

2  
P

**Seminar of Image Analysis: Applications to Material Science and Biology**  
**Silvia Blacher**

**1. Introduction**

- 1.1. Scope of morphological image analysis
- 1.2. Image filtering
- 1.3. Image segmentation
- 1.4. Image measurements

**2. Discrete images**

- 2.1. From continuous to discrete spaces
- 2.2. Binary, grey level and color images
- 2.3. Graphs, grids and connectivity
- 2.4. Discrete distances and distance functions
- 2.5. Arithmetic-based operations
- 2.6. Examples

**3. Filtering**

- 3.1. Histogram-based Operations: contrast stretching, equalization.
- 3.2. Smoothing Operations: linear and non-linear filters.
- 3.3. Convolution-based Operations : spatial and frequency domains.
- 3.4. Derivative-based Operations : laplacien, derivatives, other filters.
- 3.5. Examples

**4. Mathematical Morphology-based Operations**

- 4.1. Dilation and Erosion
- 4.2. Opening and Closing
- 4.3. Hit and Miss Operations: skeletons
- 4.4. Geodesic transformations
- 4.5. Examples

**5. Morphological filters**

- 5.1. Gray-value morphological processing
- 5.2. Morphological smoothing
- 5.3. Morphological gradient
- 5.4. Morphological Laplacian
- 5.5. Examples

**6. Image Segmentation**

- 6.1. Watershed transformation
- 6.2. Marker-controlled segmentation
- 6.3. Applications: overlapping blobs, fibers, etc
- 6.4. Examples

**7. Image Measurements**

- 7.1. Counting features
- 7.2. Feature sizes and shapes
- 7.3. Granulometries
- 7.4. Dispersion
- 7.5. Anisotropy
- 7.6. Fractal dimension
- 7.7. Examples

**8. Applications**

- 8.1. Characterization of porous materials
  - 8.1.2. 2D Imaging from Transmission and Scanning electron microscopy
  - 8.1.3. 3D imaging from X-ray and Electron tomography
- 8.2. Experimental and clinical angiogenesis
  - 8.2.1. 2D Imaging from Optical microscopy, Transmission electron microscopy and ultrasonography
  - 8.2.2. 3D Imaging from Confocal microscopy and X-ray tomography.

3 P

SEMINAR OF IMAGE ANALYSIS: APPLICATIONS TO MATERIAL SCIENCE AND BIOLOGY

DRA SILVIA BLACHER (Université de Liège)

BIBLIOGRAFIA:

-Pierre Soille. Morphological Image Analysis, Springer-Verlag, Berlin, Heilderberg, New-York. 2<sup>nd</sup> Edition 2003.

- John Russ The Image Processing Handbook, CRC, Press, Springer, IEEE Press. 4<sup>th</sup> Edition 2002.