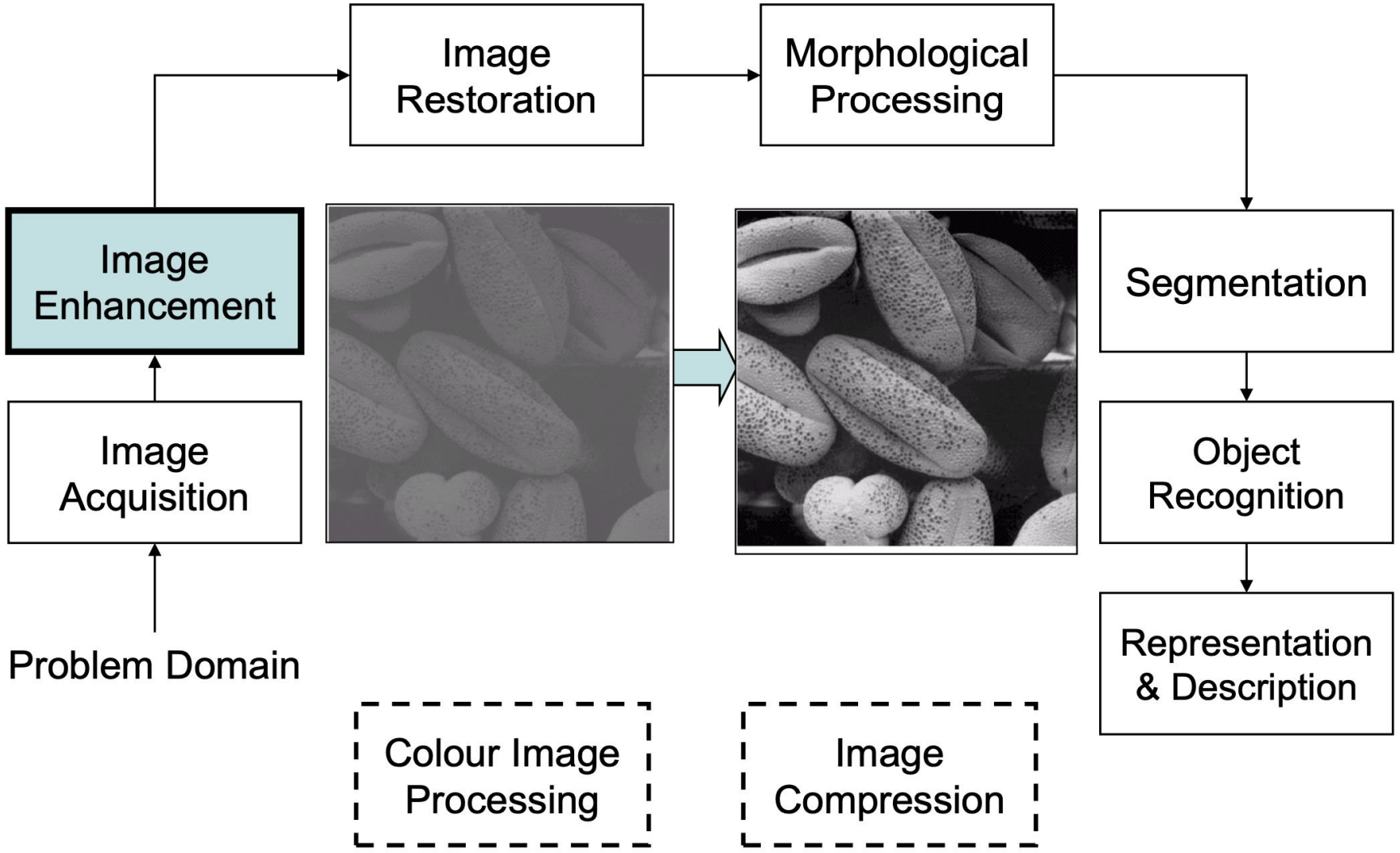


Image Restoration

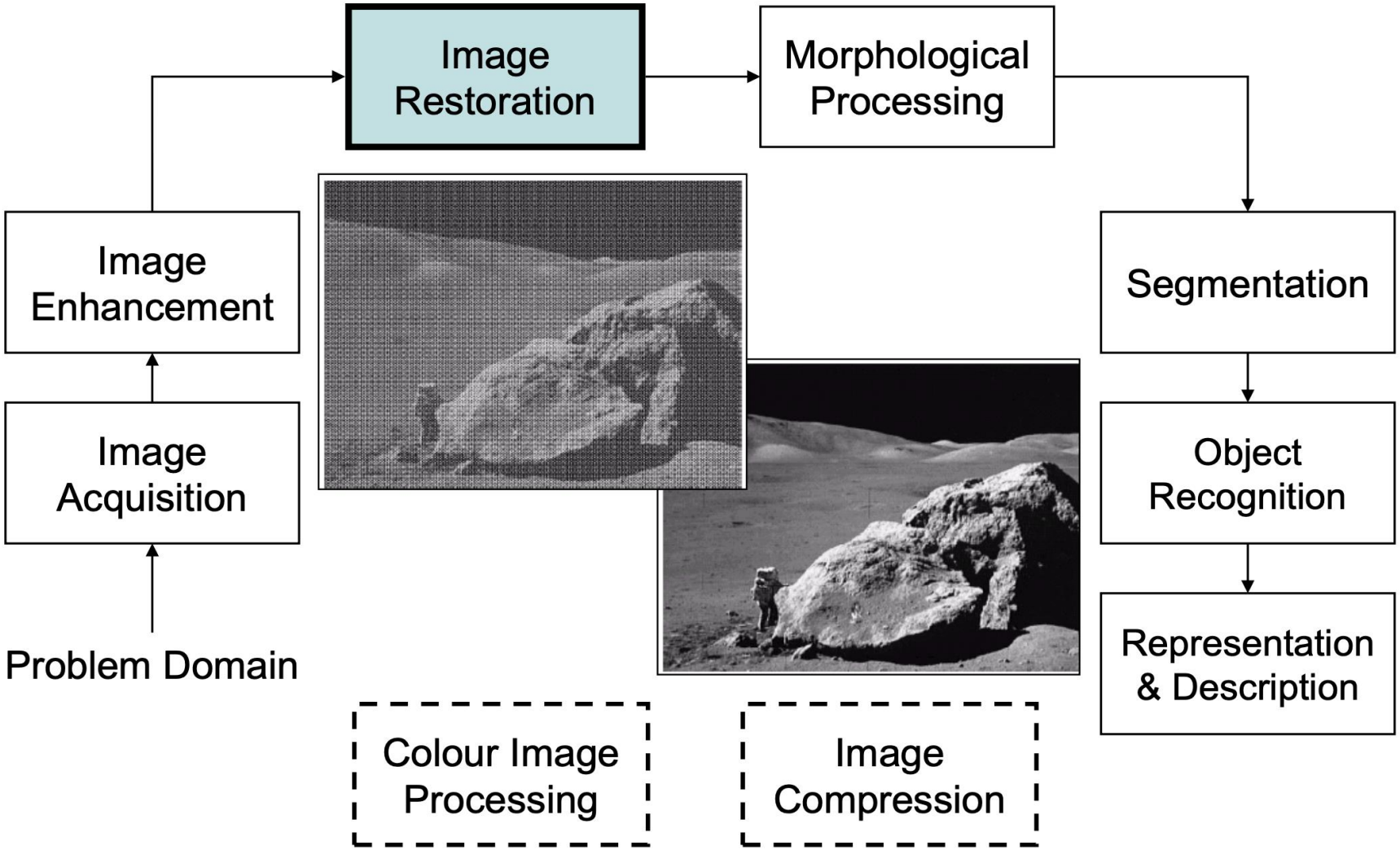


Image Morphology

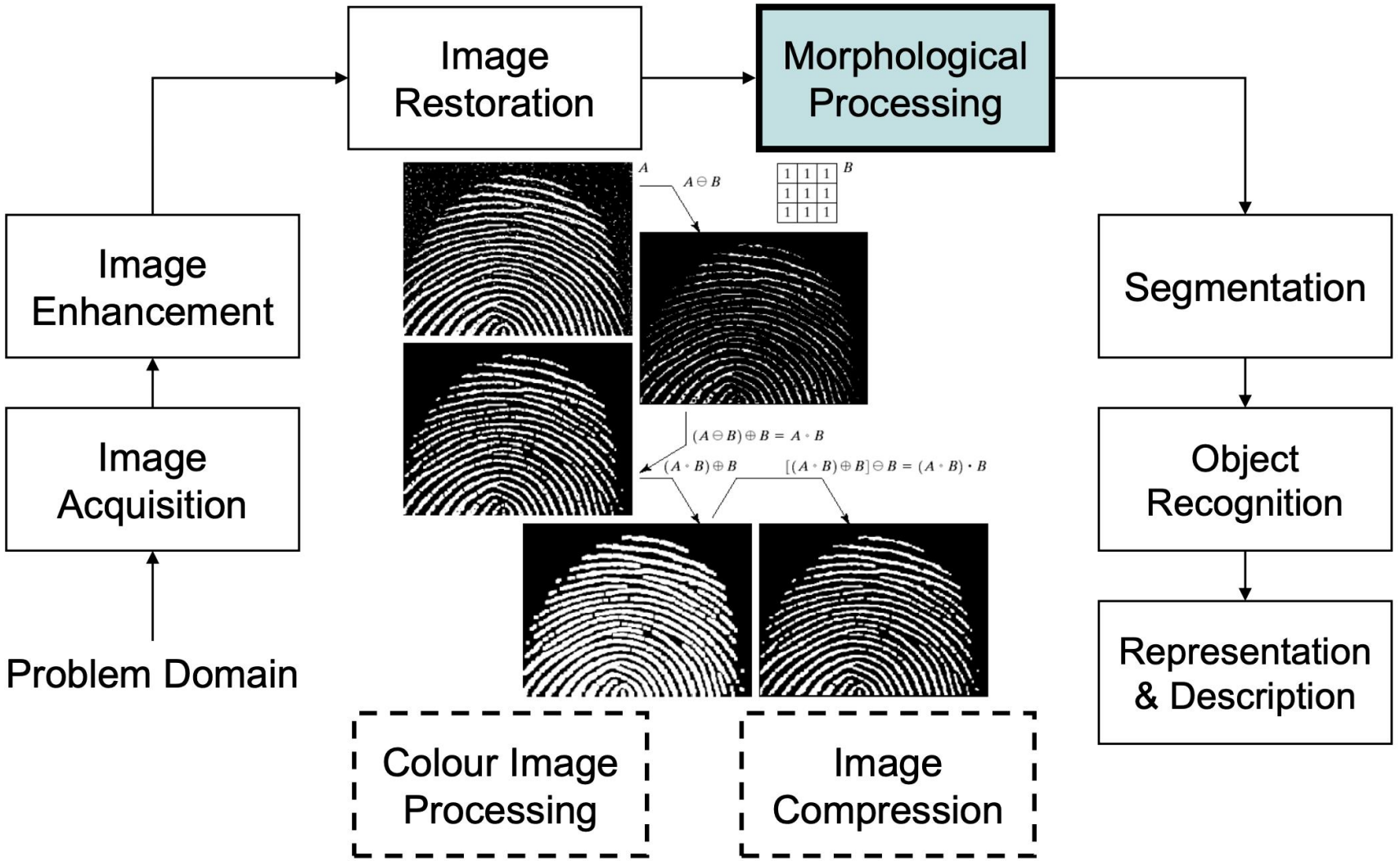


Image Segmentation

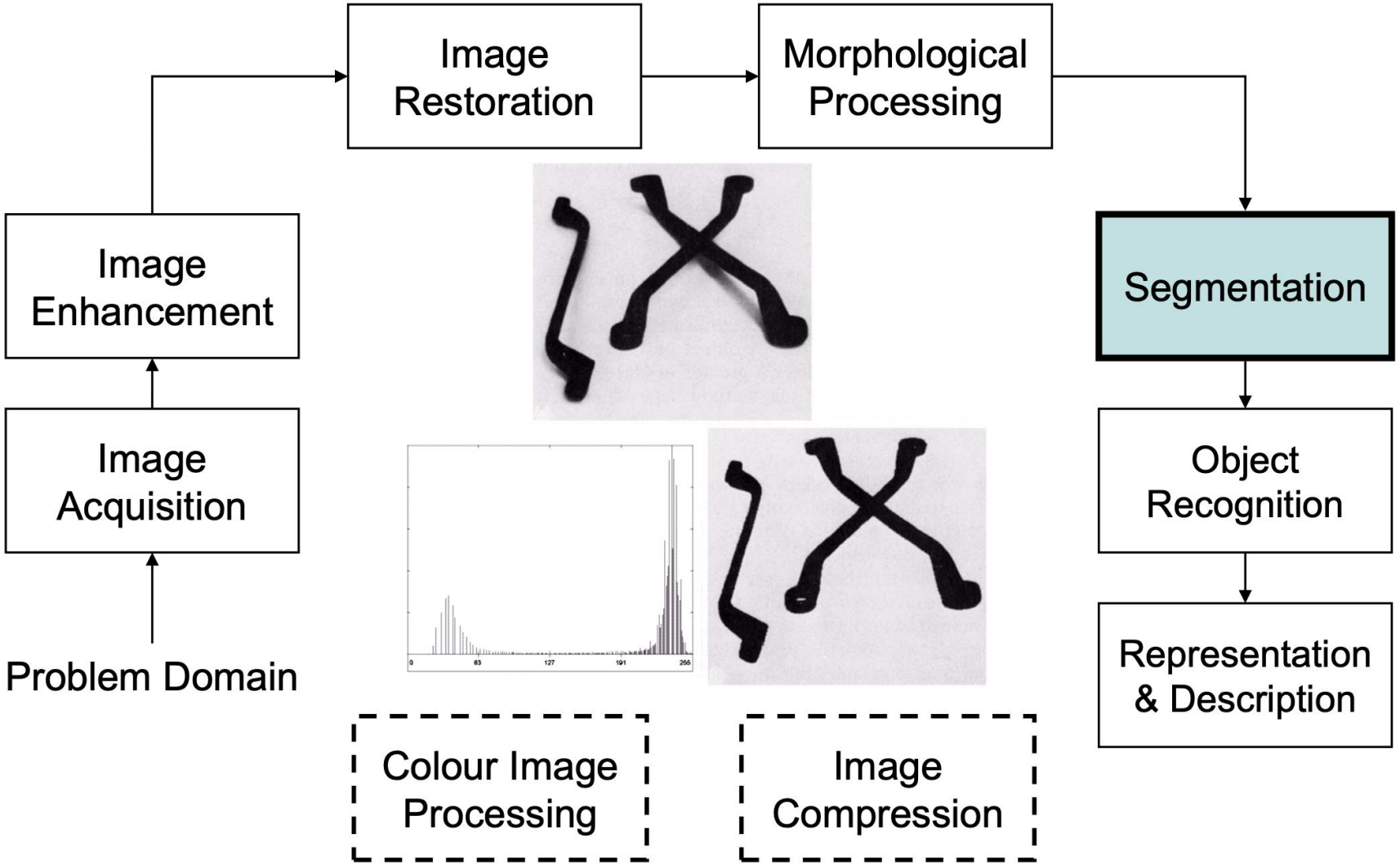


Image Object Recognition

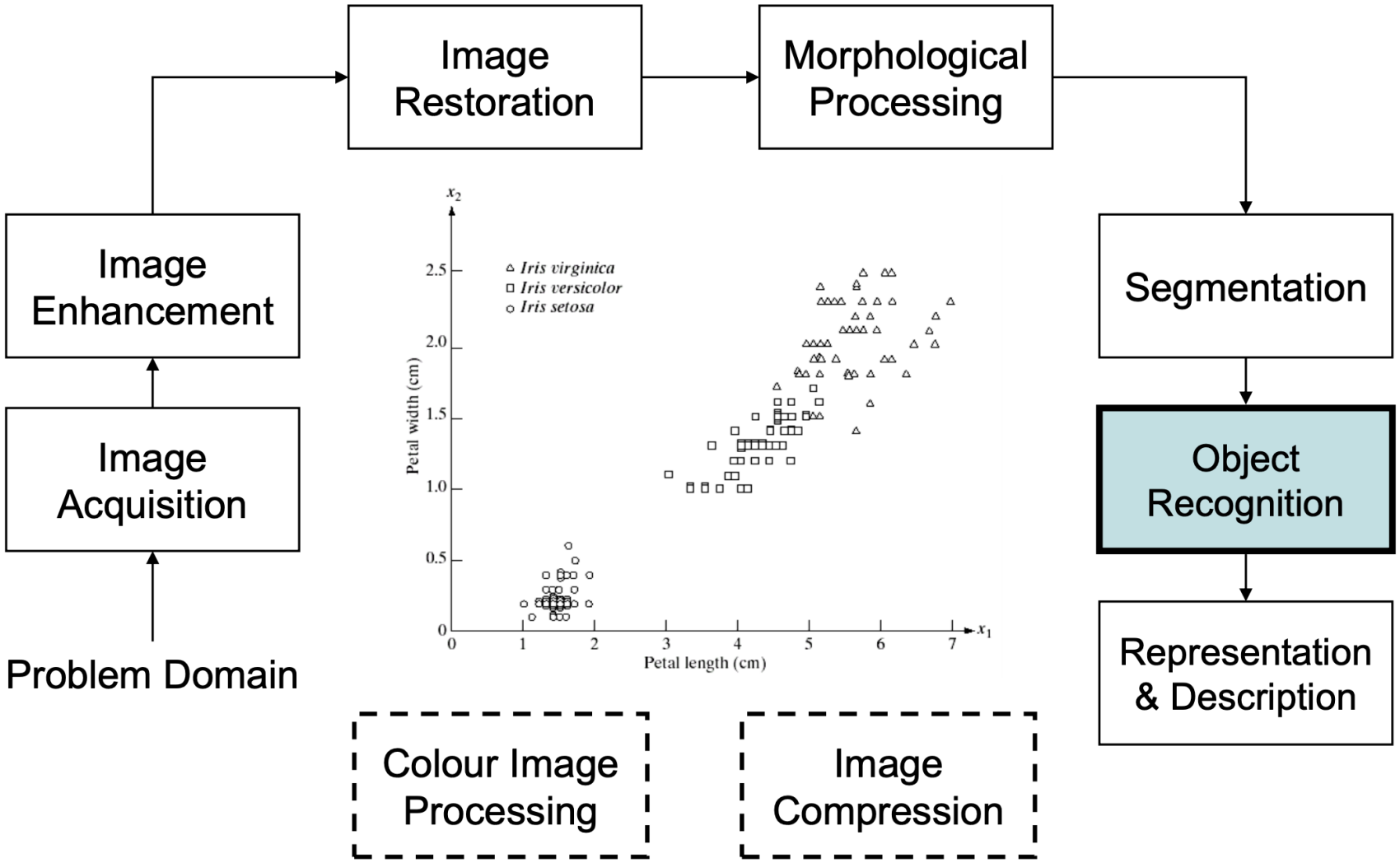


Image Representation

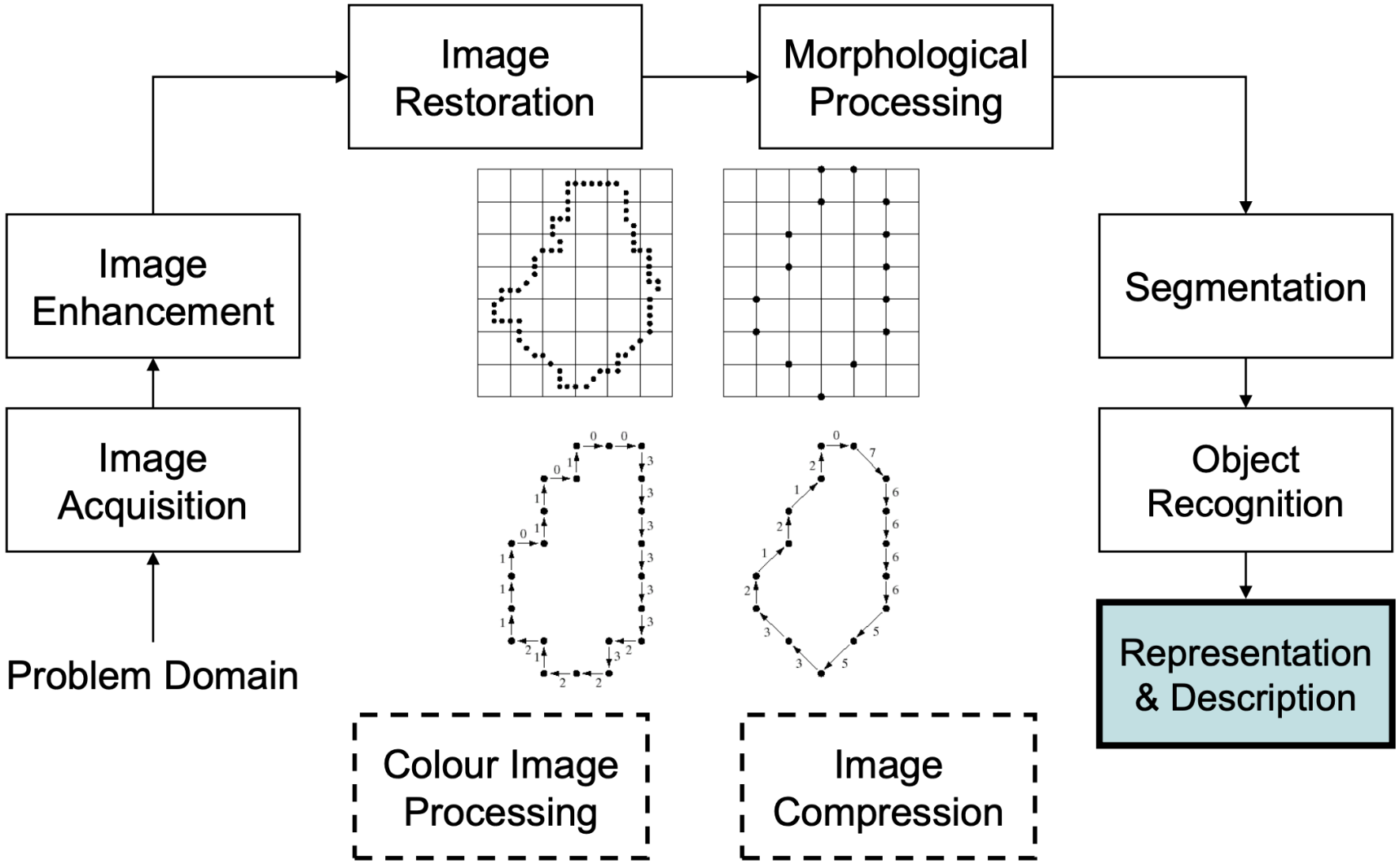


Image Compression

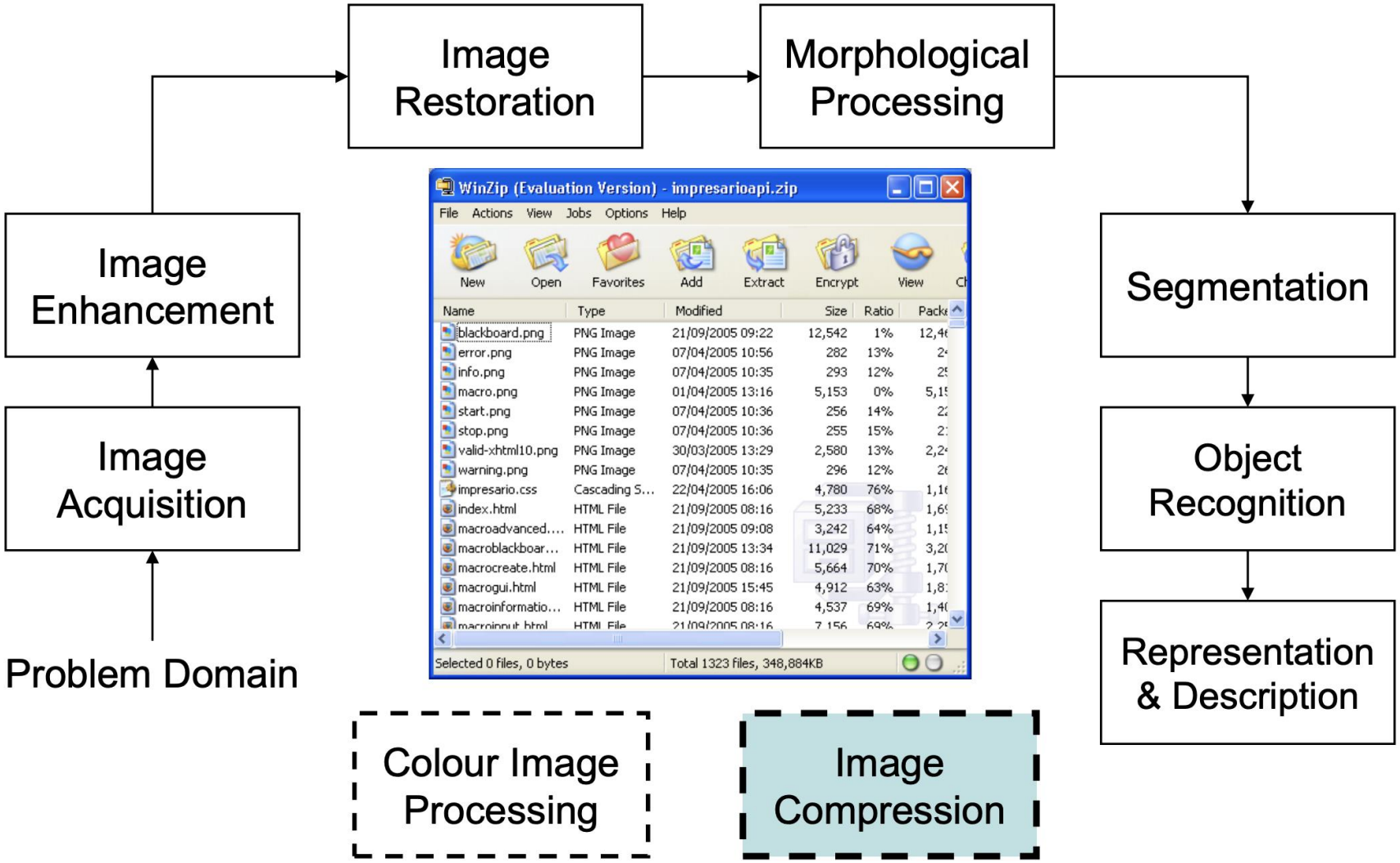
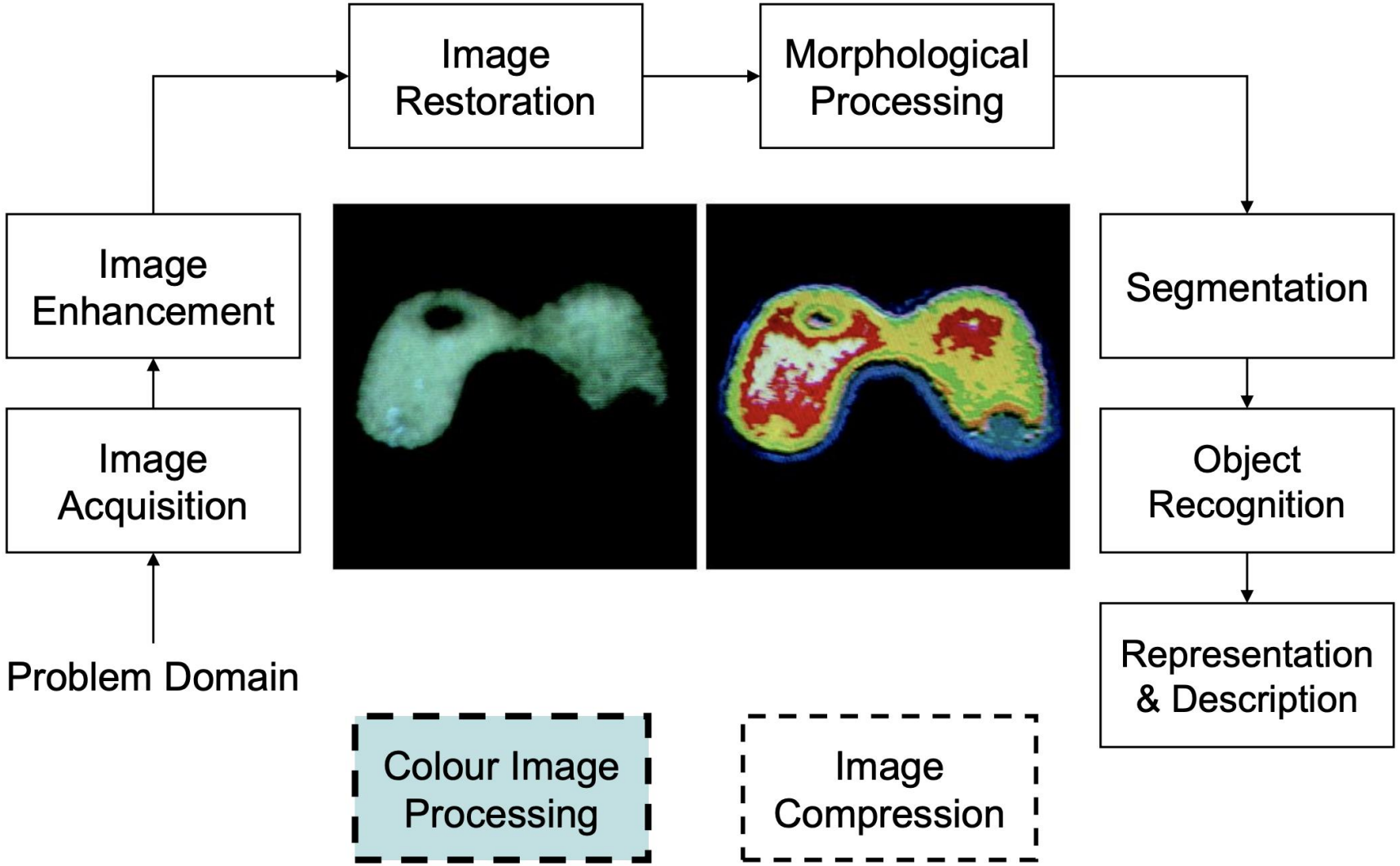


Image Color Processing



OpenCV

OpenCV Installation

mac

pip install opencv-python

conda install opencv / conda install –c conda-forge opencv

Windows

pip install opencv-python

Image Basics

Image Basics

Loading an image

Details of an image

Displaying an image

Saving an image

Slicing an image

Loading an image

imread( )

Reads an image and stores them in a NumPy array

Details of an image

Width

Height

Channels

Get details about the image

Displaying an image

imshow( )

Displays an image in a window

waitKey( )

Expects a keypress to hold the display

Saving an image

imwrite( )

Saves an image in a file

Slicing an image

Image[0:100, 0:100]

Slices an image with the specified pixels

Drawing Shapes

Drawing Shapes

Line

Rectangle

Circle

Drawing a line

line( )

Draws a line

Drawing a rectangle

rectangle( )

Draws a rectangle

Drawing a circle

circle( )

Draws a circle

Image Math

Image Math

Add

Subtract

Bitwise

Add

add( )

Image enhancer

Subtract

subtract( )

Image enhancer

Bitwise

bitwise_and( )

If both pixel values > 0, pixel is turned ON else turned OFF

bitwise_or( )

If either pixel values > 0, pixel is turned ON else turned OFF

Bitwise

bitwise_xor( )

If both pixel values > 0, pixel is turned OFF

bitwise_not( )

If pixel values == 0, pixel is turned ON

If pixel values == 255, pixel is turned OFF

Color Spaces

Color Spaces

BGR

HSV

LaB

GrayScale

BGR Color Space

Split channels

Display channels

Merge channels

Conversion

Channels

split( )

Splits a BGR color image into Blue, Green, Red channels

merge( )

Merge different channels

Conversion

cvtColor( )

Grayscale – COLOR_BGR2GRAY

HSV – COLOR_BGR2HSV

LaB – COLOR_BGR2LAB

Image Manipulations

Image Manipulations

Crop

Flip

Mask

Crop

Removes the outer parts of the image that we are not interested

Image_array[startY:endY, startX:endX]

Flip

Changes the orientation of the image

- Horizontal
- Vertical
- Both Axes

flip(image, flip code)

Mask

Focus only on the portions of interest in an image

- Create a mask
- Apply mask

bitwise_and(image, image, mask)

Further Reading

Digital Image Processing 4th edition

Rafael Gonzalez & Richard Woods