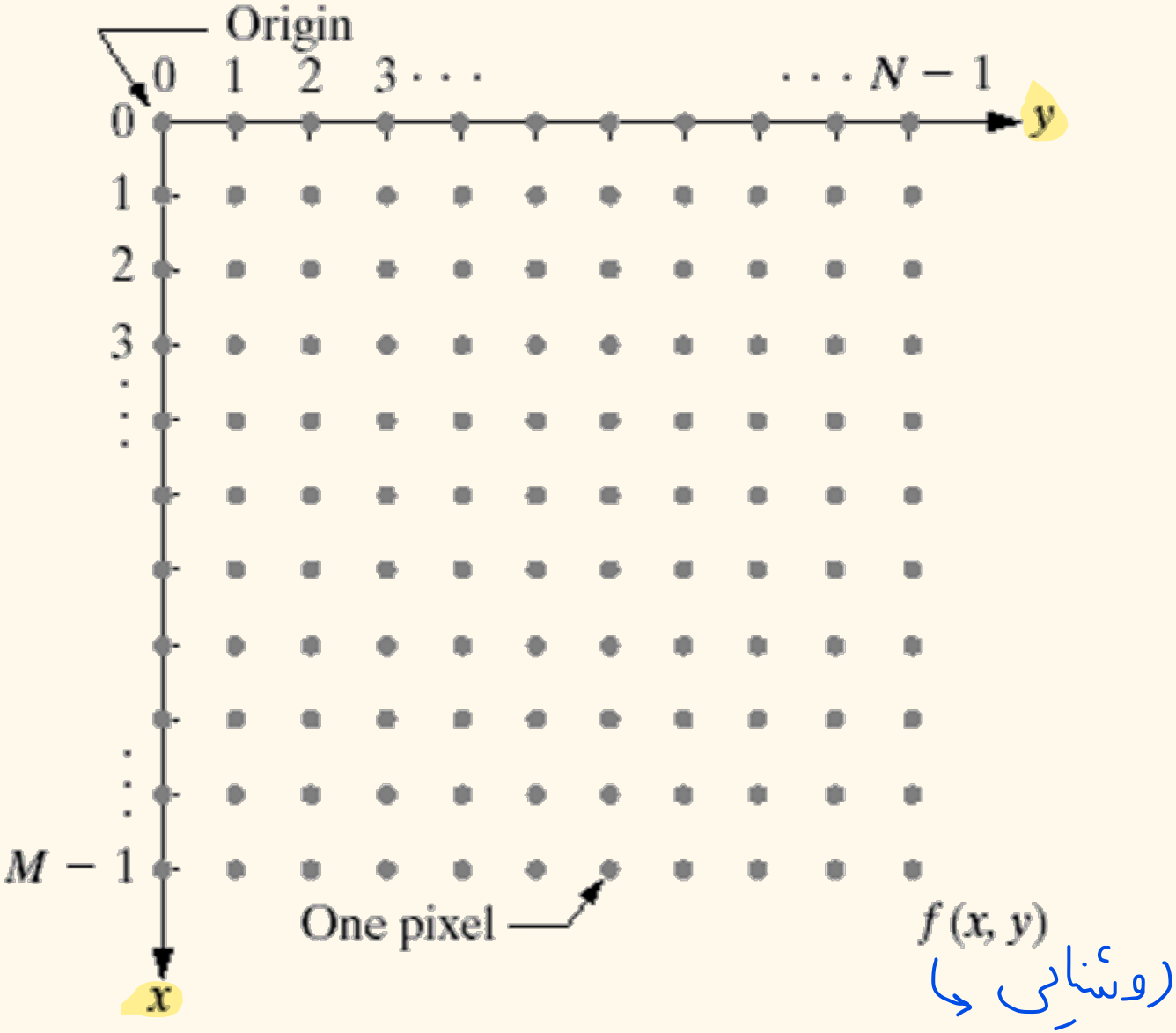
Image processing: basic definitions and related domains

What is digital image processing?

A gray level digital image



روشنایی

Context

Image processing

Image analysis

Image understanding

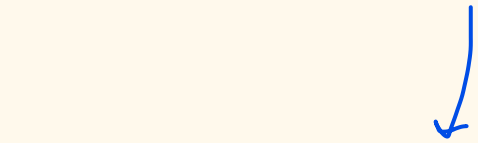
Computer vision

What are example operations?

Image enhancement

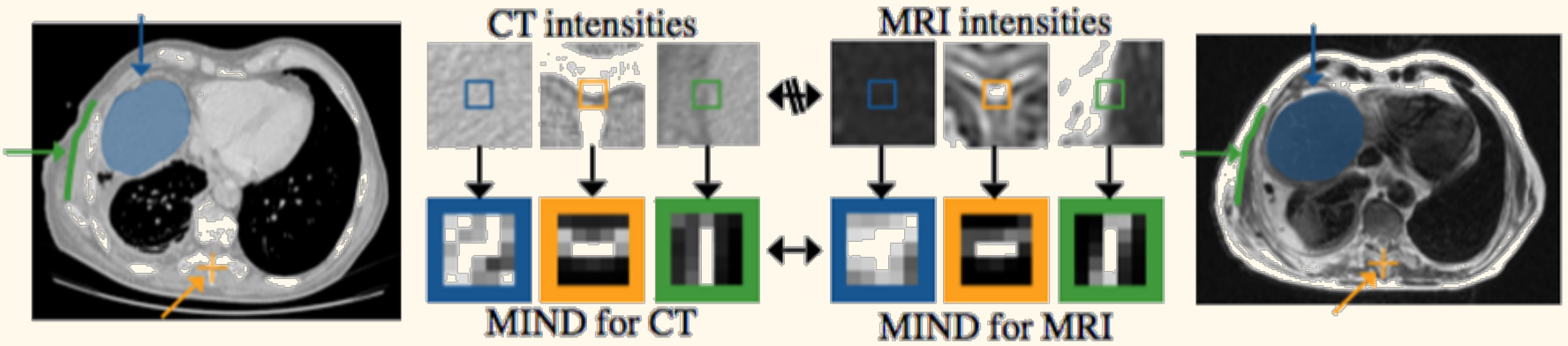
Image enhancement

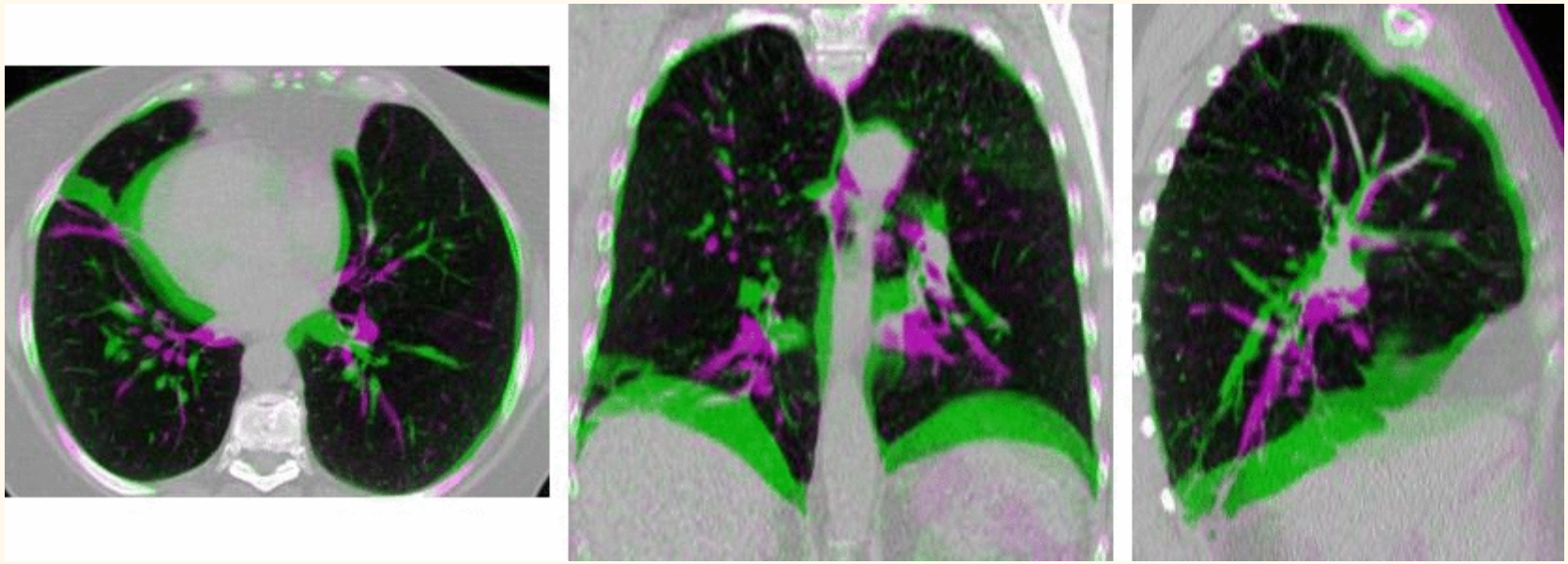
Image registration and tracking



تصاویر رو بری هم بندازیم

Image registration and tracking





Credit: Integrated Analysis and Probabilistic Registration of Medical Images with Missing Correspondences
M.Sc. Sandra Schultz
Dr. rer. nat. Jan Ehrhardt
Prof. Dr. rer. nat. habil. Heinz Handels

Image registration and tracking

Image is public domain

Image is public domain

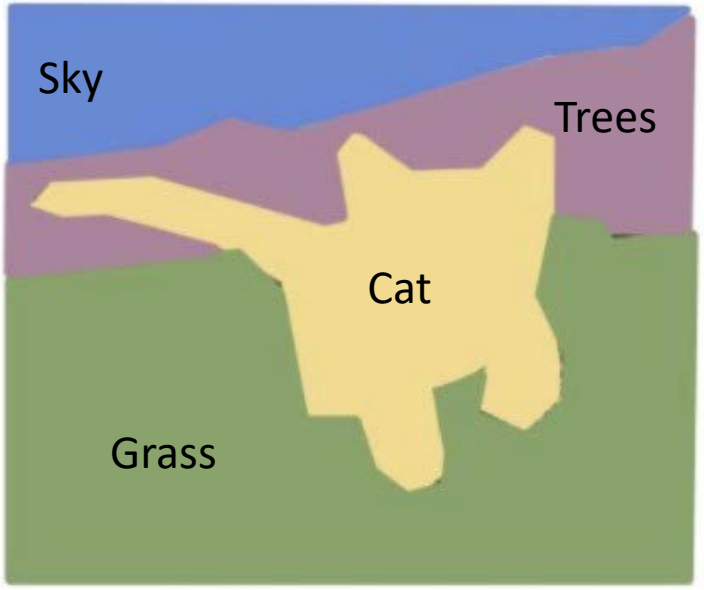
"SIFT" & Object Recognition, David Lowe, 1999

Credit: Fei-Fei Li, Justin Johnson, Serena Yeung

Image segmentation

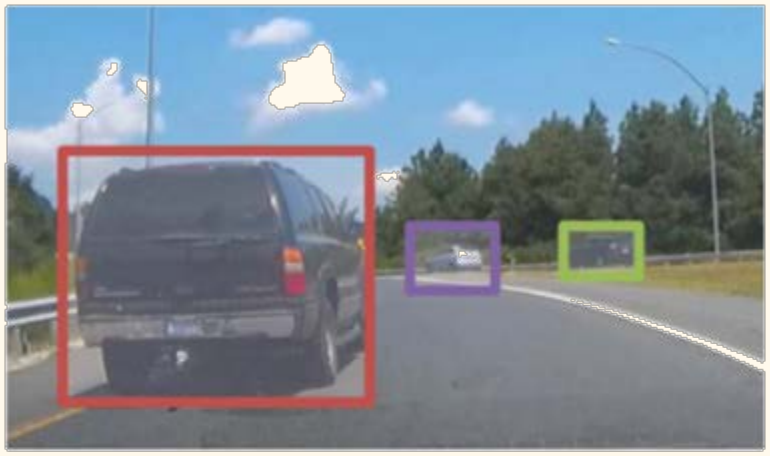
طبقه بندی پیکسل رو کلاس

Image segmentation

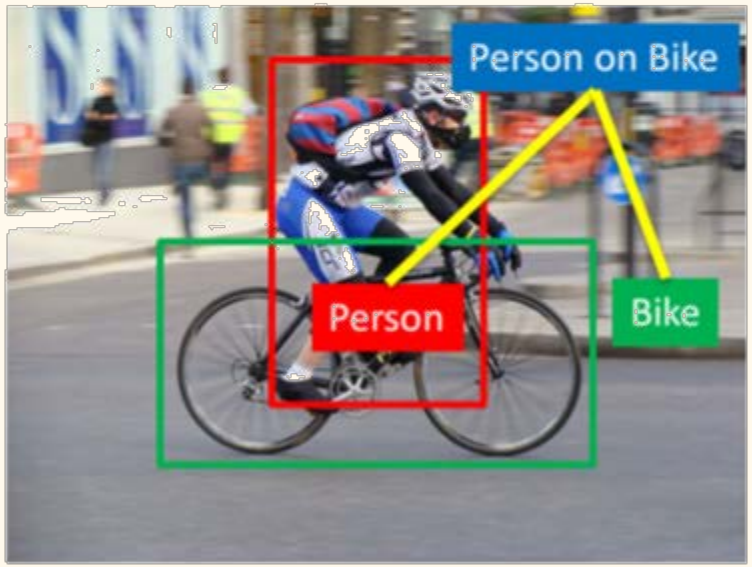


Credit: Fei-Fei Li, Justin Johnson, Serena Yeung

More intelligent operations



- Object detection
- Action classification
- Image captioning
- …



Credit: Fei-Fei Li, Justin Johnson, Serena Yeung

More intelligent operations

Context

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Computer vision

Context

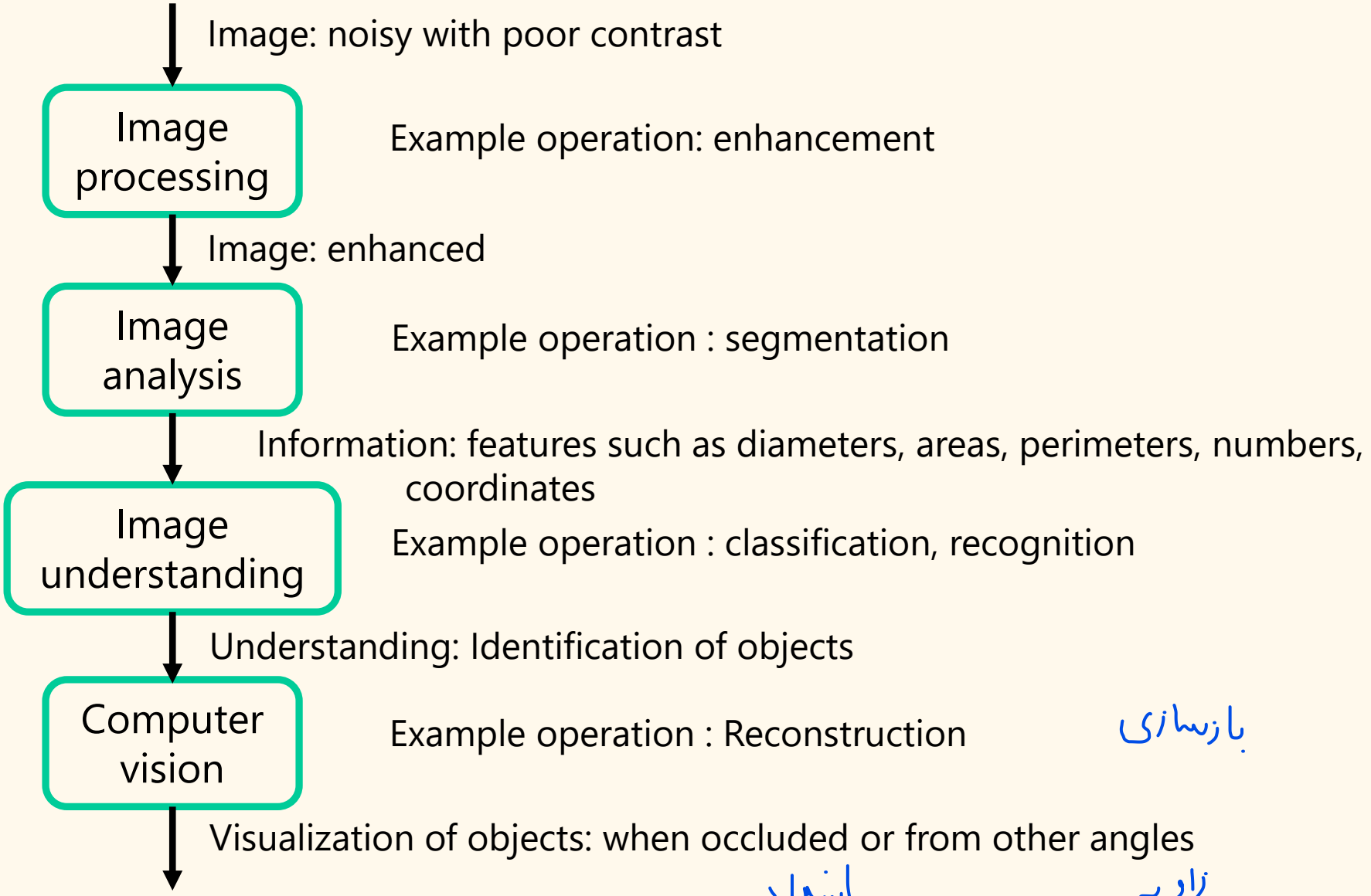
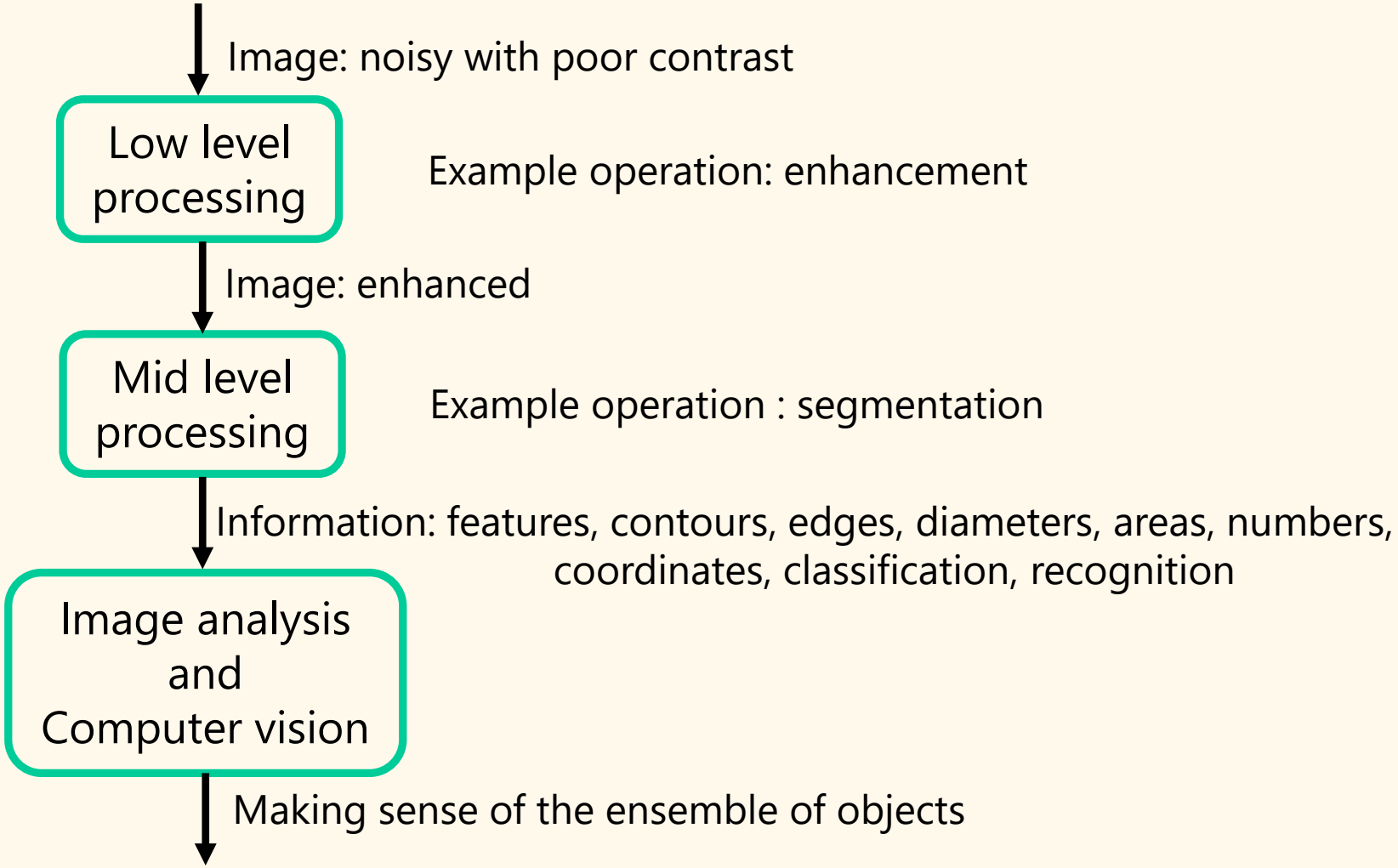


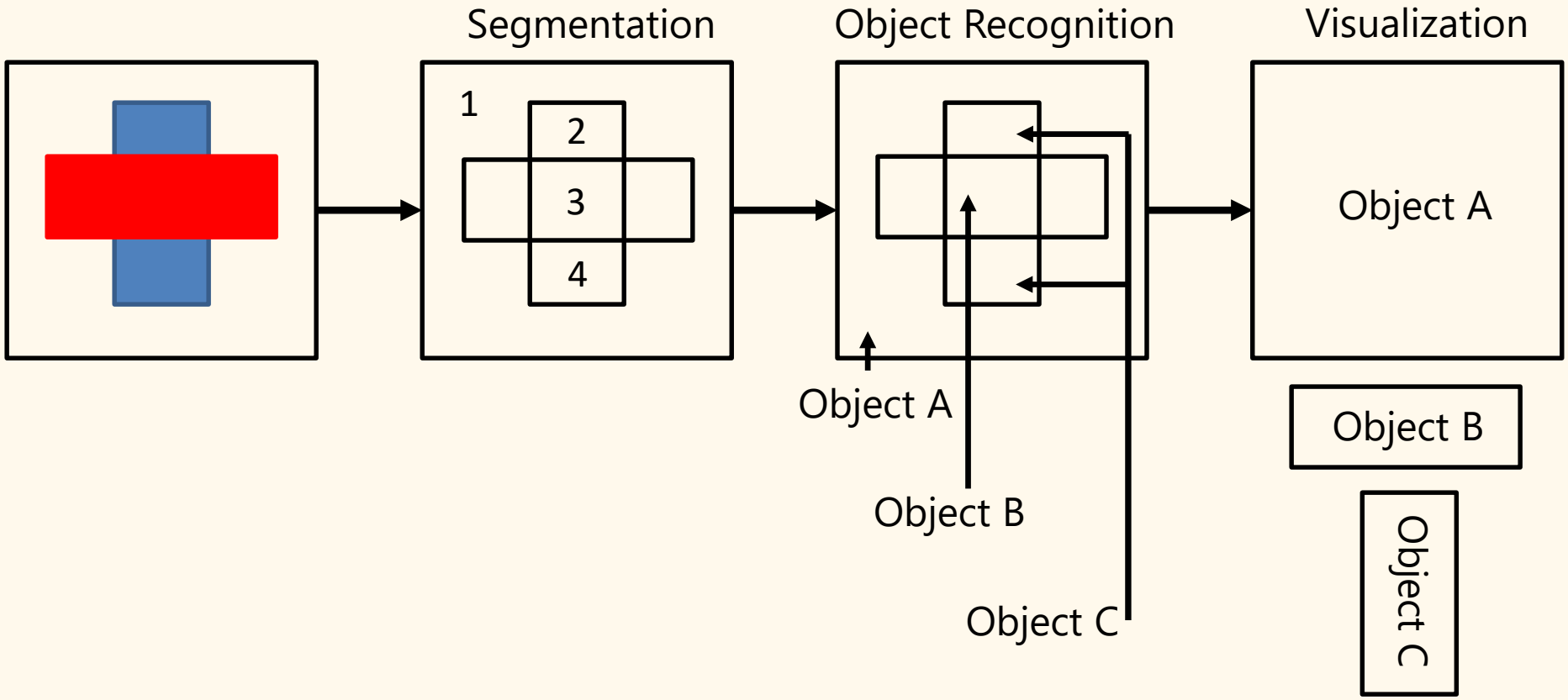
Image: noisy with poor contrast
Image processing
Example operation: enhancement
Image: enhanced
Image analysis
Example operation : segmentation
Information: features such as diameters, areas, perimeters, numbers, coordinates
Image understanding
Example operation : classification, recognition
Understanding: Identification of objects
Computer vision
Example operation : Reconstruction
بازسازی
Visualization of objects: when occluded or from other angles
اسناد
زاویه

Context

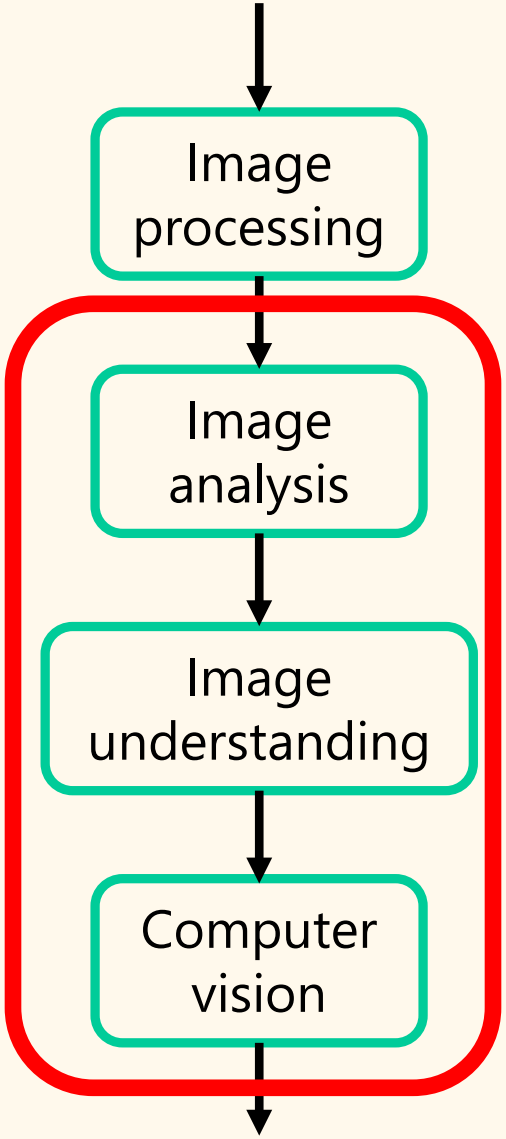
Gonzalez Text Book:



Context


Segmentation
Object Recognition
Visualization
1
2
3
4
Object A
Object A
Object B
Object C
Object B
Object C

Context



Lots of discrepancies in the literature! These 3 may overlap or be used in place of one another.

Final output could guide intelligent or cognitive functions related to vision

Context

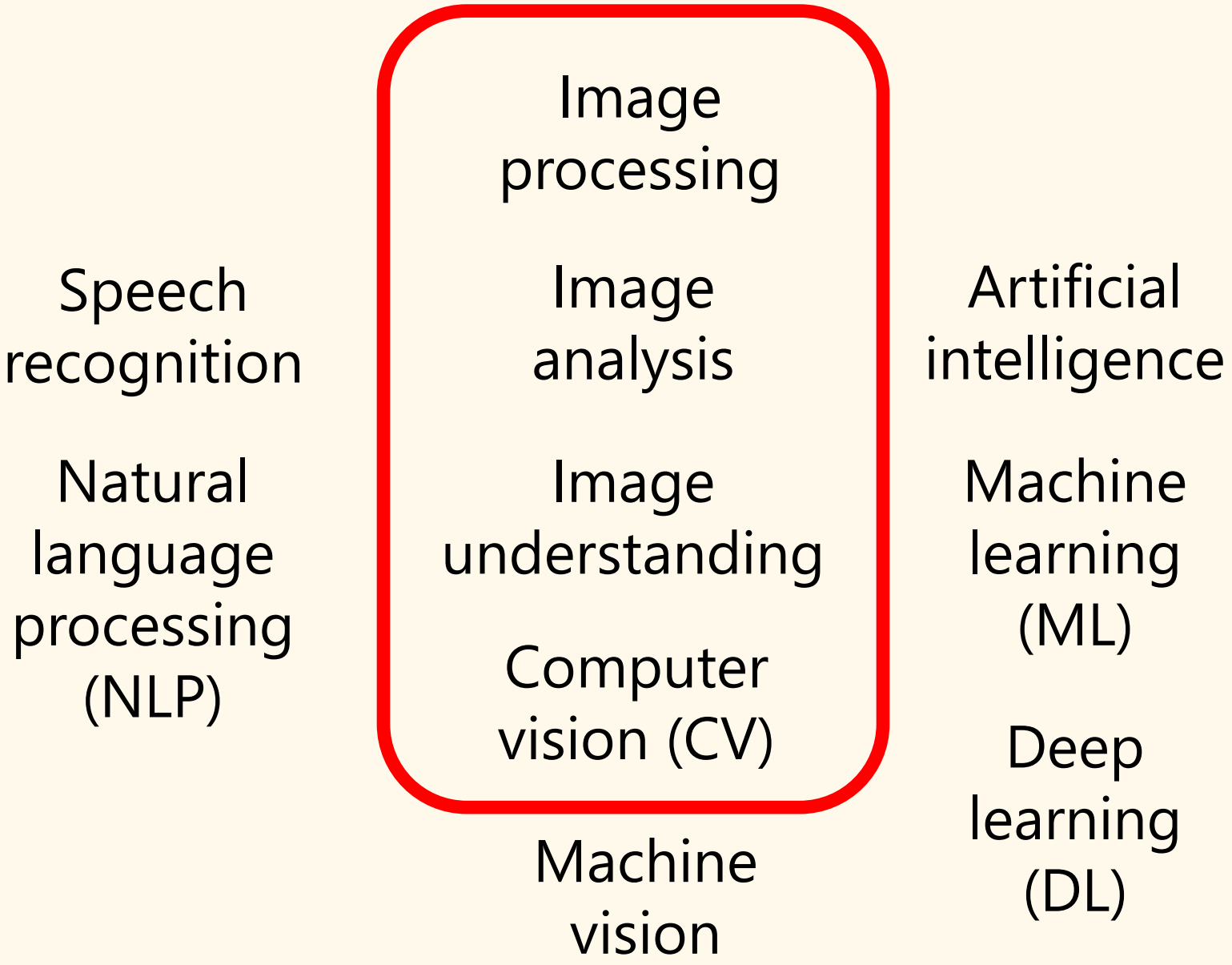


Image processing
Image analysis
Image understanding
Computer vision (CV)
Machine vision
Speech recognition
Natural language processing (NLP)
Artificial intelligence
Machine learning (ML)
Deep learning (DL)

Why image processing?

Why image processing?

Credit: Fei-Fei Li, Justin Johnson, Serena Yeung