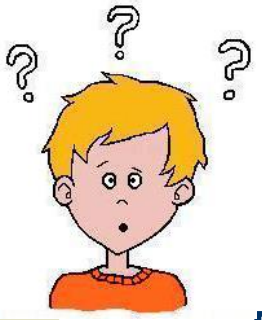
Digital Image Processing

Lecture # 1 (b): Introduction

Image Sources

- Electromagnetic (EM) band imaging
  - Gamma ray band images
  - X-ray band images
  - Ultra violet band images
  - Visual light and infra-red images
  - Images based on micro waves or radio
- Non-EM band imaging
  - Acoustic and ultrasonic images
  - Electron microscopy
  - Computer generated images (synthetic)

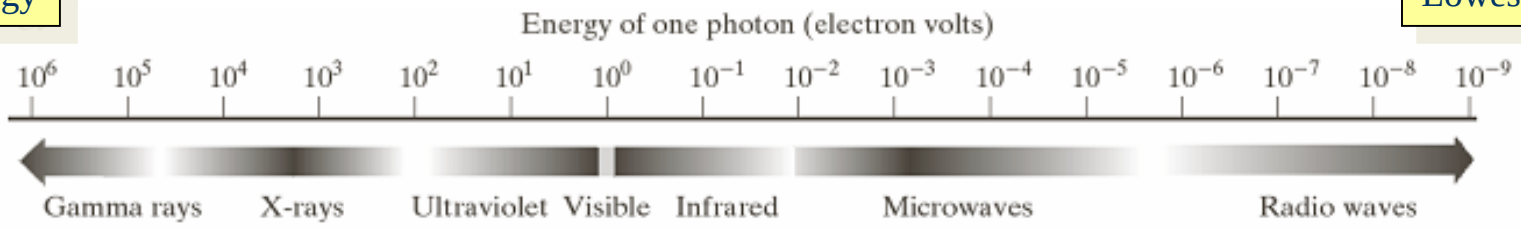


Light & EM Spectrum

- EM Waves
  - A stream of mass less particles each travelling in a wave like pattern, moving at the speed of light and contains a certain bundle of energy
  - The electromagnetic spectrum is split up in to bands according to the energy per photon

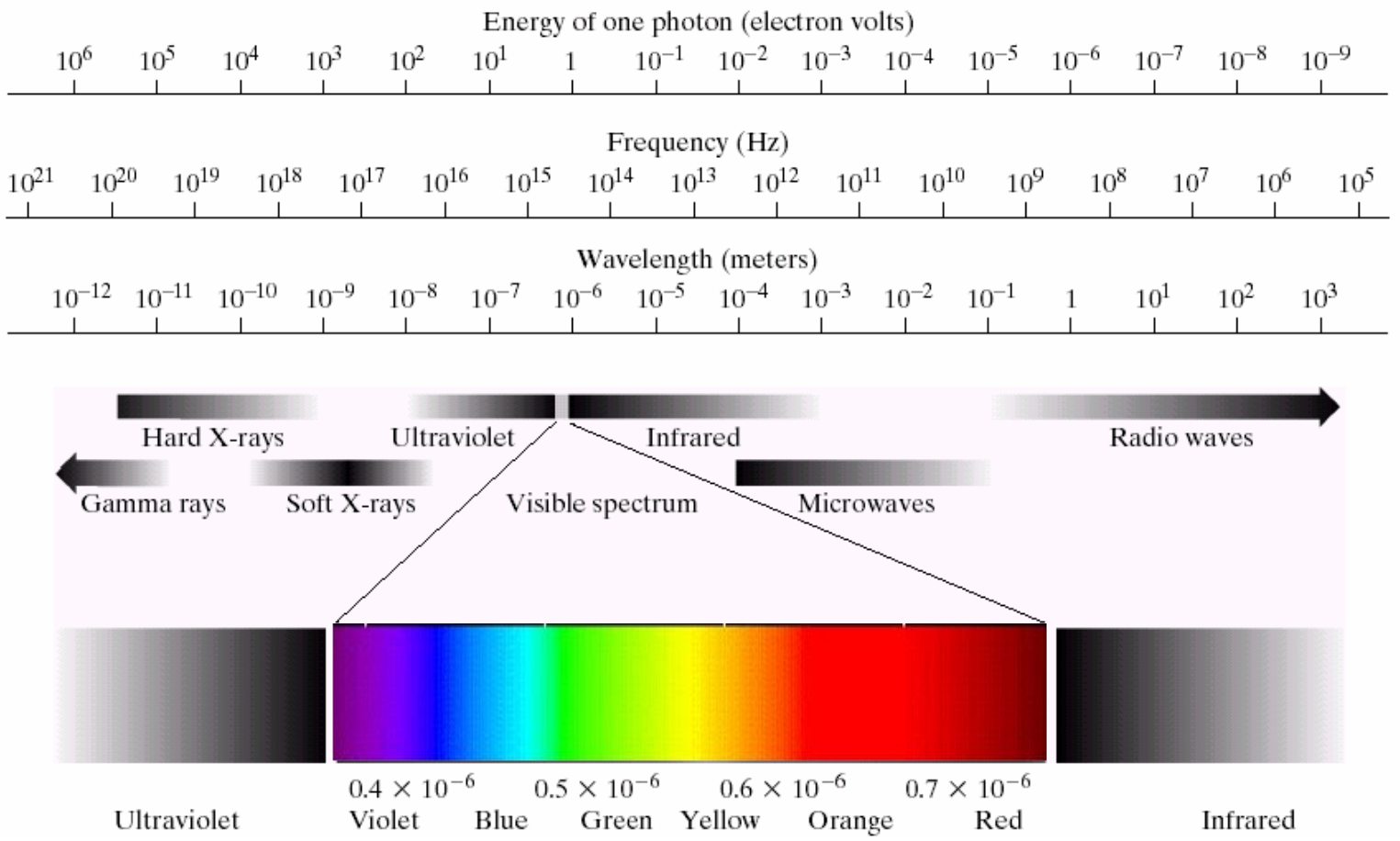
Highest Energy

Lowest Energy



Visible light is just a particular part of the electromagnetic spectrum that can be sensed by the human eye

Light & EM Spectrum

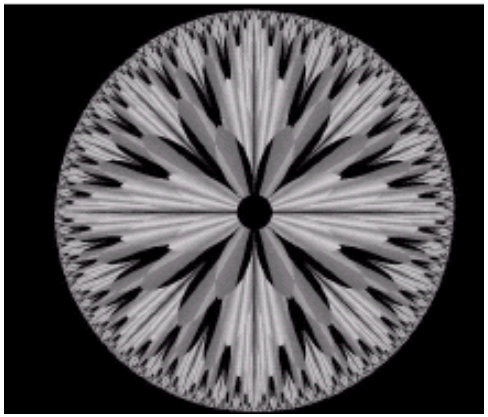


Examples: Imaging in EM bands

Spectral Band	Example
Gamma-Rays	Nuclear Medicine (Radioactive isotope injected in the patient)
X-Rays	Medical Diagnostic
Ultraviolet	Fluorescence microscopy
Visible & Infrared	Remote sensing, industrial inspection, …
Microwave	Radar
Radio	Medicine – MRI

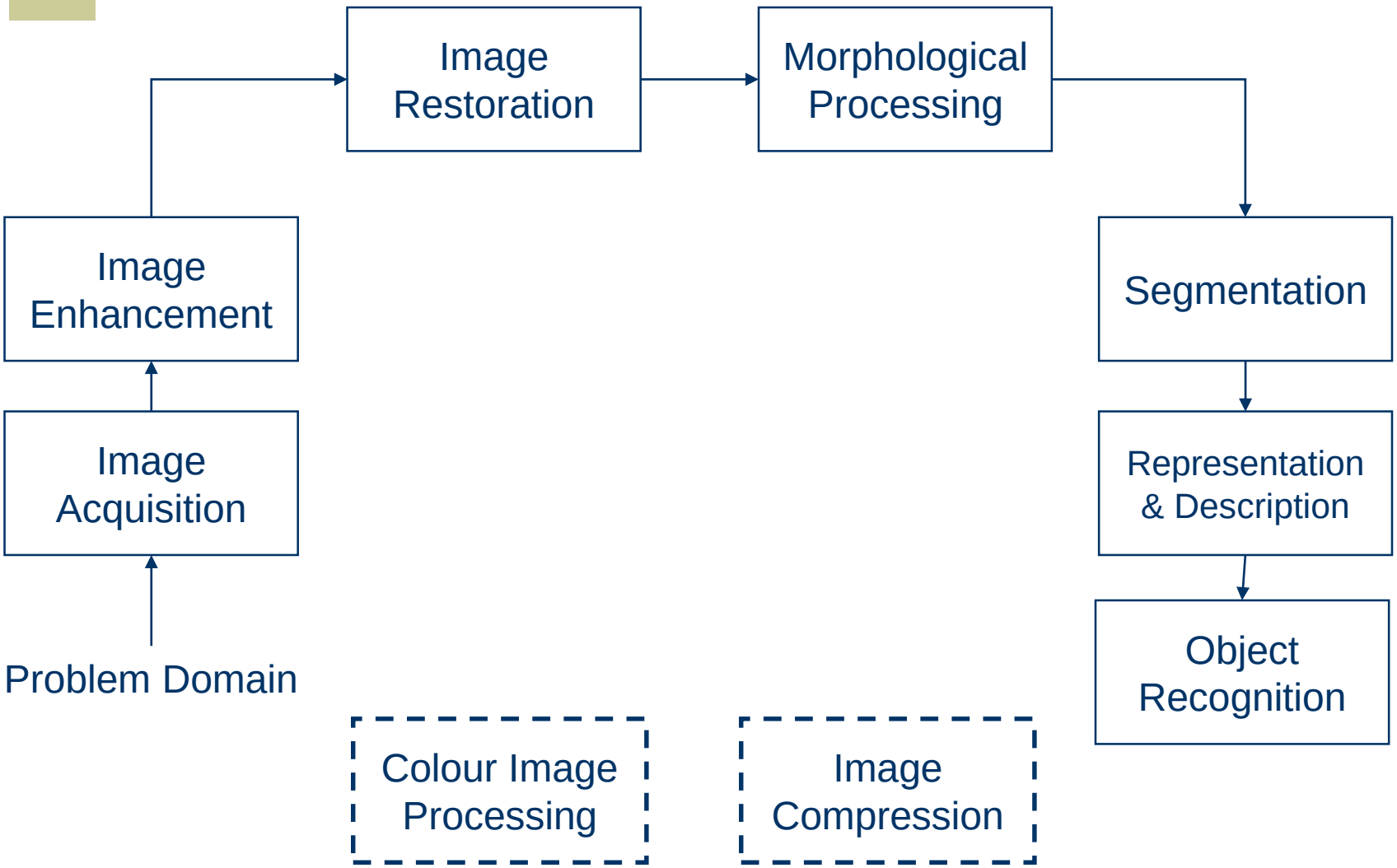
Examples: Imaging other Modalities

- Sound
  - Geological Applications – Oil and Gas Exploration
  - Medicine – Ultrasound Imaging
- Synthetic Images
  - Computer generated



A synthetic image

Key Stages in DIP



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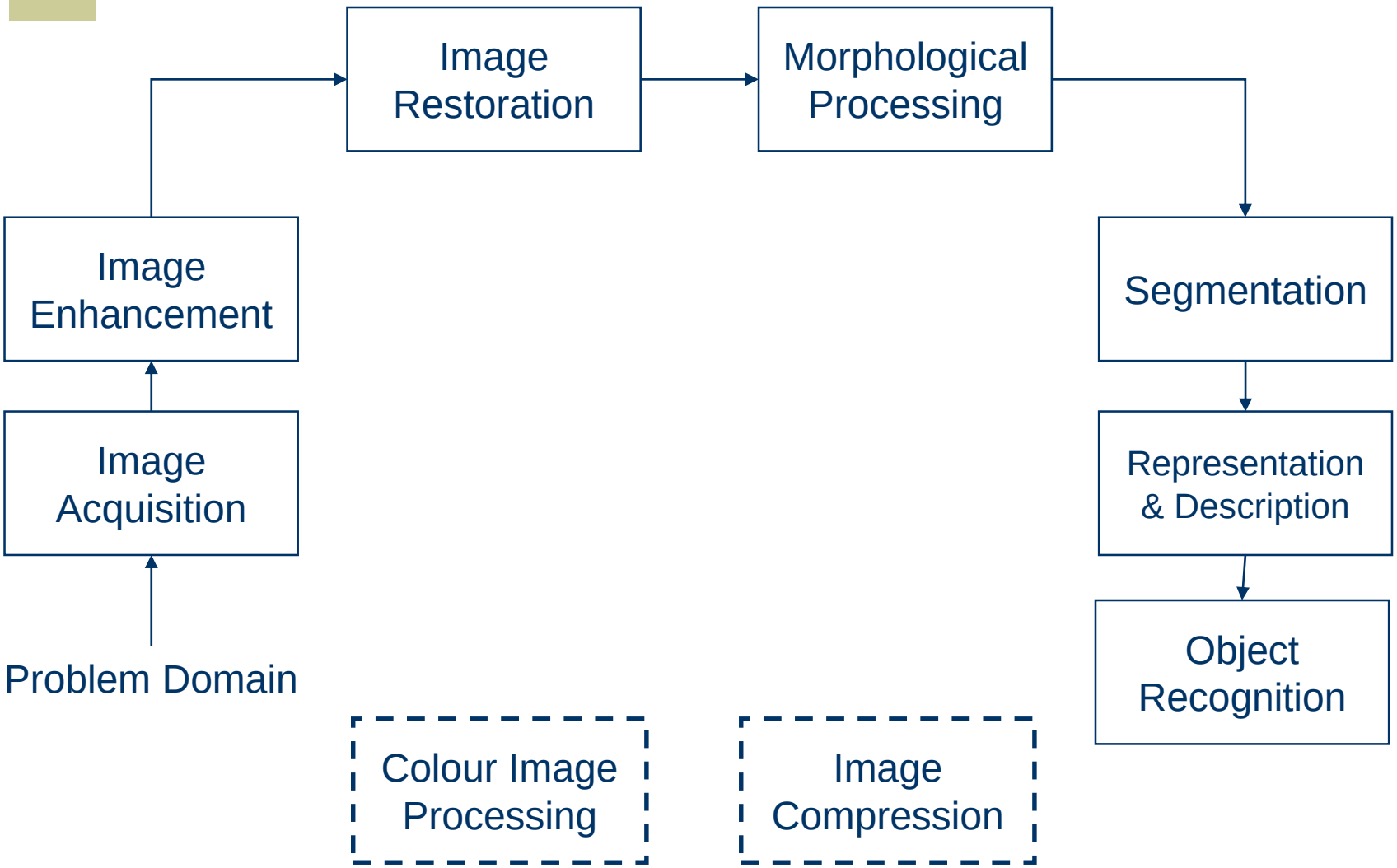


Key Stages in DIP

Problem Domain

Image Acquisition

Image Enhancement

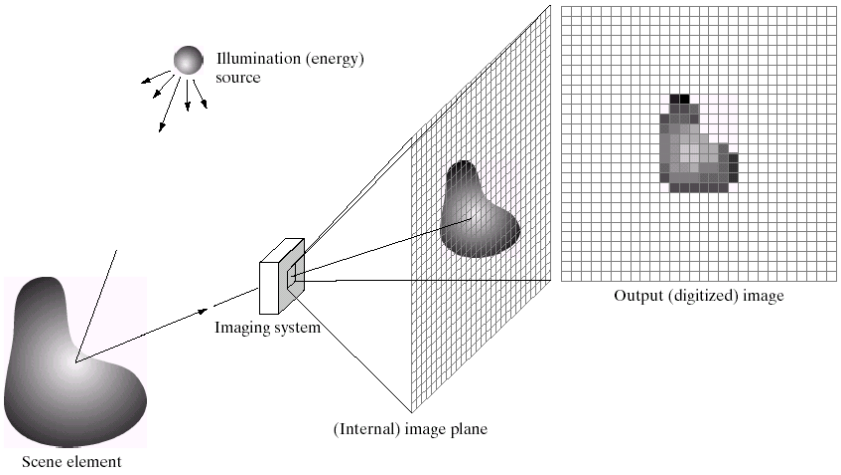
Image Restoration

Morphological Processing

Segmentation

Representation & Description

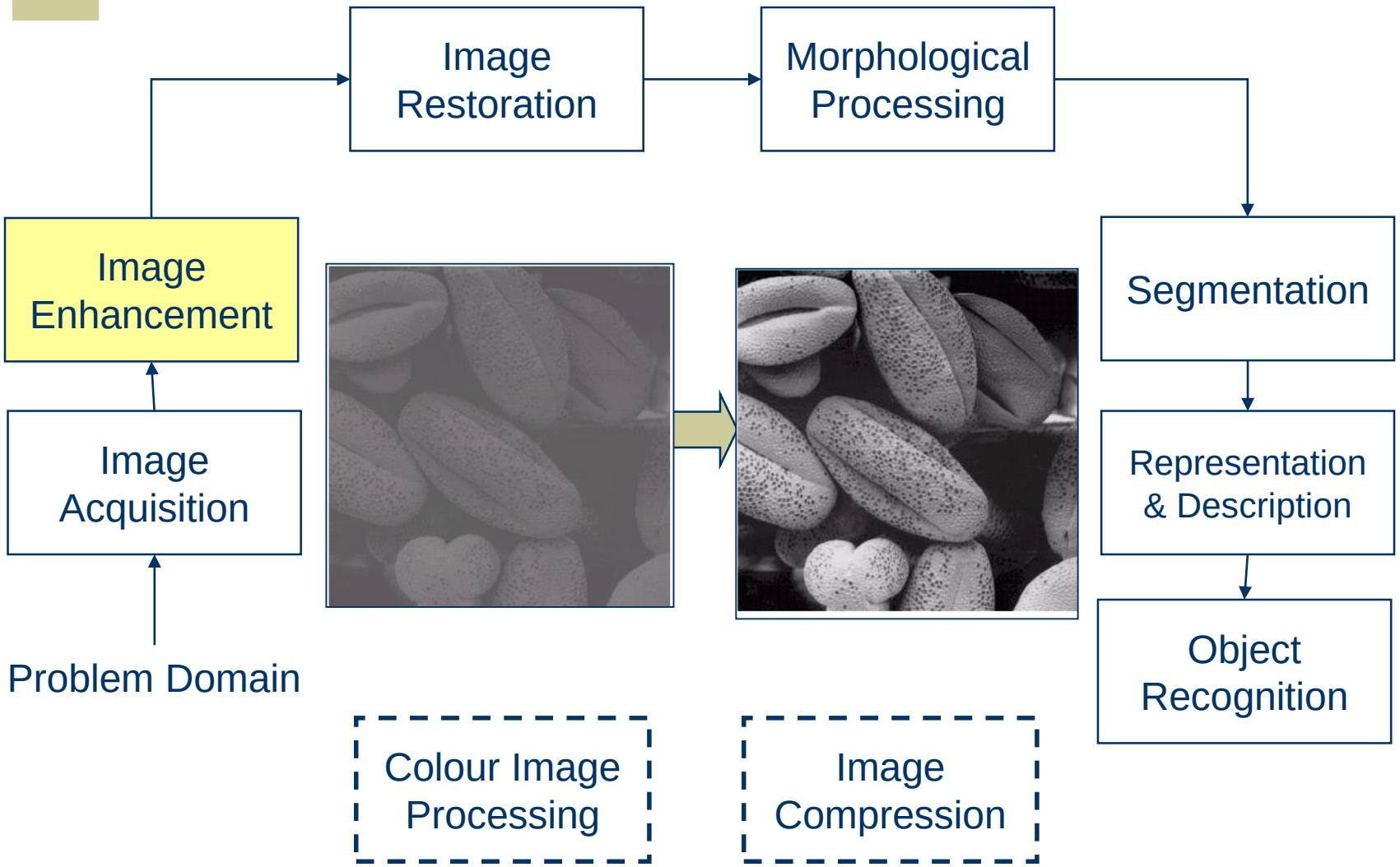
Object Recognition



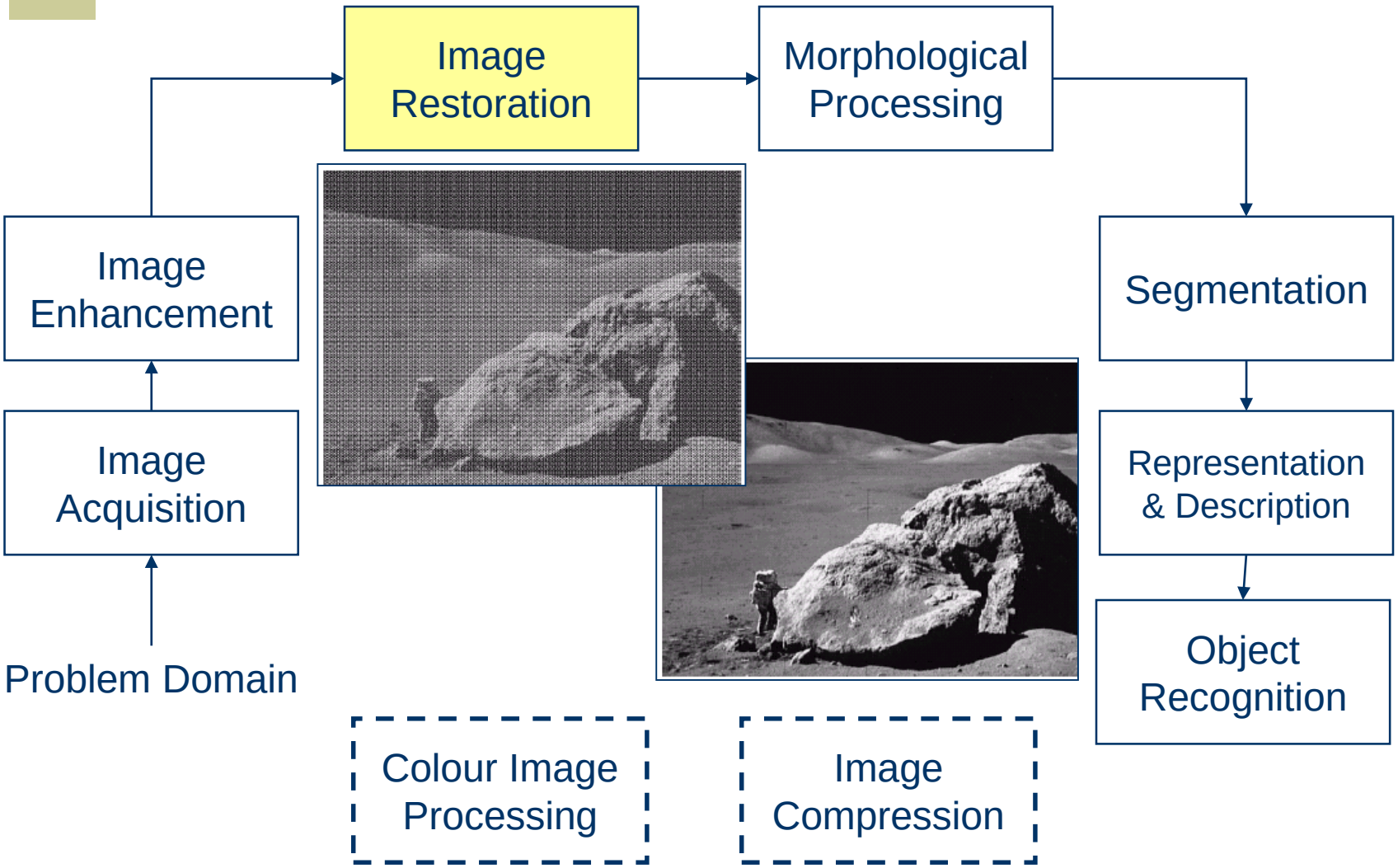
Colour Image Processing

Image Compression

Key Stages in DIP



Key Stages in DIP



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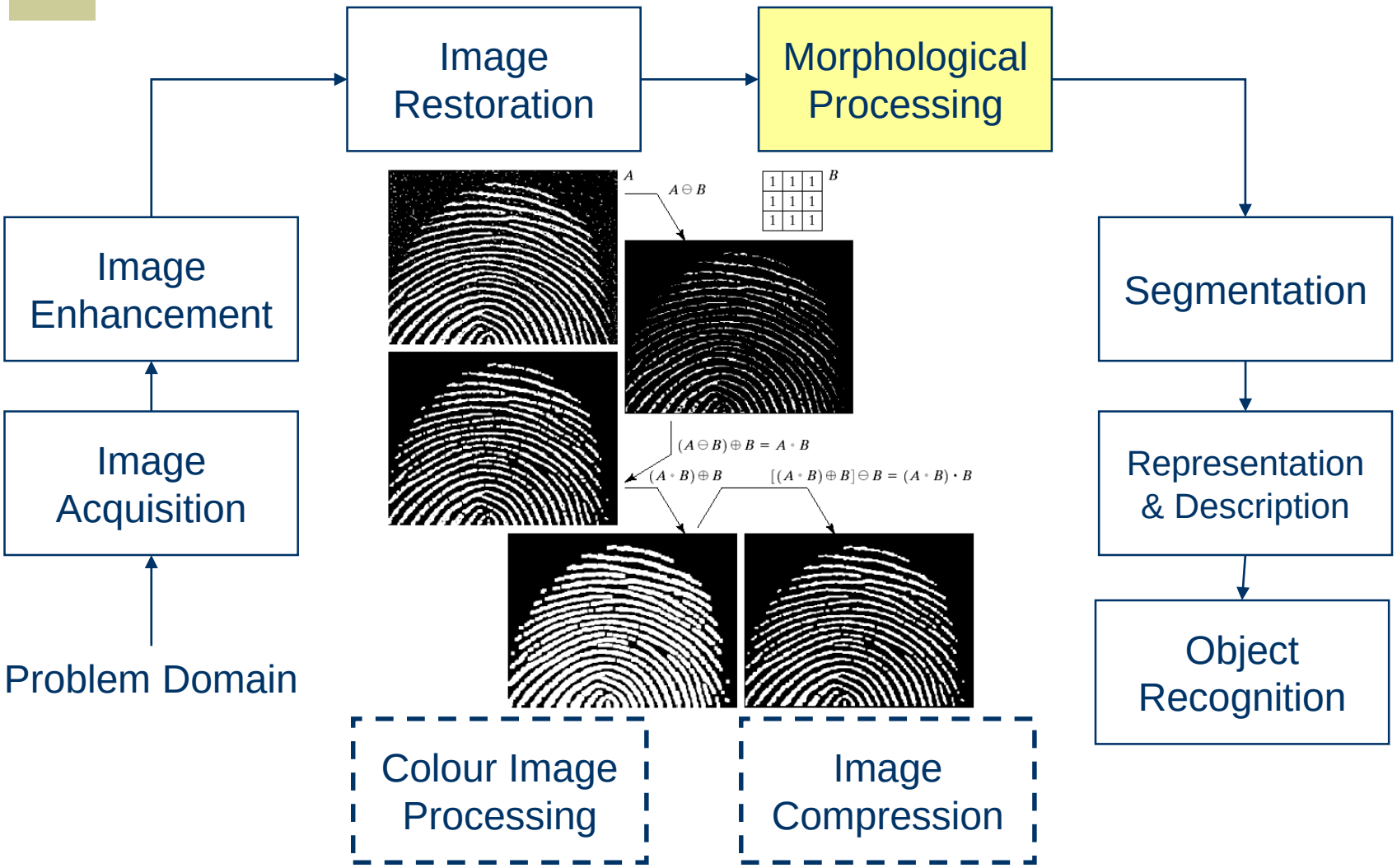

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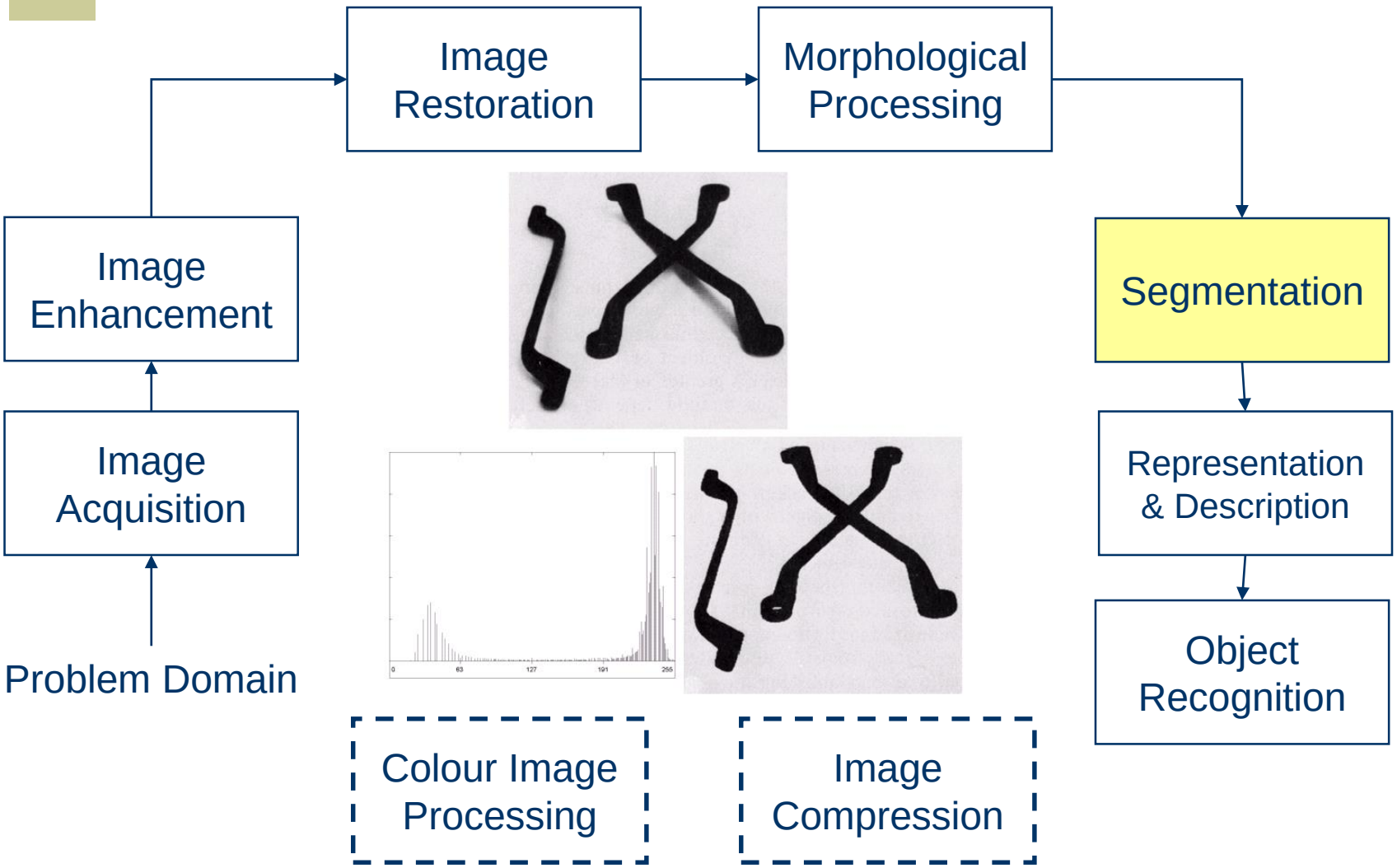

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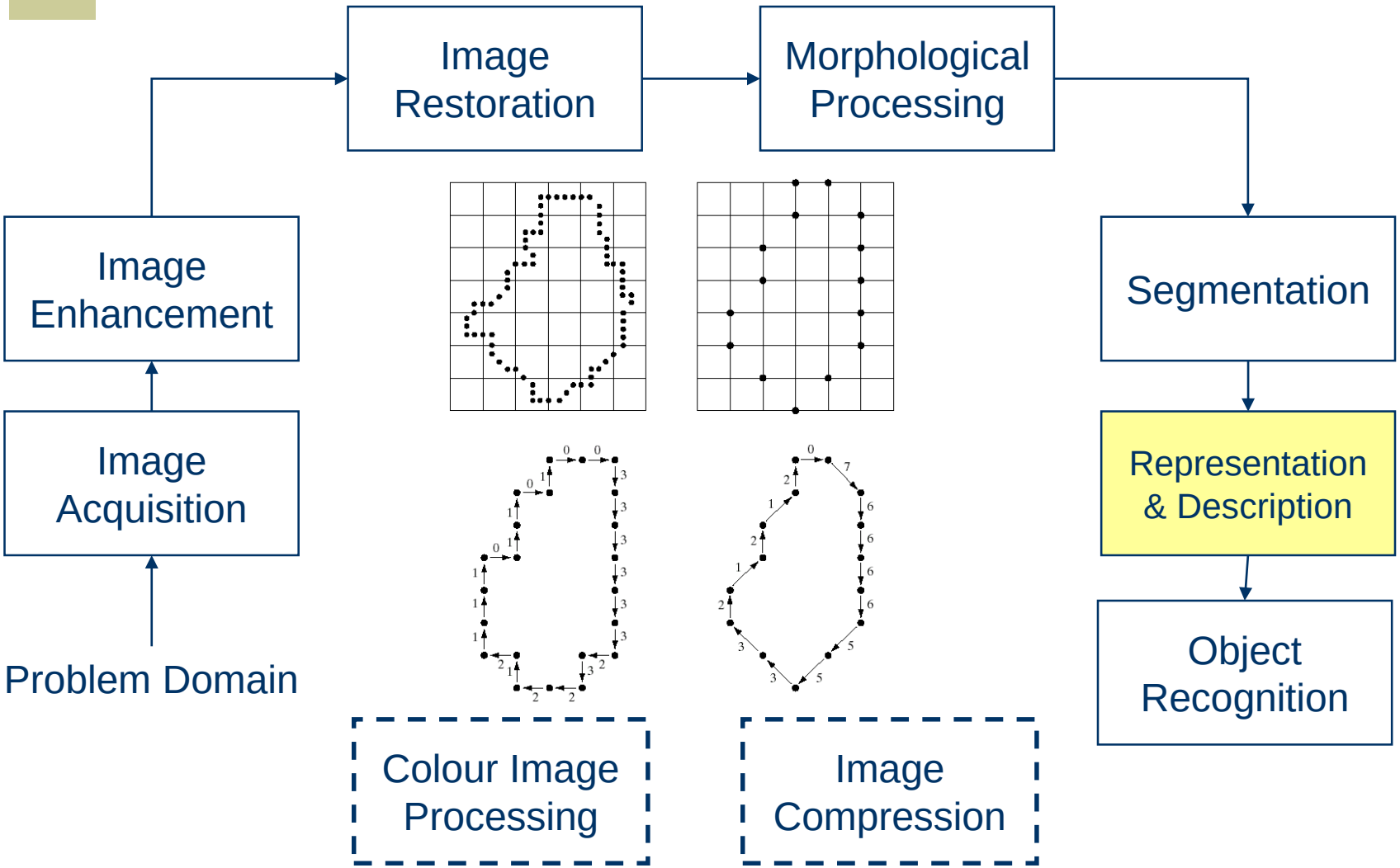

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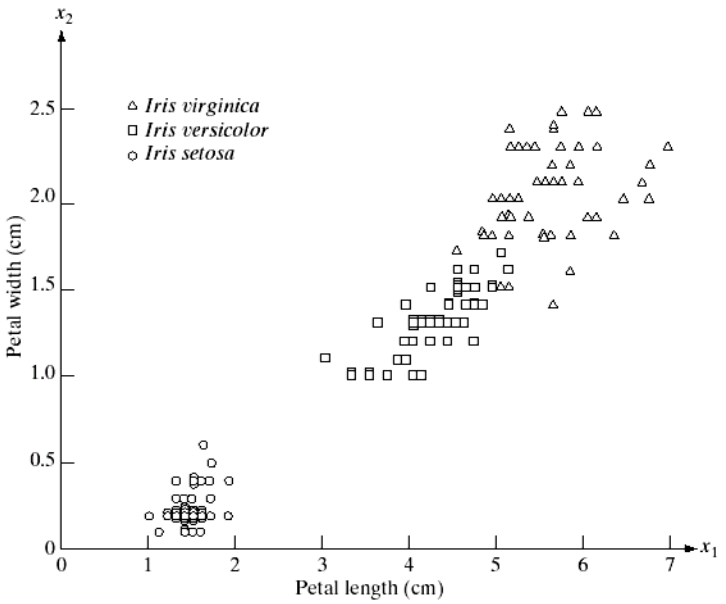

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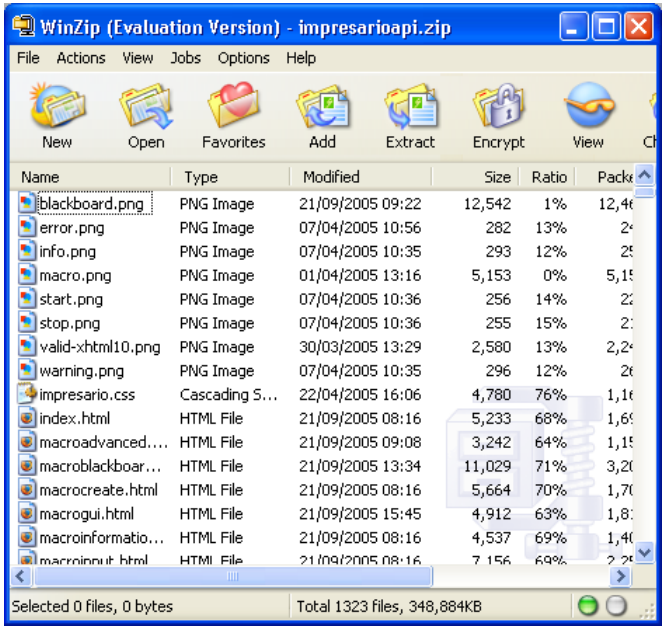

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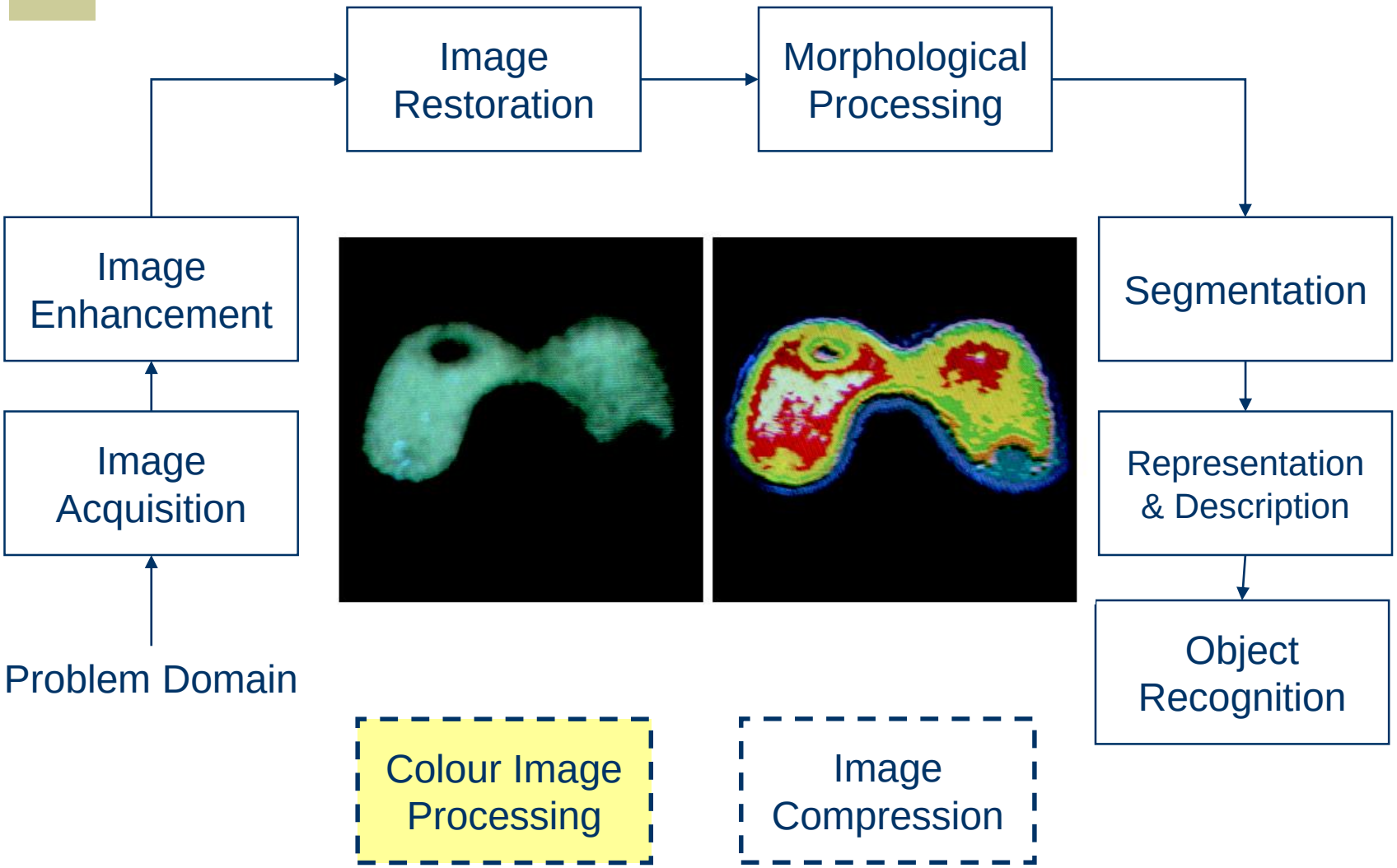

Acknowledgements

- Statistical Pattern Recognition: A Review – A.K Jain et al., PAMI (22) 2000
- Pattern Recognition and Analysis Course – A.K. Jain, MSU
- *Pattern Classification"* by Duda et al., John Wiley & Sons.
- Digital Image Processing", Rafael C. Gonzalez & Richard E. Woods, Addison-Wesley, 2002
- Machine Vision: Automated Visual Inspection and Robot Vision", David Vernon, Prentice Hall, 1991
- www.eu.aibo.com/
- Advances in Human Computer Interaction, Shane Pinder, InTech, Austria, October 2008

Material in these slides has been taken from, the following resources