



Képfeldolgozás

Barsi Árpád

BME Fotogrammetria és Térinformatika Tanszék

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- „A digitális képanalízis a valóság képeken ábrázolt részletére (kivágatára) vonatkozó explicit leírás automatikus előállítására számítógép segítségével”
- (Rosenfeld 1982)

Mottó

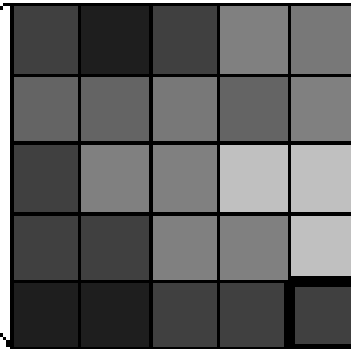
- A képalkotás: elmélet és gyakorlat (CCD)
- Alapfogalmak
- DICOM
- Szoftverek, ImageJ/FIJI
- Világosság és kontrasztműveletek
- LUT
- Mérések
- Geometriai manipulációk
- Szűrések

Tartalom

digitális kép



részlet

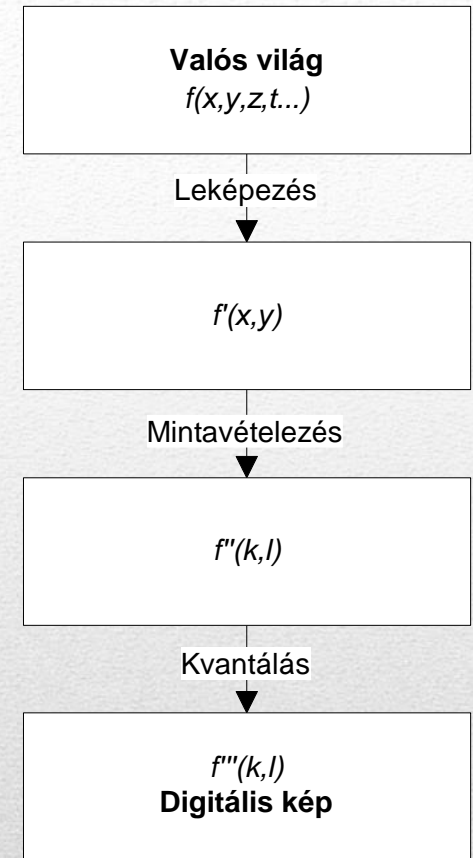
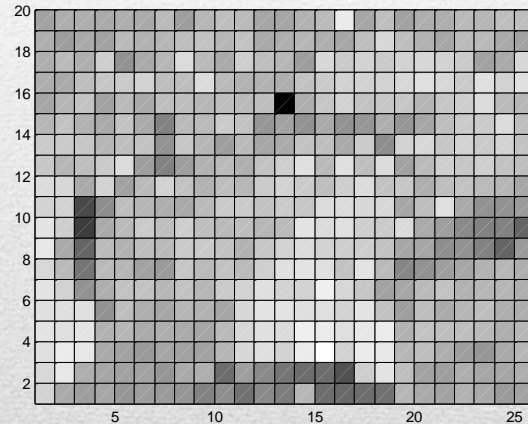
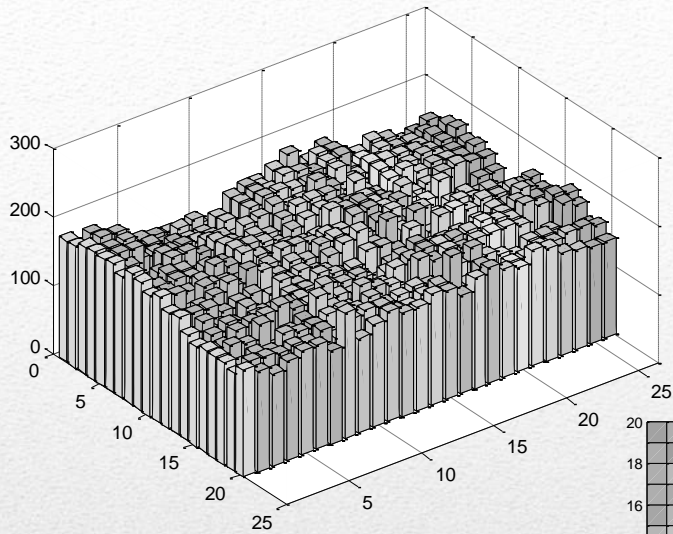


mátrix

45	51	35	35	33
47	47	61	34	32
48	45	49	43	41
35	49	66	61	55
29	42	53	64	71

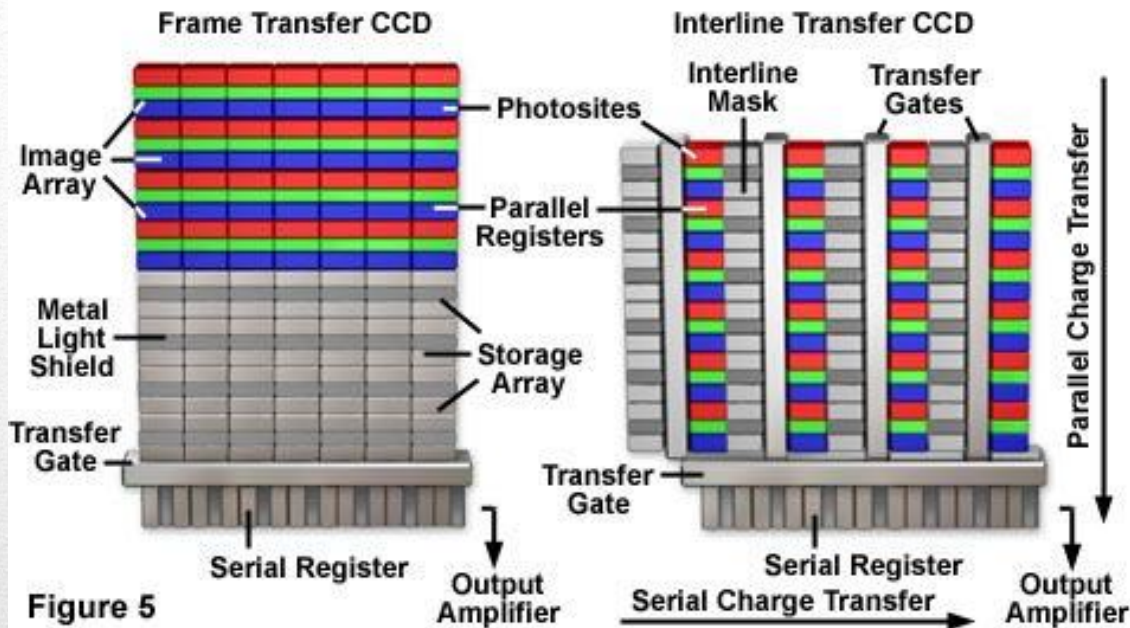
pixel

A kép és a pixel



Az elméleti képalkotási folyamat

Charged Coupled Device Architecture



CCD Scanning Formats

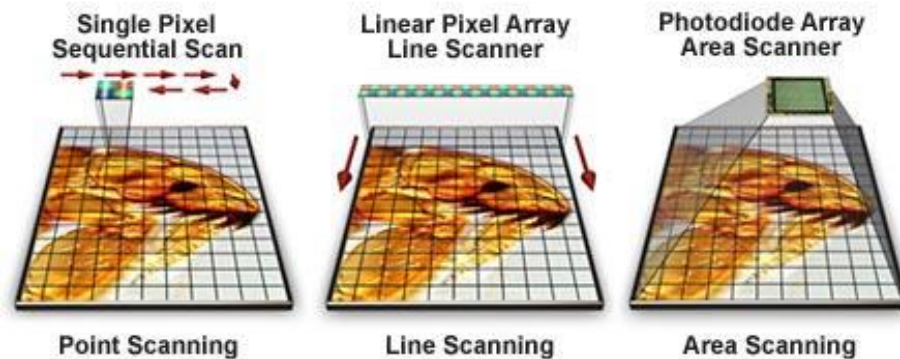


Figure 1

A CCD működése vázlatosan

- A kép egy $f(x,y,b,t)$ típusú függvény
- Felbontás: geometriai, radiometriai, spektrális, temporális
- Kivágat: szabályos, maszk (ROI, AOI)
- Tárolási formátumok (színes és FF; veszteséges és veszteségmentes)
- Képjellemzők: leíró adatok, statisztikák, hisztogram

Képi alapok



a) eredeti felbontás



b) az eredeti felbontás negyede



c) az eredeti felbontás nyolcada



d) az eredeti felbontás tizenhatoda

Geometriai felbontás



a) 64 színárnyalat



b) 16 színárnyalat



c) 8 színárnyalat



d) 4 színárnyalat

Radiometriai felbontás



R

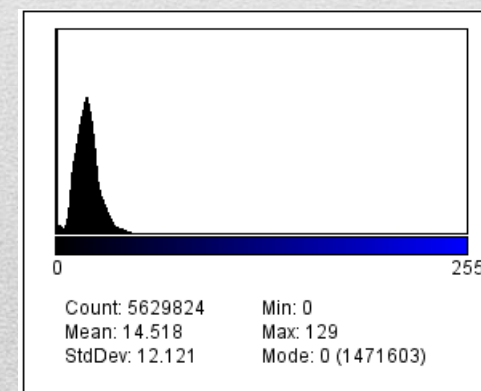
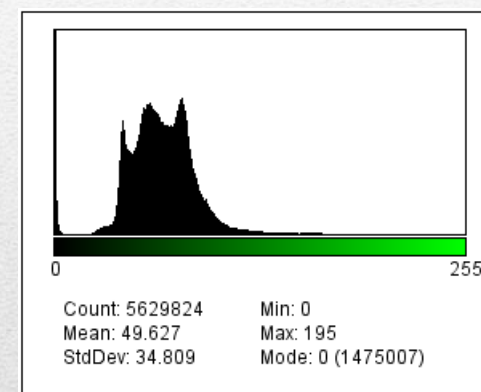
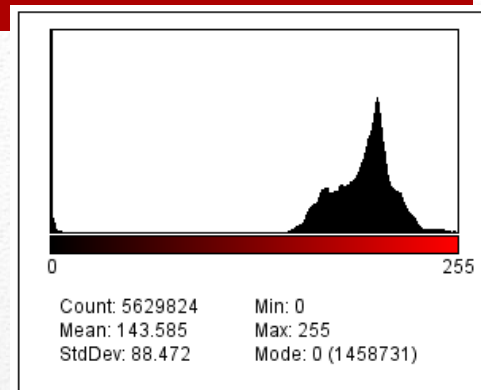
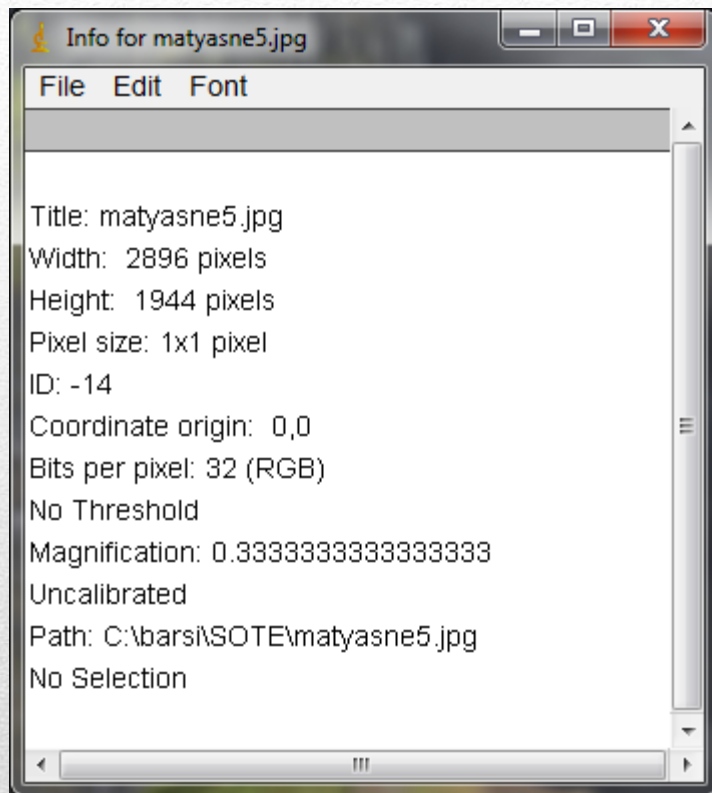
G



B

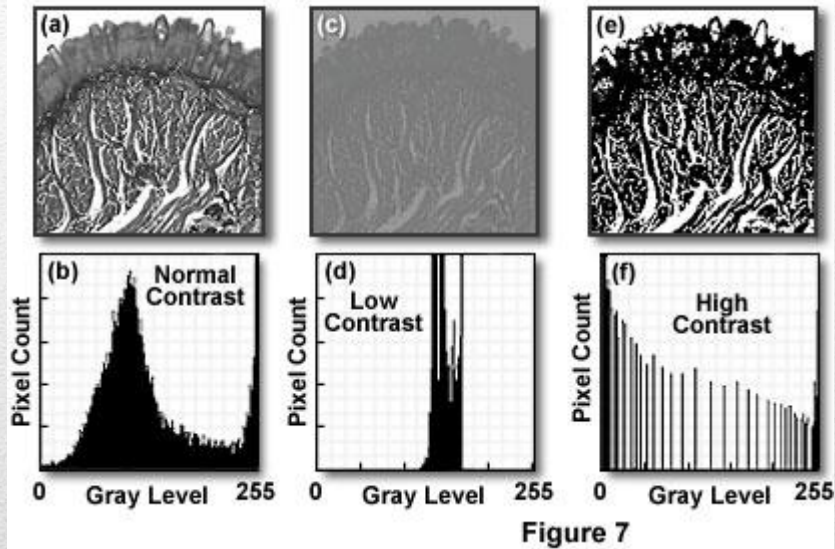


Spektrális felbontás

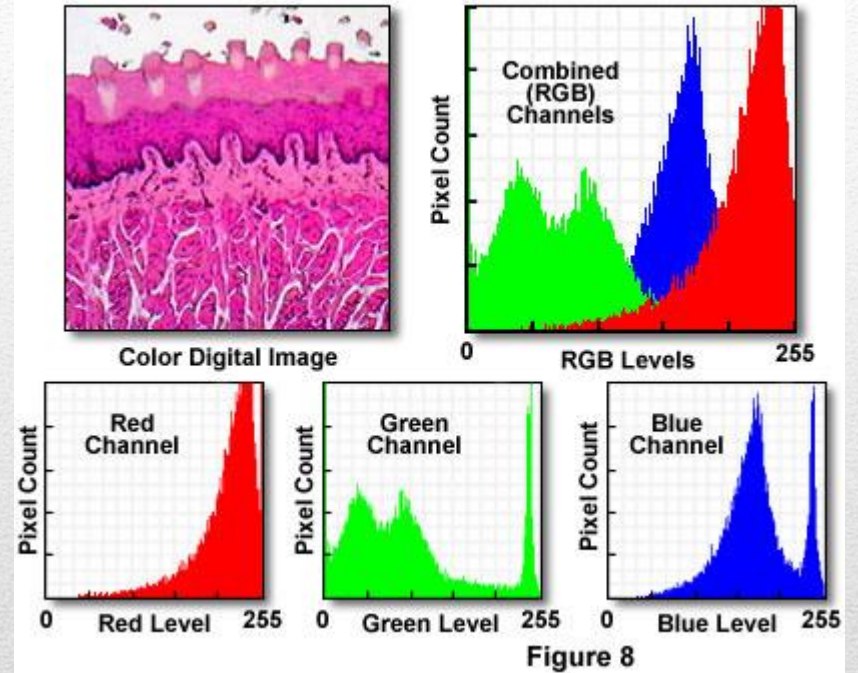


Alapjellemezők

Grayscale Histograms and Contrast Levels in Digital Images



Color Digital Images and RGB Histograms



A hisztogram még egyszer

- DICOM – Digital Imaging and Communication in Medicine
- NEMA – National Electrical Manufacturers Association – rendelkezik a copyright-tal
- Első szabvány: NEMA + Americal College of Radiology (1985)
- DICOM Standard Committee
- Gyártók: pl. Agfa, Philips, Siemens, Zeiss...
- Felhasználók: pl. Amerikai Szemészeti Társaság, Európai Kardiológiai Társaság, Francia Radiológiai Társaság...
- Egyéb tagok: pl. informatikai, egészségipari cégek...









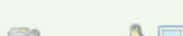












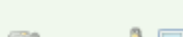
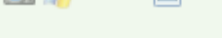

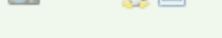




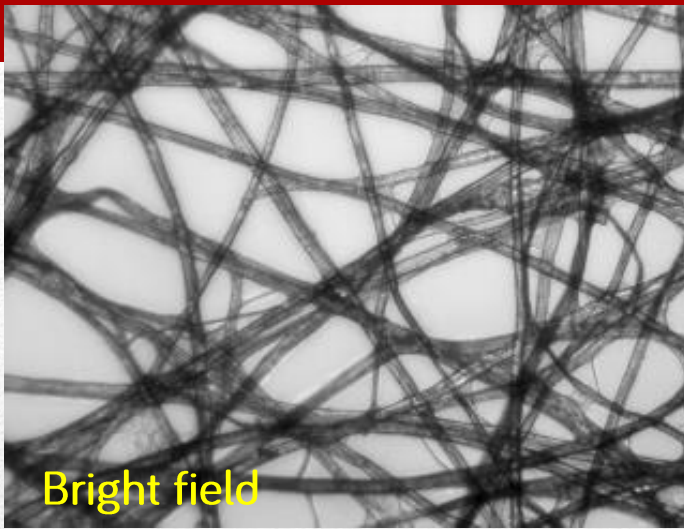
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0020,0013 Image Number: 4
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0020,0037 Image Orientation (Patient): 0.99996411800384\ -6.167521496E-05\ 0.00847145821899\
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0020,0105 Number of Temporal Positions: 1
0020,1040 Position Reference Indicator:
0020,1041 Slice Location: 0
0028,0002 Samples per Pixel: 1
0028,0004 Photometric Interpretation: MONOCHROME2
0028,0010 Rows: 256
0028,0011 Columns: 256
0028,0030 Pixel Spacing: 0.8984375\ 0.8984375
0028,0034 Pixel Aspect Ratio: 1\ 1
0028,0100 Bits Allocated: 16
0028,0101 Bits Stored: 12
0028,0102 High Bit: 11
0028,0103 Pixel Representation: 0
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0028,1051 Window Width: 8233.37373737373
0028,2110 Lossy Image Compression: 00
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0040,0244 Performed Procedure Step Start Date: 20071214
0040,0245 Performed Procedure Step Start Time: 140213
0040,0250 Performed Procedure Step End Date: 20071214
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0040,0254 Performed Procedure Step Description: Koponya Orbita
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0040,9225 >---:  dī?
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2001,100B ---: TRANSVERSAL
2005,0010 ---: Philips MR Imaging DD 001
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DICOM-példa

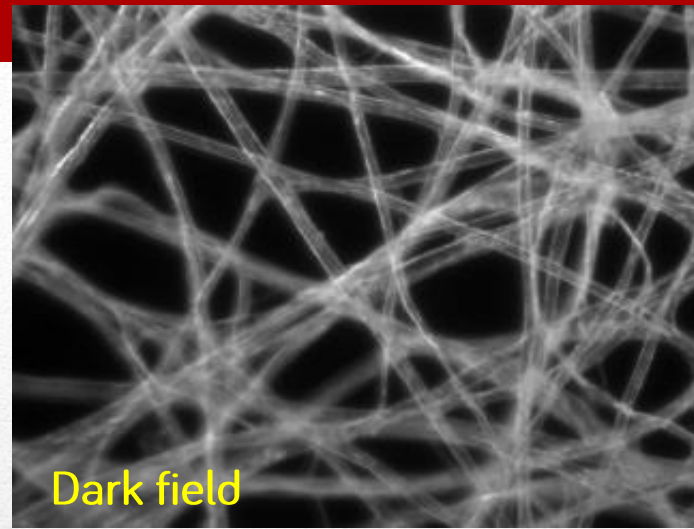
Quick Links To Popular Programs

Display DICOM	Windows	Macintosh	Linux
	Full List of 96 79 Screen Captures	Full List of 61 47 Screen Captures	Full List of 61 47 Screen Captures
1	Mango 	OsiriX 	Mango 
2	MIPAV - Medical... 	Mango 	MIPAV - Medical... 
3	Synedra View Pe... 	MIPAV - Medical... 	Aeskulap - DICO... 
Convert Files	Full List of 40 19 Screen Captures	Full List of 23 11 Screen Captures	Full List of 34 14 Screen Captures
	1	Mango 	Mango 
2	MIPAV - Medical... 	MIPAV - Medical... 	MIPAV - Medical... 
3	XMedCon 	XMedCon 	XMedCon 
PACS Client	Full List of 39 29 Screen Captures	Full List of 25 20 Screen Captures	Full List of 27 21 Screen Captures
	1	MIPAV - Medical... 	OsiriX 
2	Synedra View Pe... 	MIPAV - Medical... 	Aeskulap - DICO... 
3	ConQuest 	CDMEDIC PACS 	ConQuest 

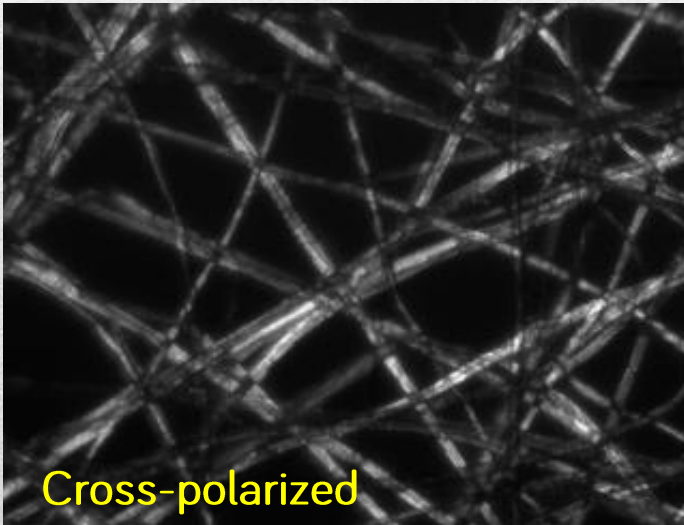
DICOM-szoftvertámogatás



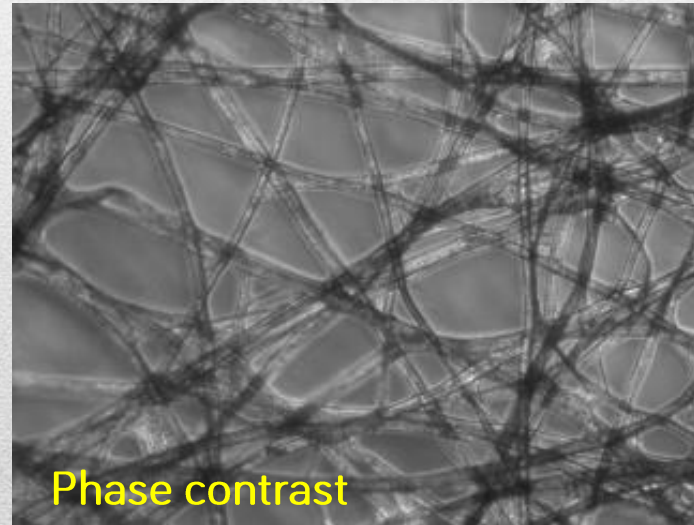
Bright field



Dark field



Cross-polarized



Phase contrast

Megvilágítási technikák

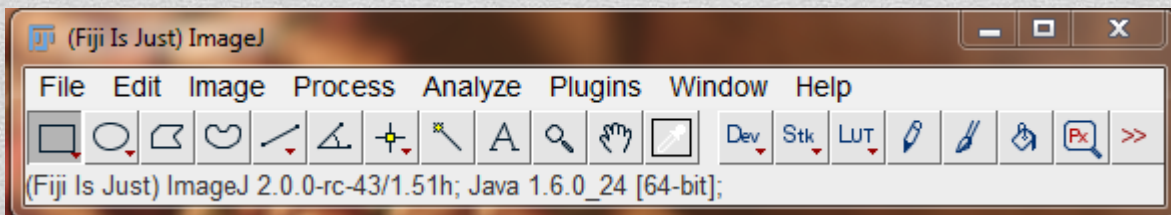
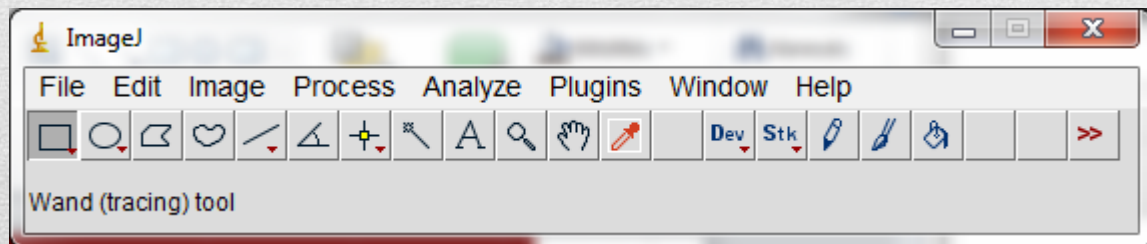
- grafikai szoftverek
 - PhotoShop, PhotoPaint, PaintShopPro, Kai, Photo DeLuxe, Gimp...
- általános célú fejlesztő környezetek
 - Khoros, Matlab Image Processing Toolbox, AVS, Image Vision Library, Halcon...
- speciális alkalmazói szoftverek
 - ImageStation Imager, Erdas Imagine, ImagePro Plus...
- ImageJ - FIJI

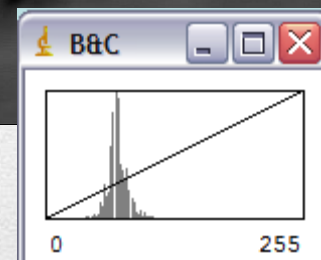
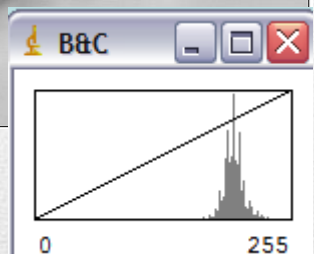
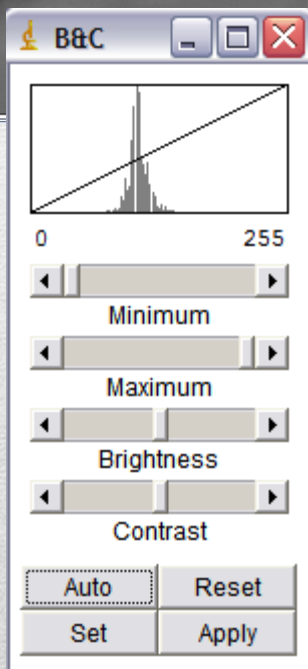
Szoftverek

- Ingyenes Java alapú képfeldolgozó szoftver
- Letölthető: <http://imagej.nih.gov/ij/>
- Áttekinthető menüszerkezet
- Számos orvosi/biológiai funkció
- Bővíthető (plug-in)
- Jól dokumentált (Help, Tutorial, videók)

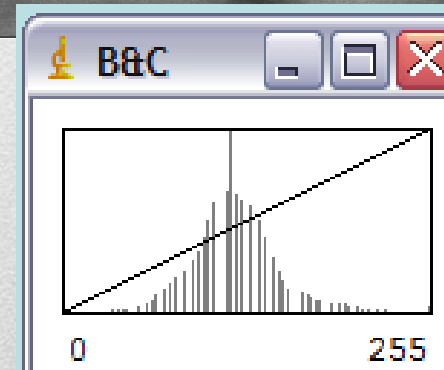
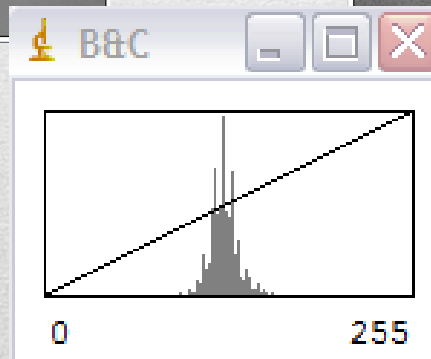
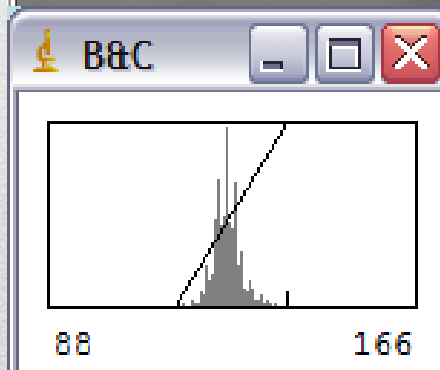
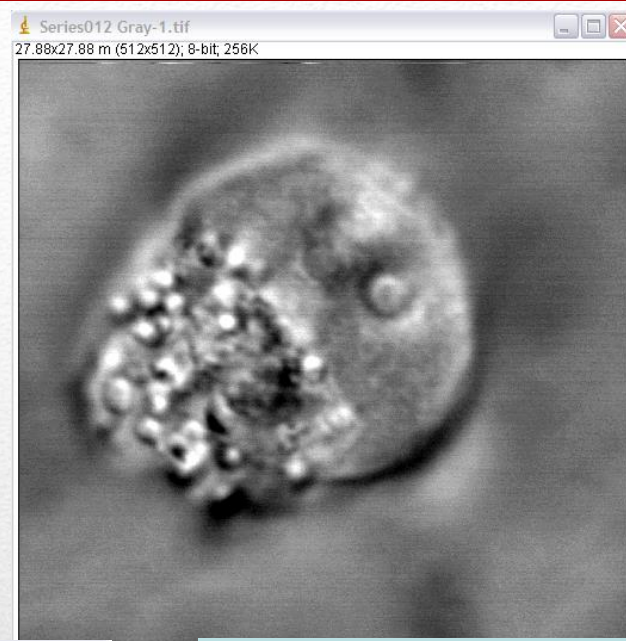
ImageJ

FIJI

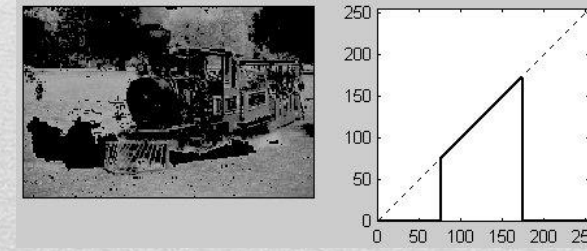
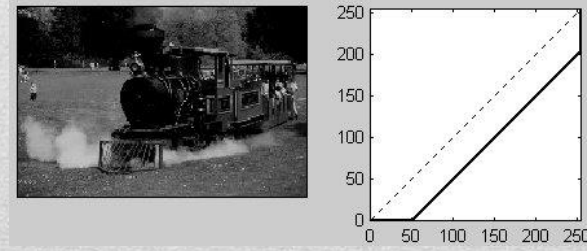
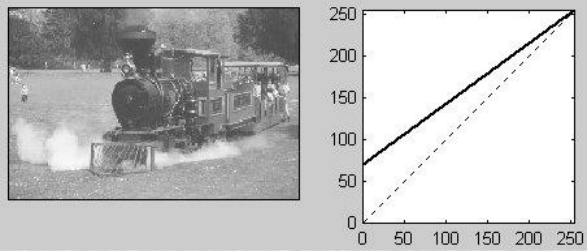
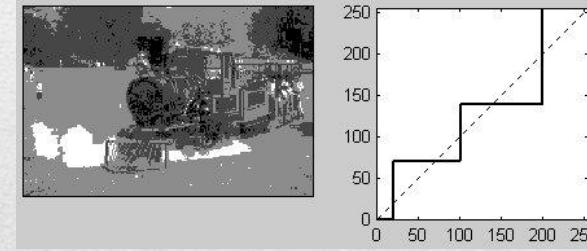
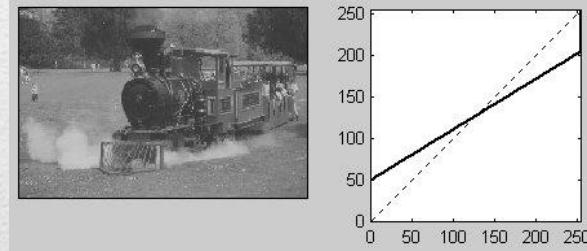
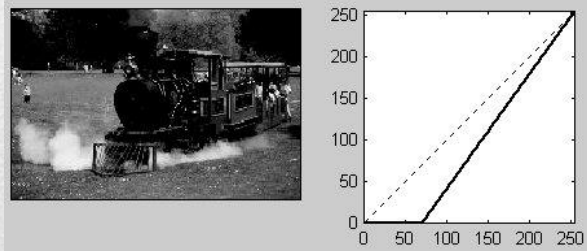
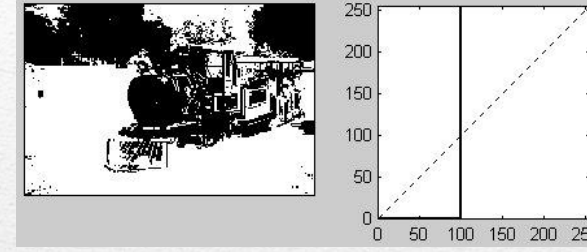
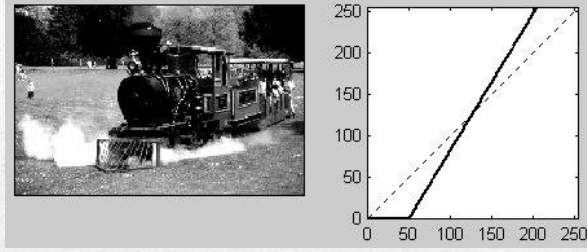
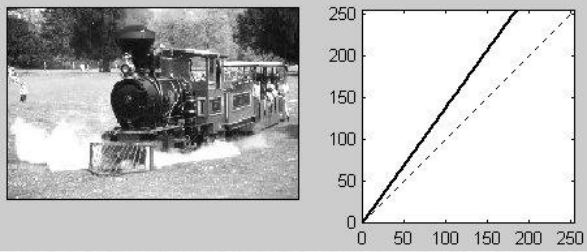
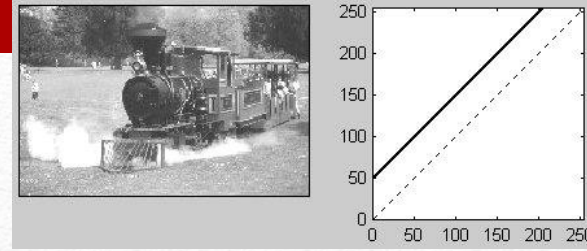
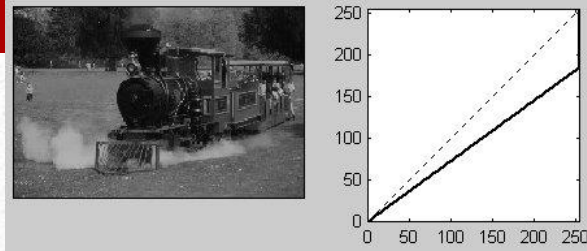
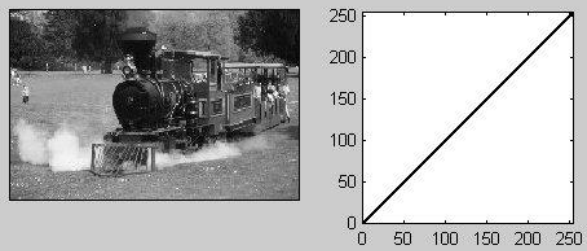




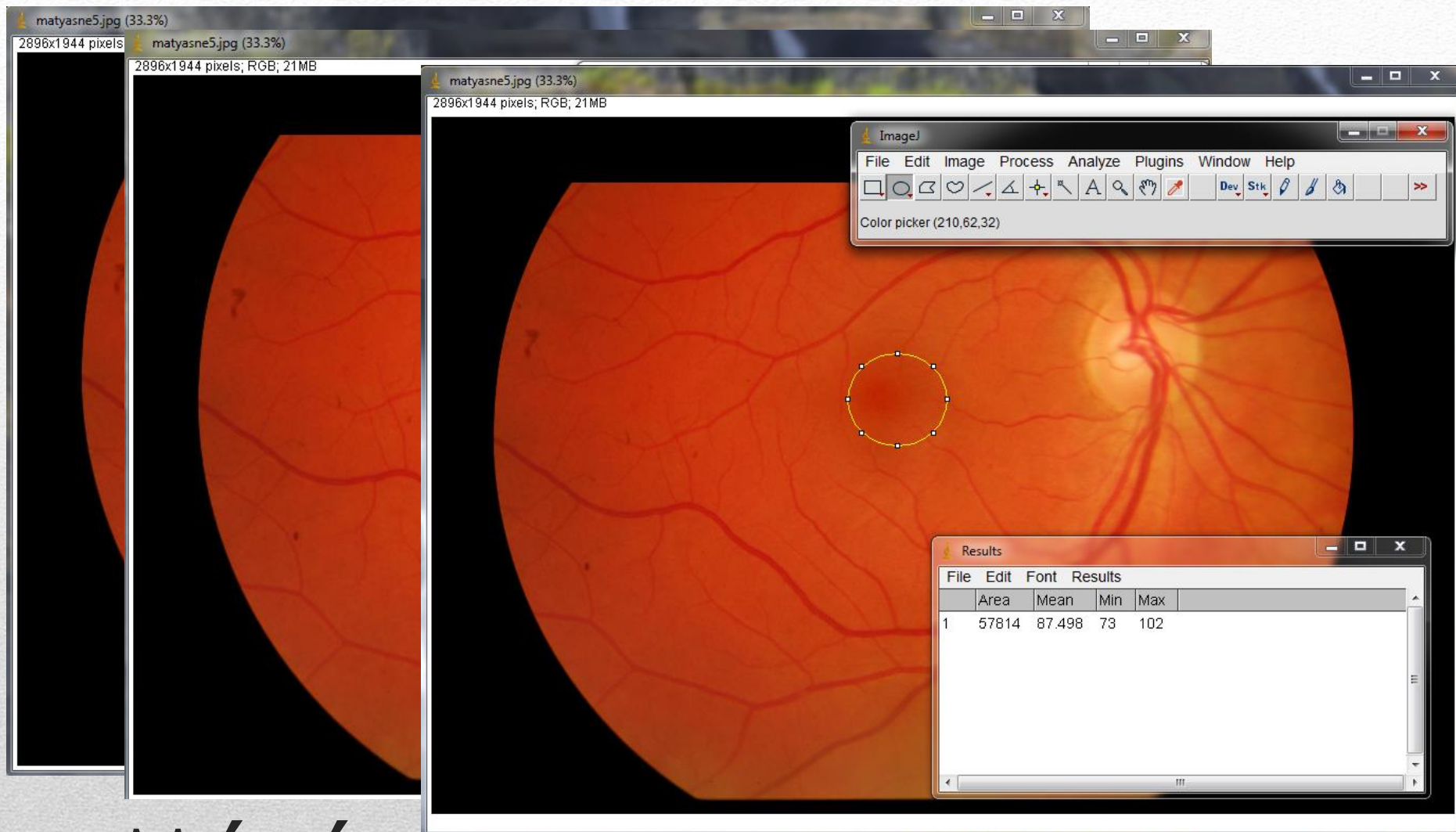
Világosság-műveletek



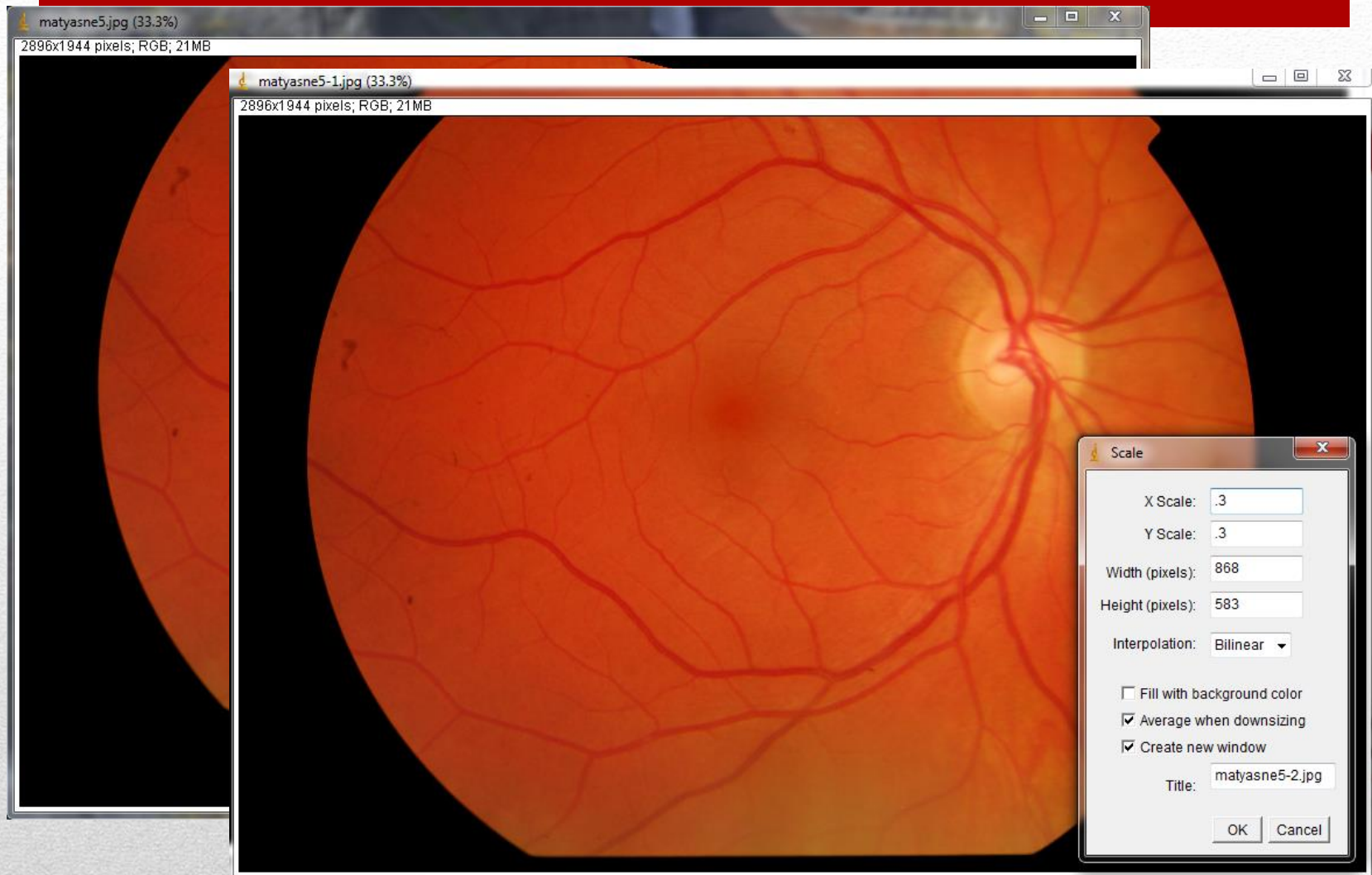
Kontraszt-műveletek



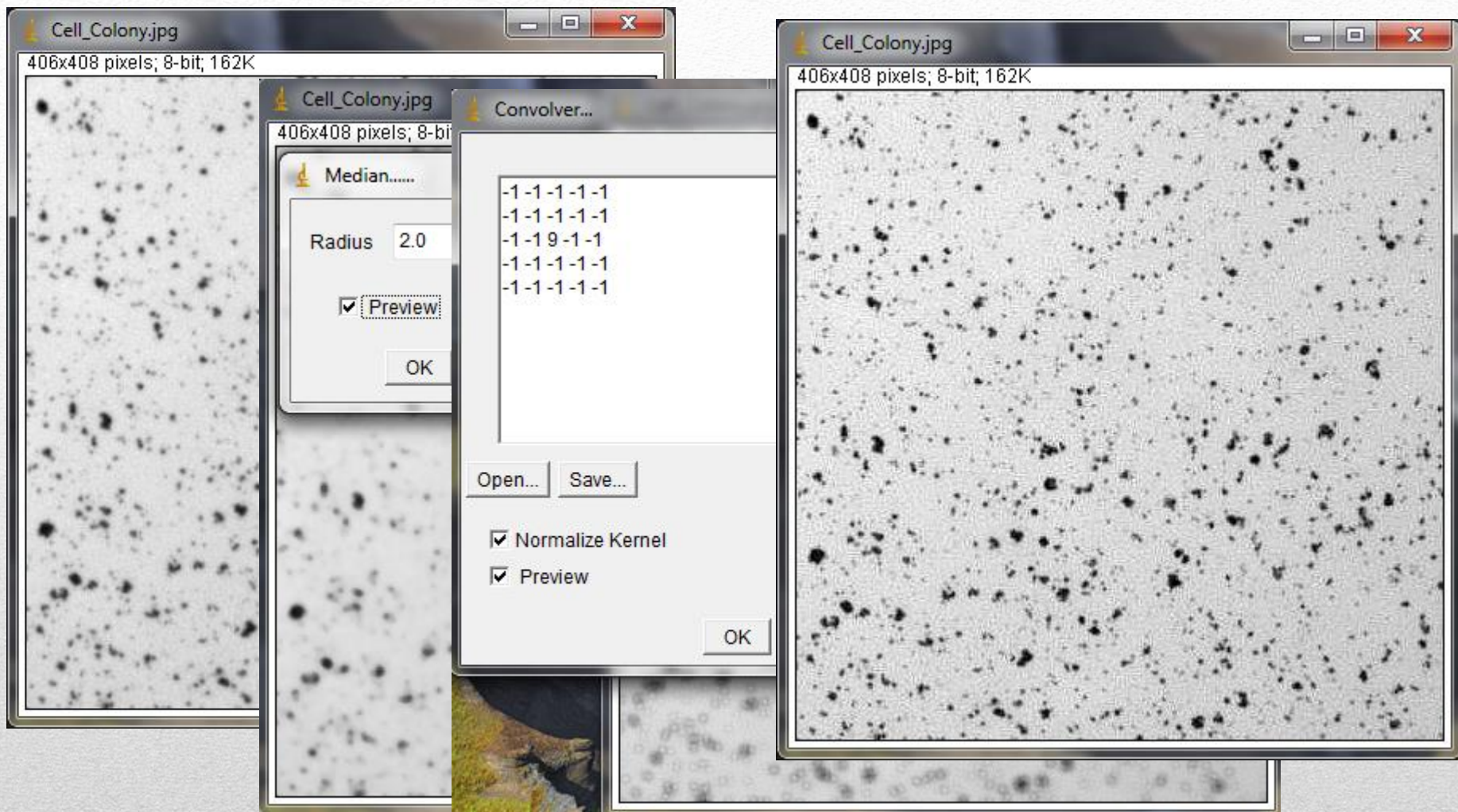
Look-up table (LUT)



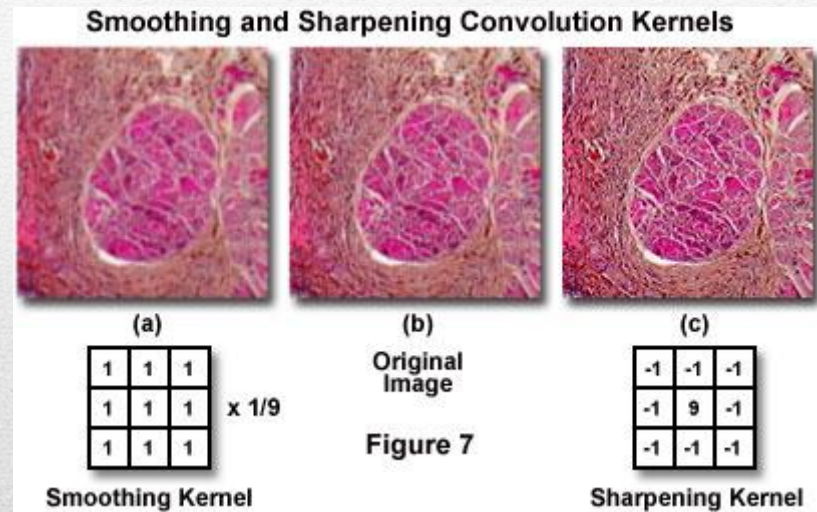
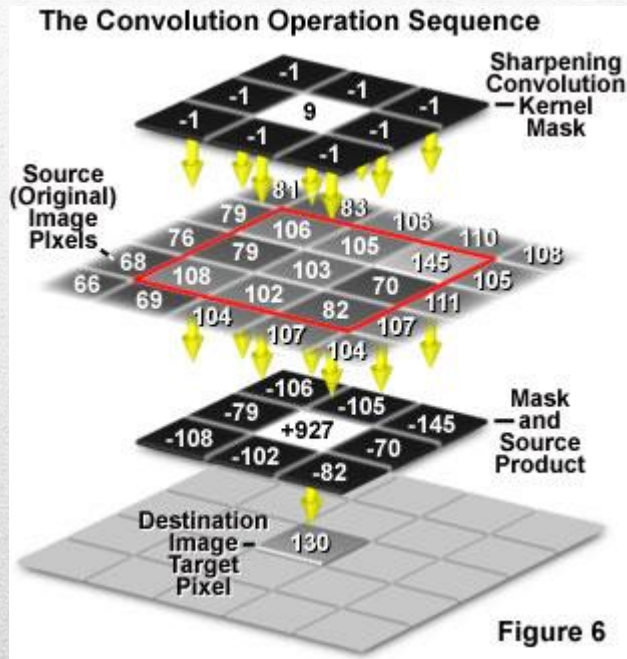
Mérések



Geometriai manipulációk



Szűrések



A konvolúció



Folytatás következik...

- Gonzalez, R.C. – Woods, R.E.: Digital Image Processing
- Jähne, B.: Digital Image Processing
- Russ, J.C.: The Image Processing Handbook
- Epstein, L.C.: Introduction to the Mathematics of Medical Imaging
- Suetens, P.: Fundamentals of Medical Imaging
- dicom.nema.org
- <http://www.olympusmicro.com/>

Irodalom/referencia