PODSTAWY PRZETWARZANIA OBRAZÓW CYFROWYCH

Formaty obrazów cyfrowych

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FORMATY OBRAZÓW CYFROWYCH:

- rastrowe
    - bezstratne
        - BMP, PNG, TIFF*, …
    - stratne
        - jpg, gif, …

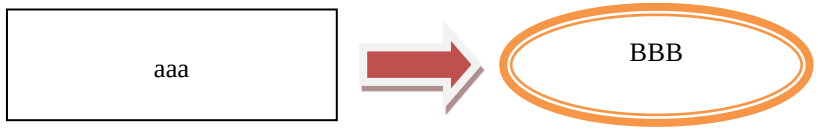
2D / 3D

- wektorowe
    - DTP:
        - ps, eps, pdf *, …
    - grafika wektorowa
        - wmf, emf, svg, obj, …
    - mapy
        - shp, …
- chmura punktów

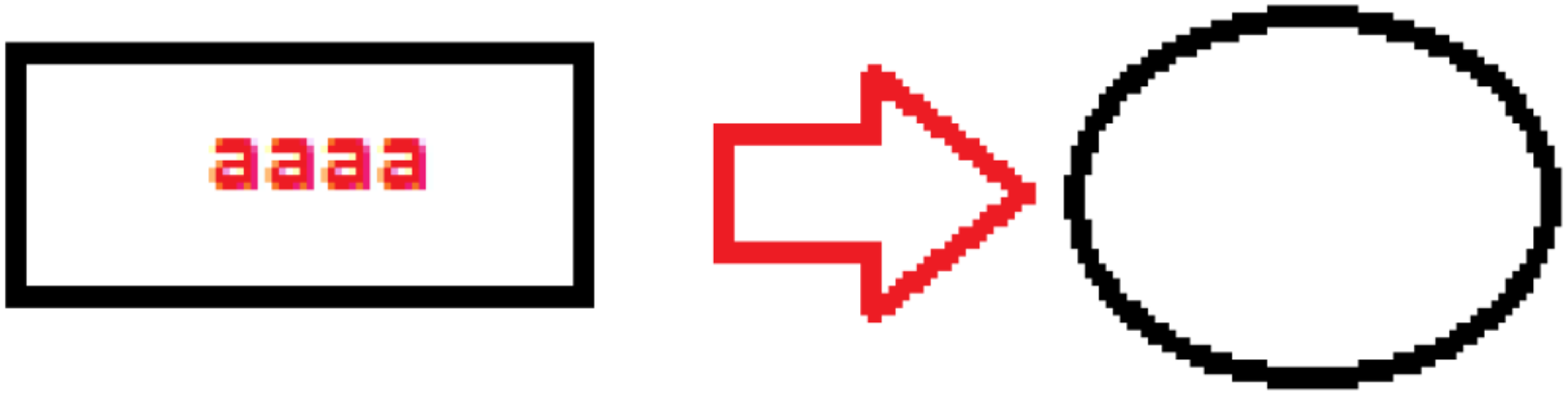
Krótko o grafice wektorowej

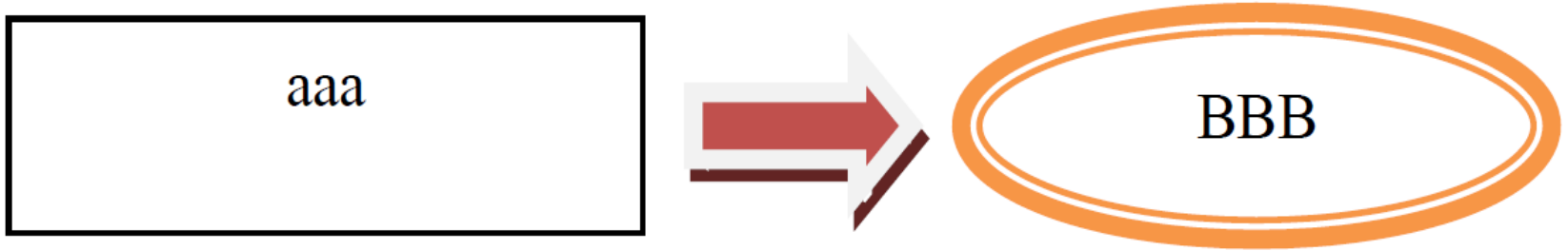
grafika rastrowa

grafika wektorowa



po powiększeniu obrazy wyglądają następująco:





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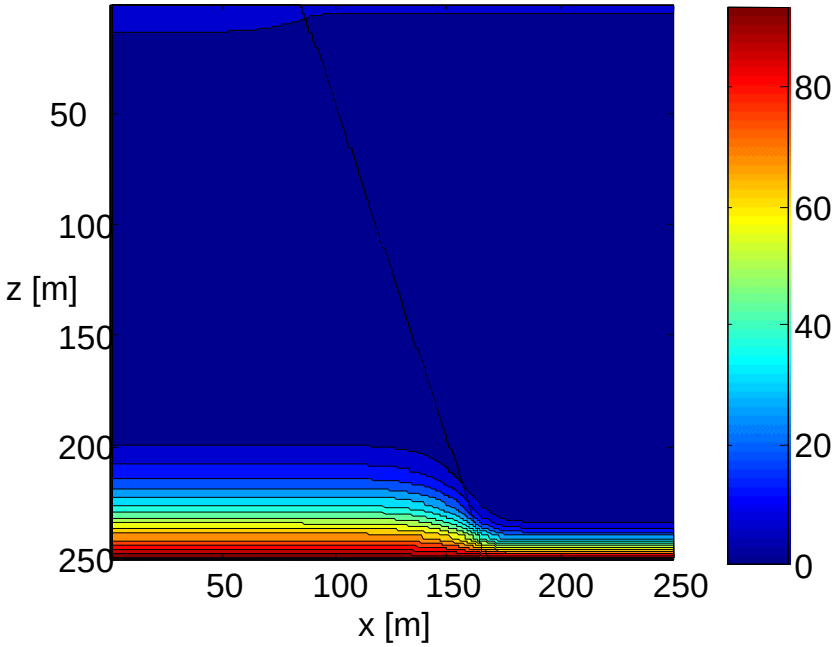
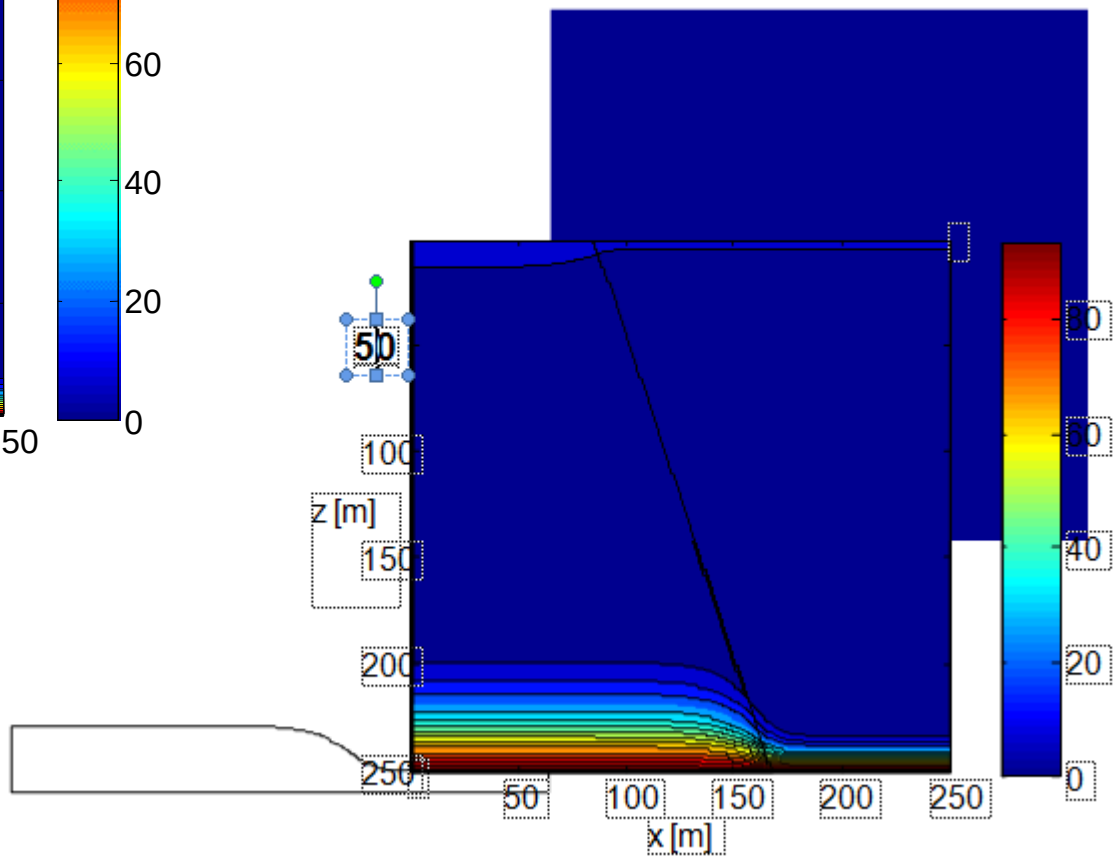
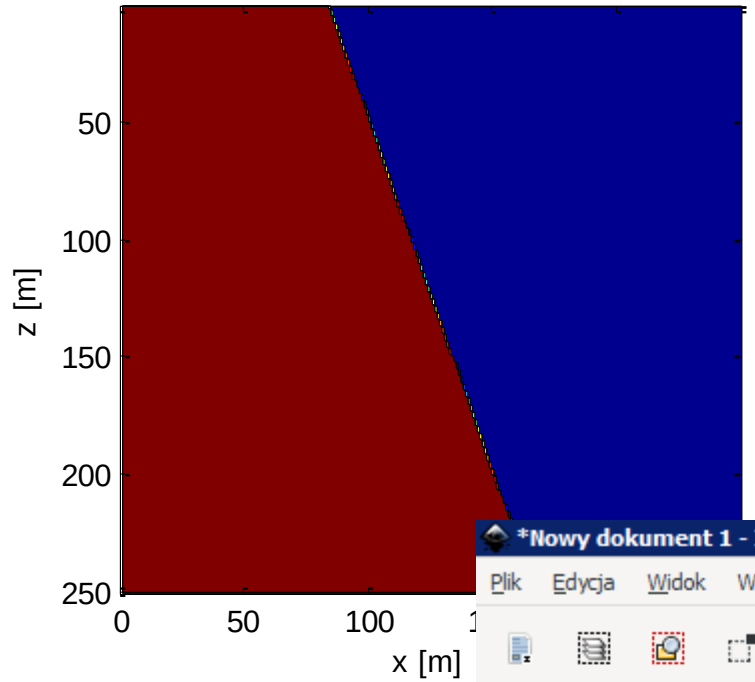
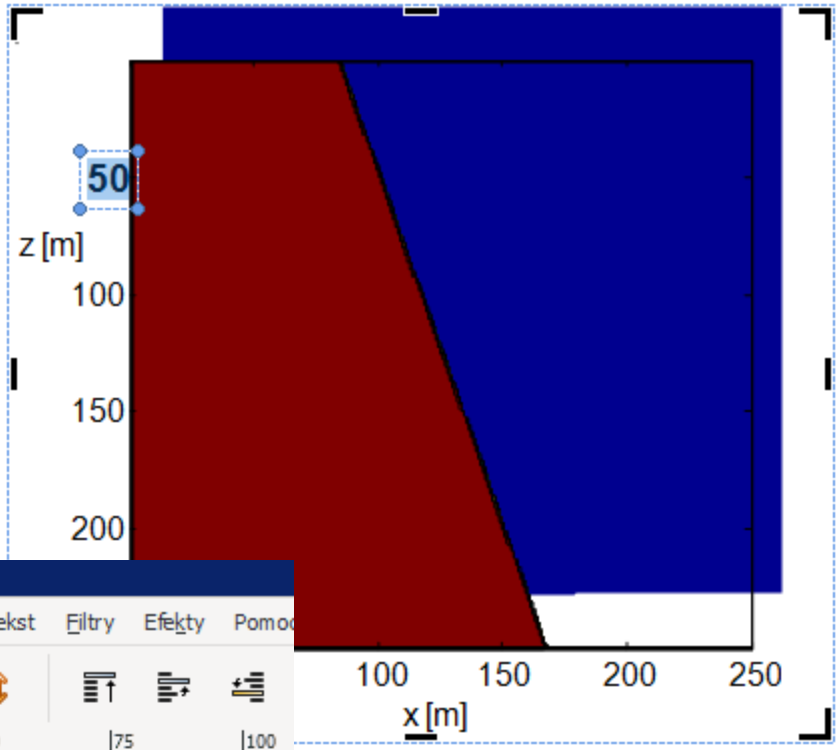
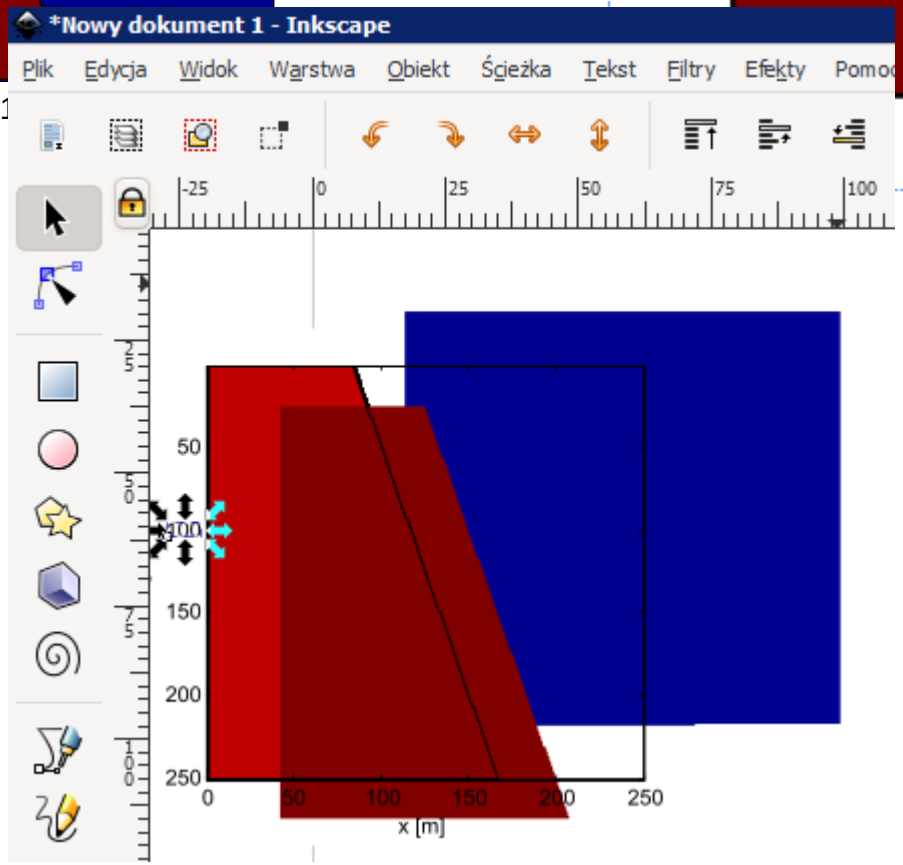






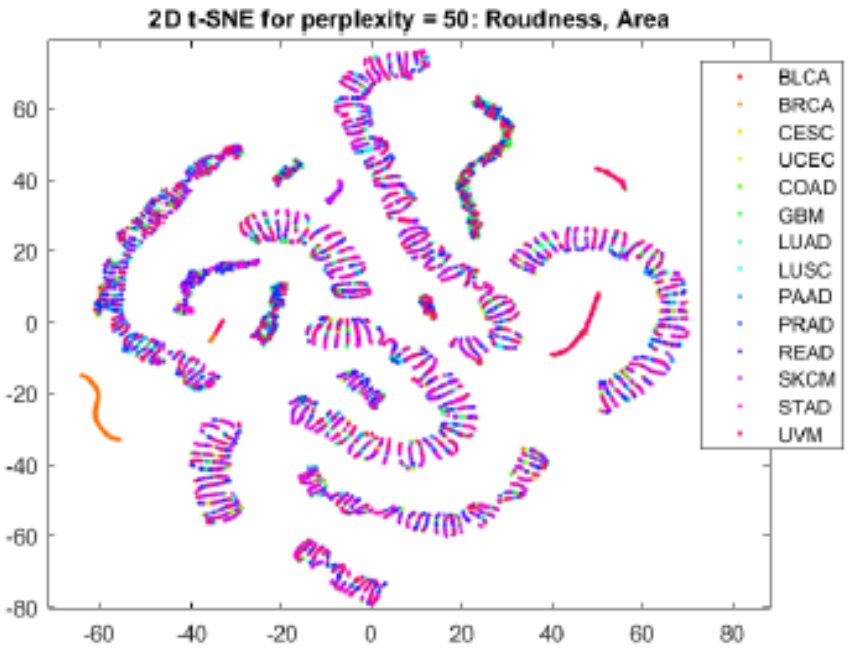


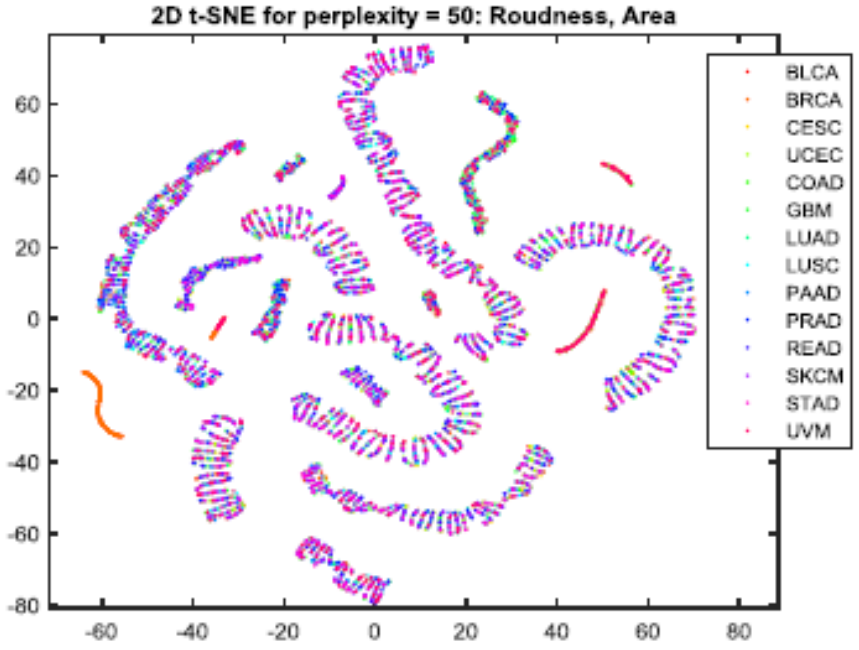
MS Word

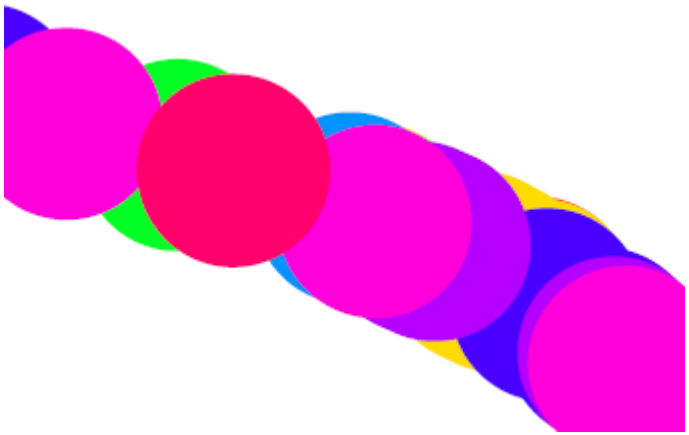


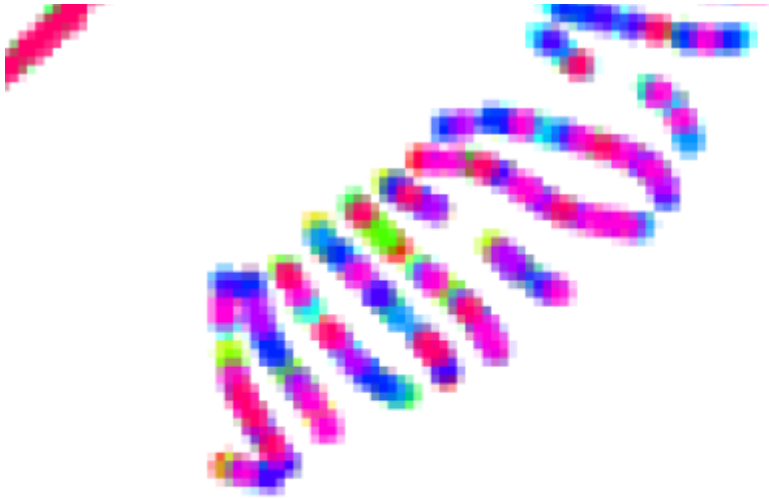
Inkscape

Krótko o grafice wektorowej

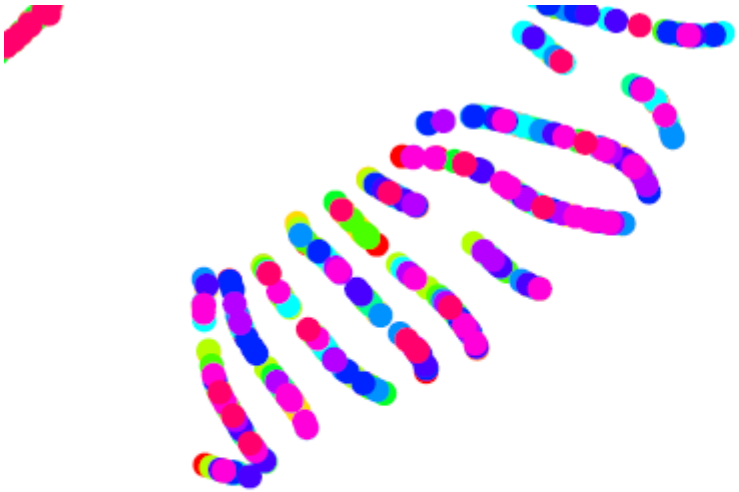








READ
SKCM
STAD
UVM



READ
SKCM
STAD
UVM

$$S_N = \frac{N}{1 + (N - 1)\alpha}$$

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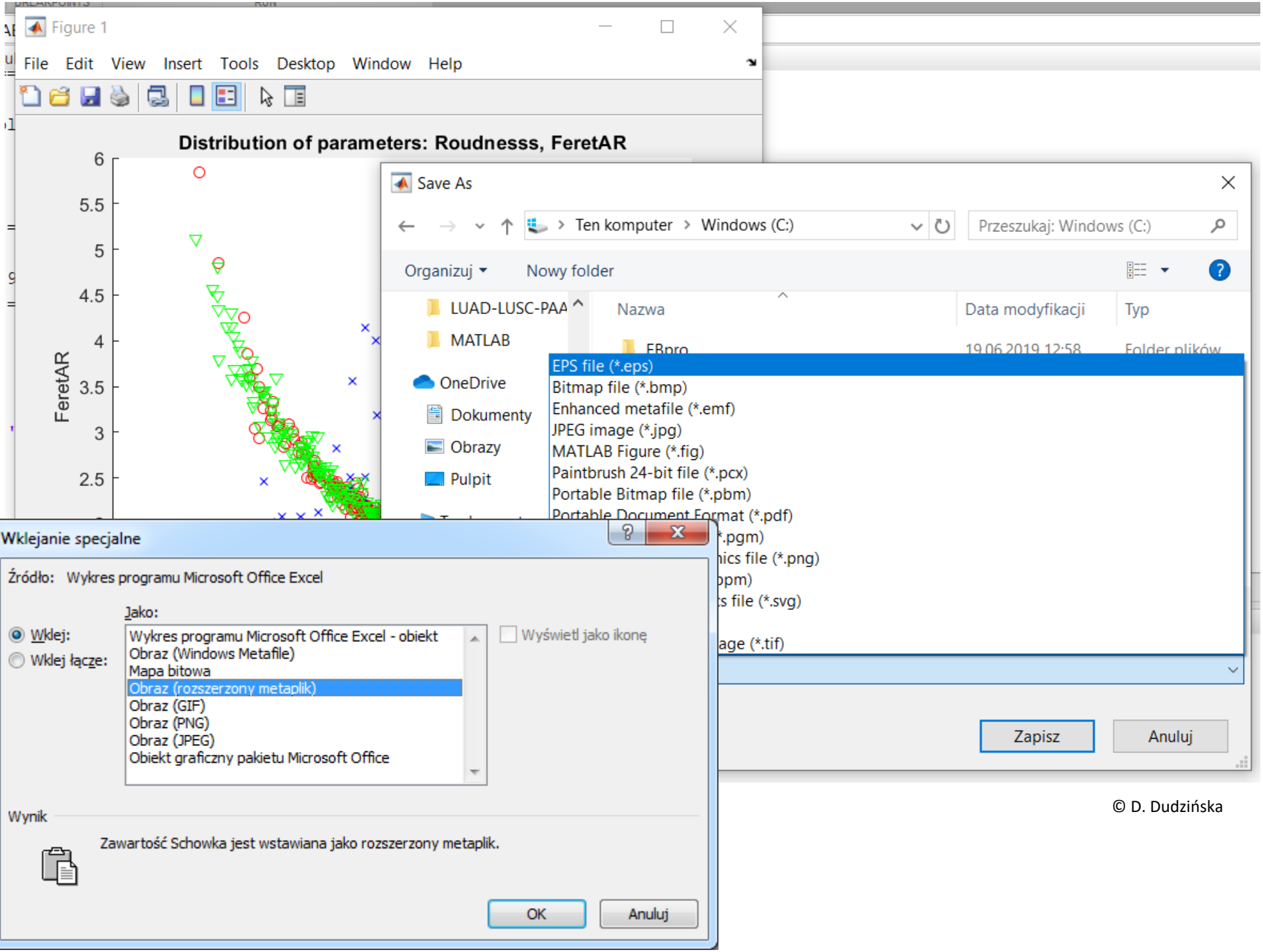
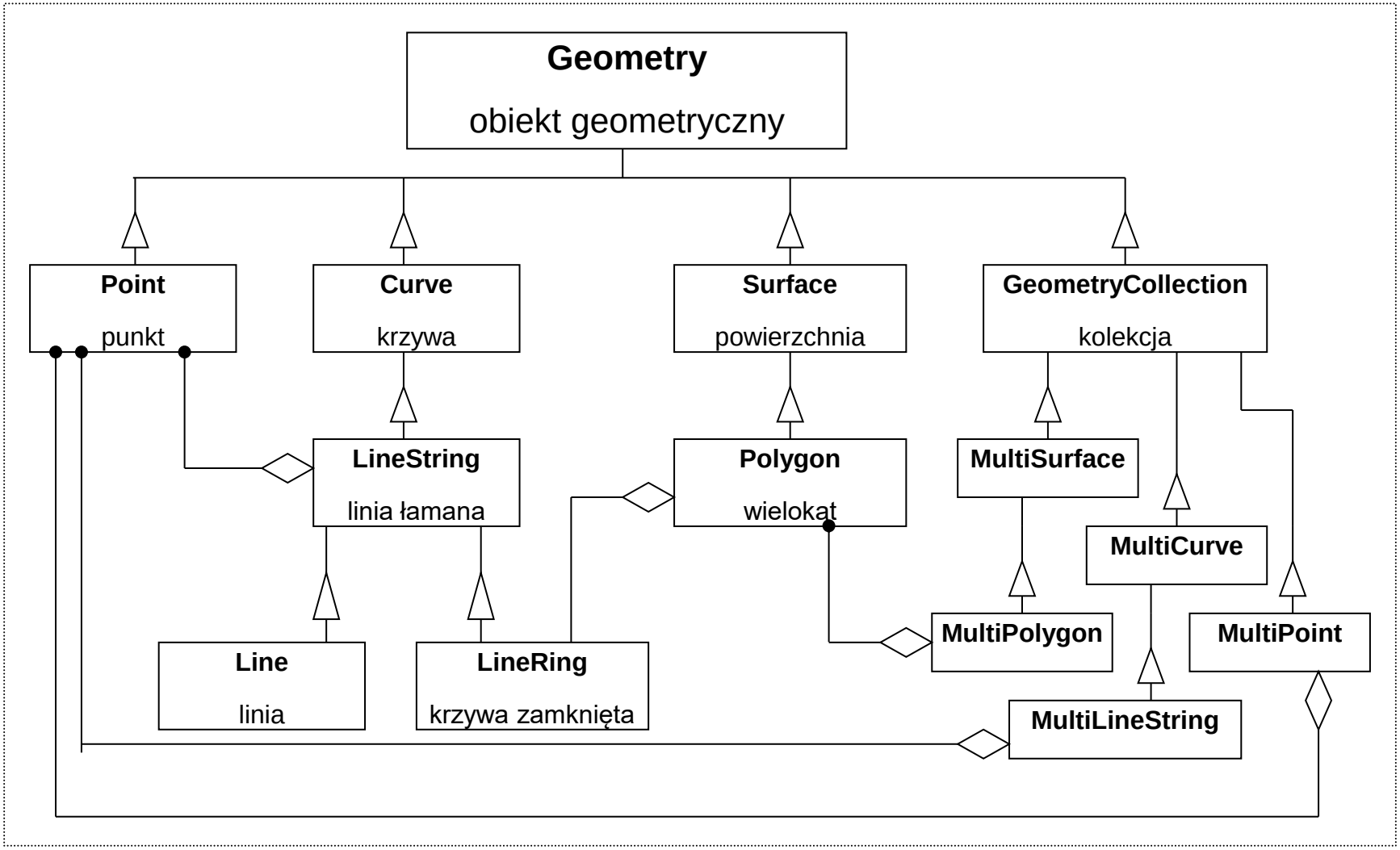


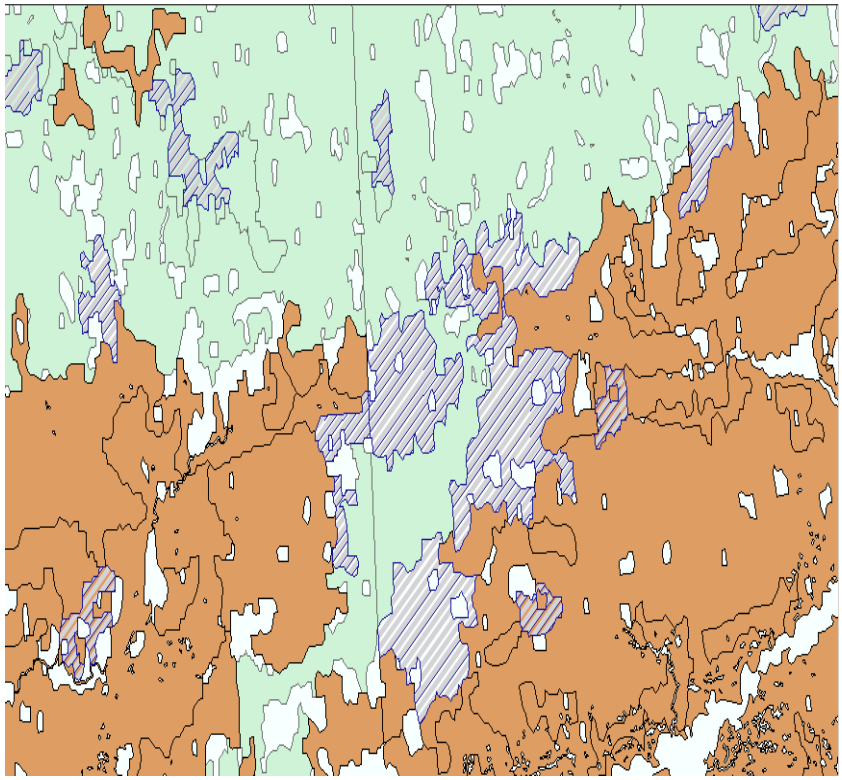
Figure 1
File Edit View Insert Tools Desktop Window Help
Distribution of parameters: Roudnesss, FeretAR
FeretAR
6
5.5
5
4.5
4
3.5
3
2.5
Save As
Ten komputer › Windows (C:)
Przeszukaj: Windows (C:)
Organizuj
Nowy folder
LUAD-LUSC-PAA
MATLAB
OneDrive
Dokumenty
Obrazy
Pulpit
Nazwa
Data modyfikacji
Typ
EBpro
19.06.2019 12:58
Folder plików
EPS file (*.eps)
Bitmap file (*.bmp)
Enhanced metafile (*.emf)
JPEG image (*.jpg)
MATLAB Figure (*.fig)
Paintbrush 24-bit file (*.pcx)
Portable Bitmap file (*.pbm)
Portable Document Format (*.pdf)
Zapisz
Anuluj
Wklejanie specjalne
Źródło: Wykres programu Microsoft Office Excel
Jako:
Wklej:
Wklej łącze:
Wykres programu Microsoft Office Excel - obiekt
Obraz (Windows Metafile)
Mapa bitowa
Obraz (rozszerzony metaplik)
Obraz (GIF)
Obraz (PNG)
Obraz (JPEG)
Obiekt graficzny pakietu Microsoft Office
Wyświetl jako ikonę
Wynik
Zawartość Schowka jest wstawiana jako rozszerzony metaplik.
OK
Anuluj

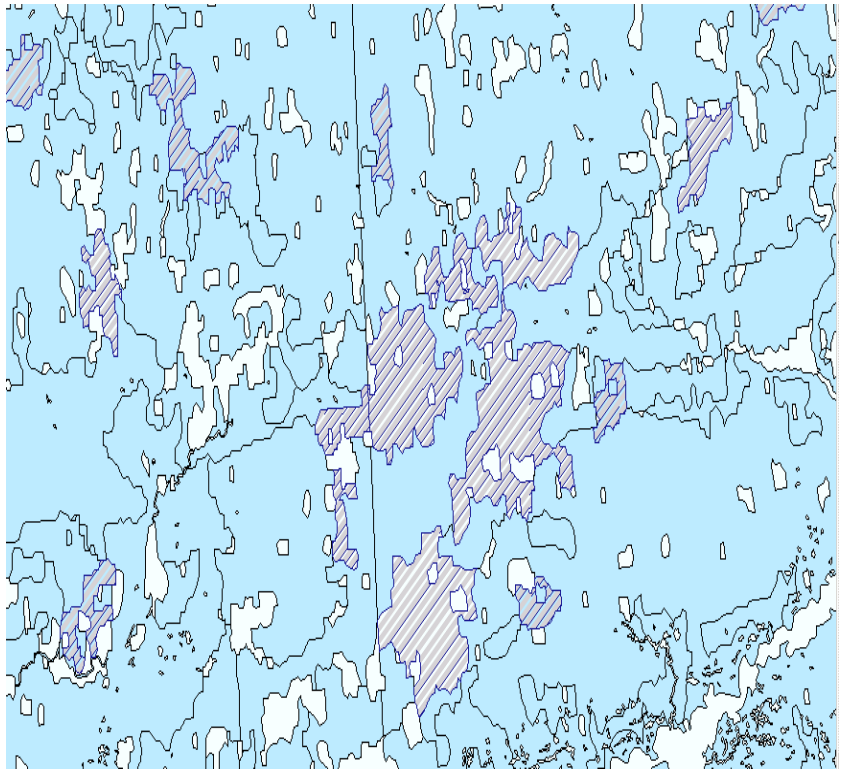
Krótko o grafice wektorowej



Część formatów definiuje wypełnienia, tekstury …

Krótko o grafice wektorowej

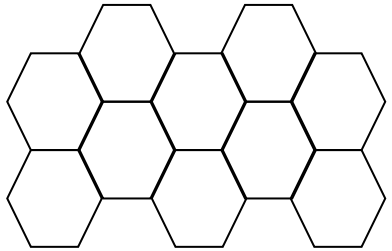




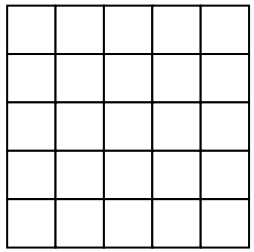
tundra, swamp, trees

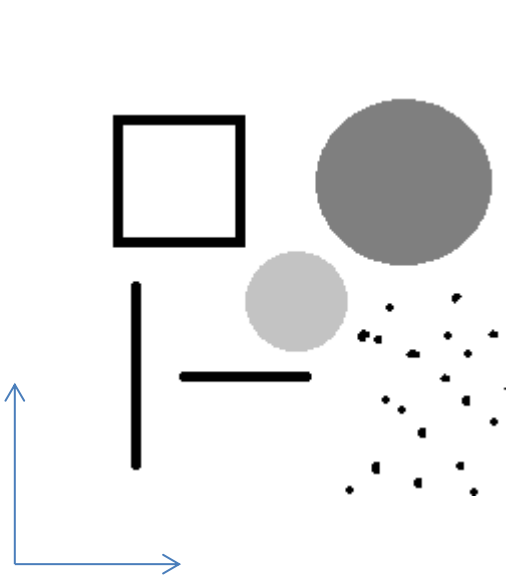
GRAFIKA RASTROWA (2D)

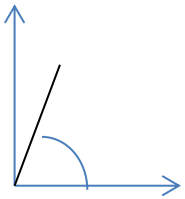
Najmniejszym elementem obrazu rastrowego jest **piksel**. (picture element)
Odpowiada on skwantyzowanej części widoku.



Organizacja pikseli:
-w zdecydowanej większości jest to siatka zbudowana z kwadratów,
- rzadko heksagonalna;
-w zdecydowanej większości siatka jest odwzorowaniem rzeczywistości w układzie kartezjańskim,
- rzadko: w układzie biegunowym, logarytmiczno-biegunowym







Metryka piksela (metadane):
-DPI (dots per inch)
- pixel spacing

3D ? -> voxel

GRAFIKA RASTROWA

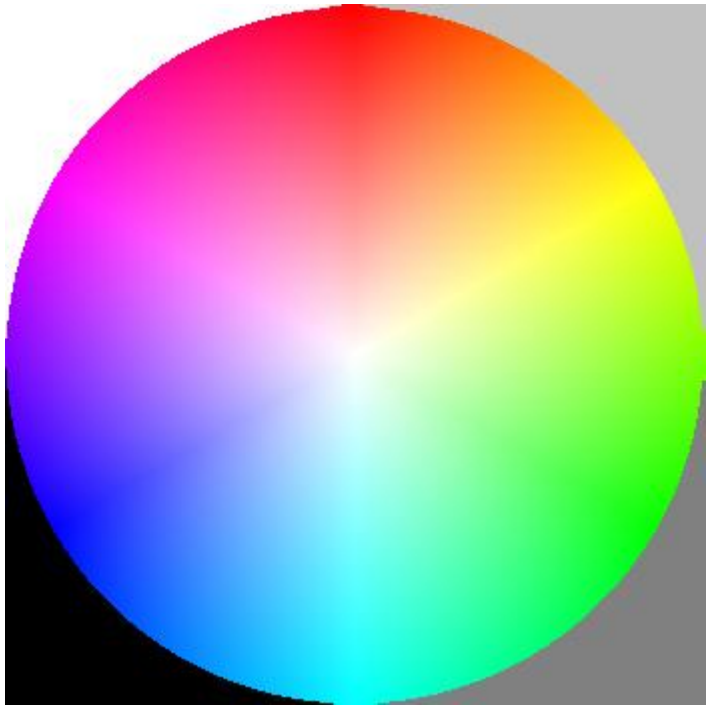
Głębia kolorów

- obraz monochromatyczny (jeden kolor, zmienna intensywność, najczęściej skala szarości):
  - -1 bit – (1bpp) 0/1, czarny/biały,
  - - 2 bit – (2bpp) 4 stopnie jasności lub paleta,
  - - 4 bit – (4bpp) 16 stopni jasności lub paleta,
  - - 8 bit – (8bpp) 256 stopni jasności lub paleta
  - - 16 bit – (16bpp) 65536 stopni szarości.
- obraz barwny (najczęściej przestrzeń barw RGB):
  - - 1 bit – paleta - dwa zdefiniowane kolory,
  - - 4 bit - paleta - 16 zdefiniowanych kolorów,
  - - 8 bit – paleta – 256 zdefiniowanych kolorów,
  - - 15/16 bit – high color – 5 bit dla R,G,B ew. 6 bit dla G,
  - - 24 bit – 8bit R x 8bit G x 8bit B (true color),
  - - 32 bit - 8bit R x 8bit G x 8bit B x kanał alfa (przeźroczystość, ARGB albo RGBA).

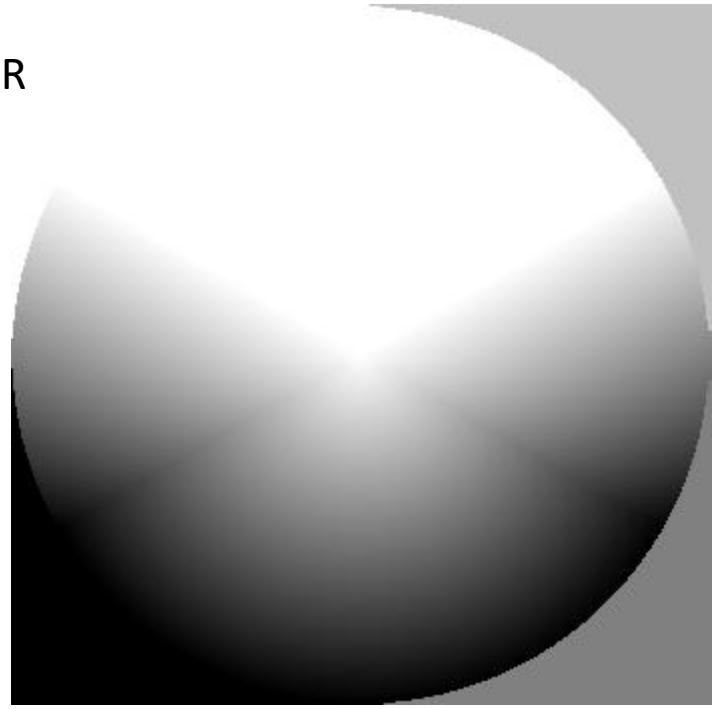
  opcjonalnie: wybór koloru oznaczającego przeźroczystość

Przestrzenie barw

- RGB (Red-Green-Blue)
- CIE Lab (International Comission on Illumination)
- HSV (HSB) / HSL   (Hue-Saturation-Brightness/Value - Lightness)
- CMYK (Cyan-Magenta-Yellow-blacK)
- YCbCr / YUV
- XYZ,
- LMS, …

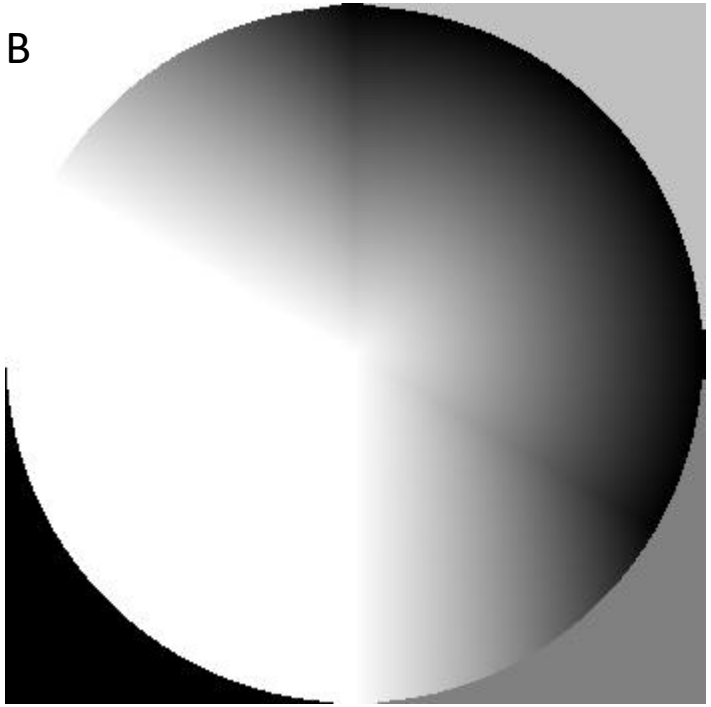


R

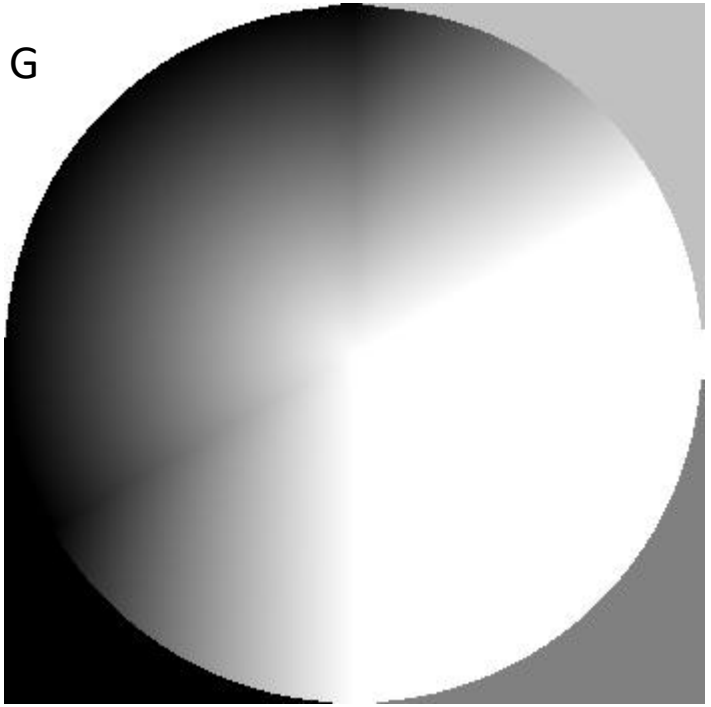


RGB

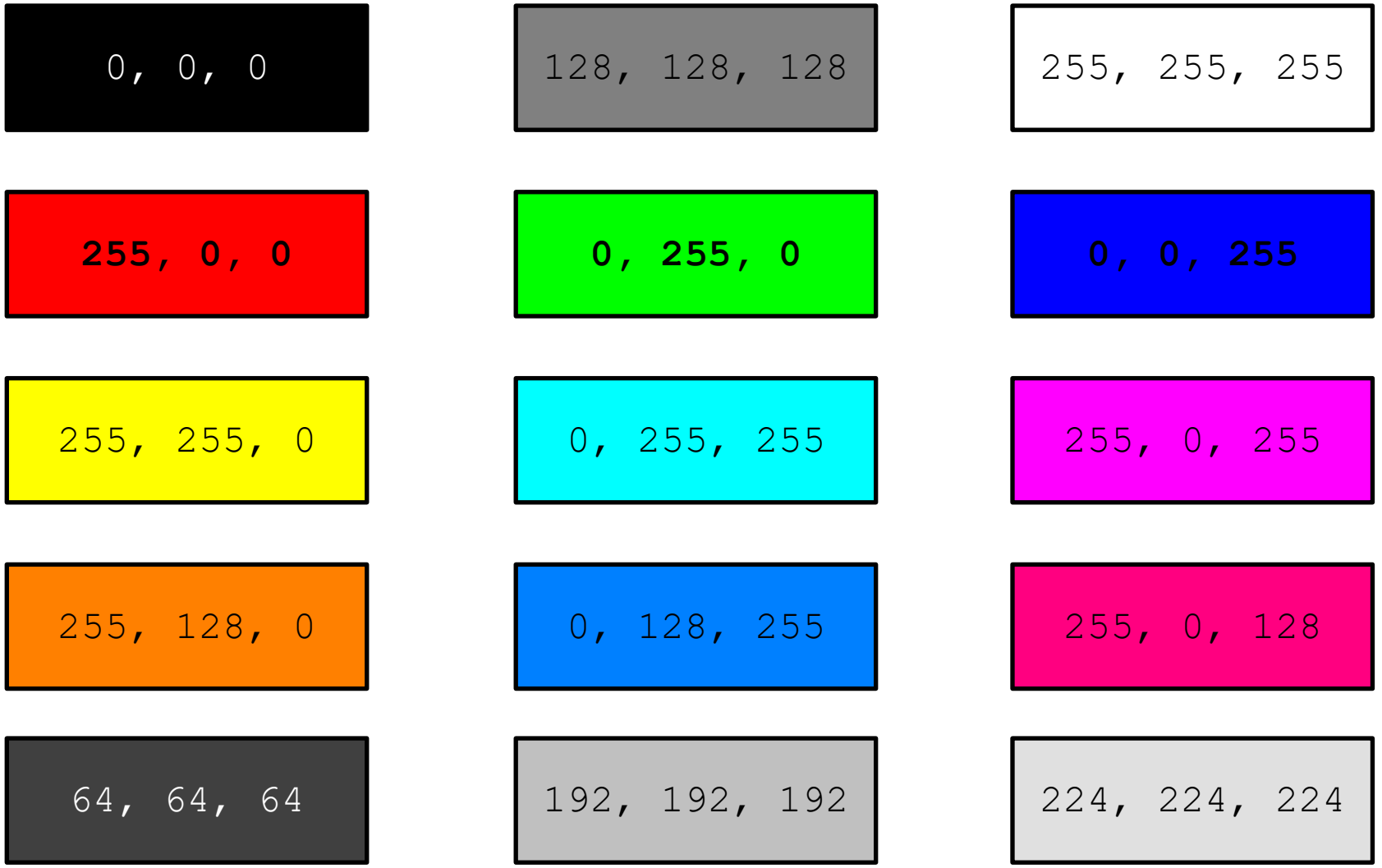
B



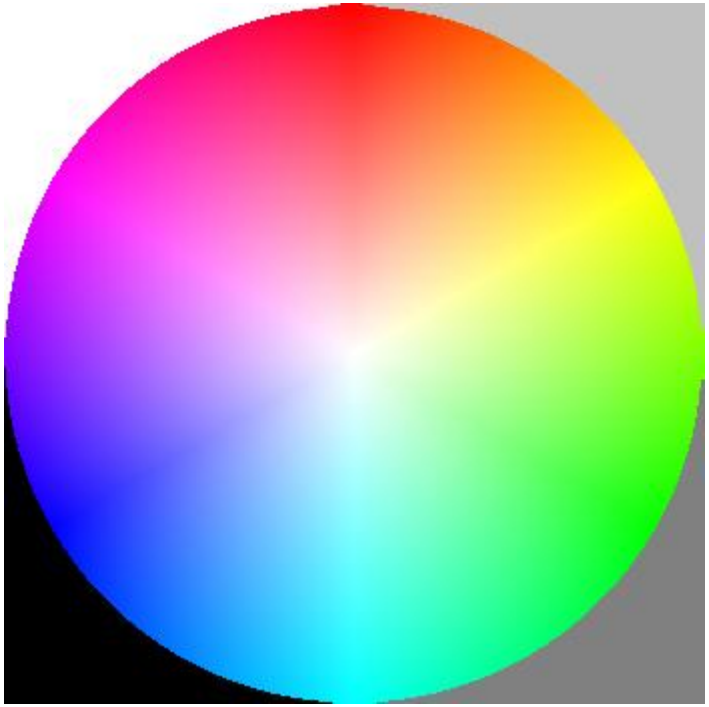
G



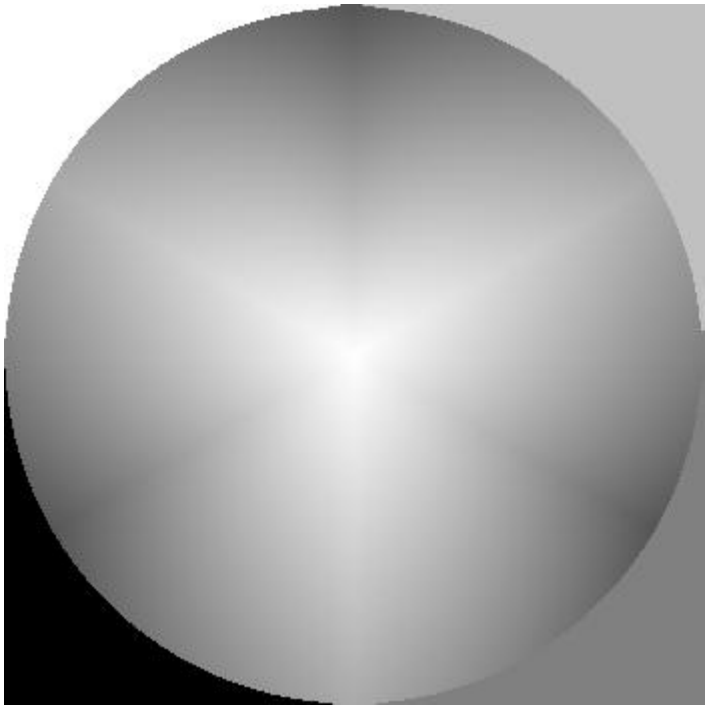
RGB – 24 bpp – 8b/8b/8b



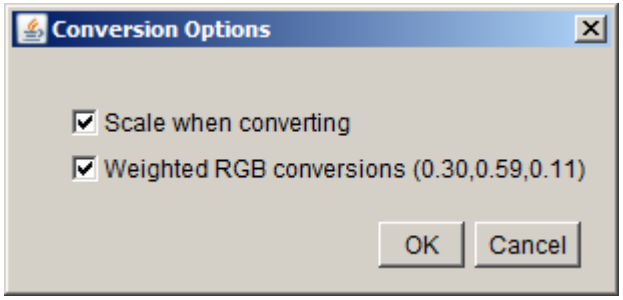
RGB – konwersja do skali szarości

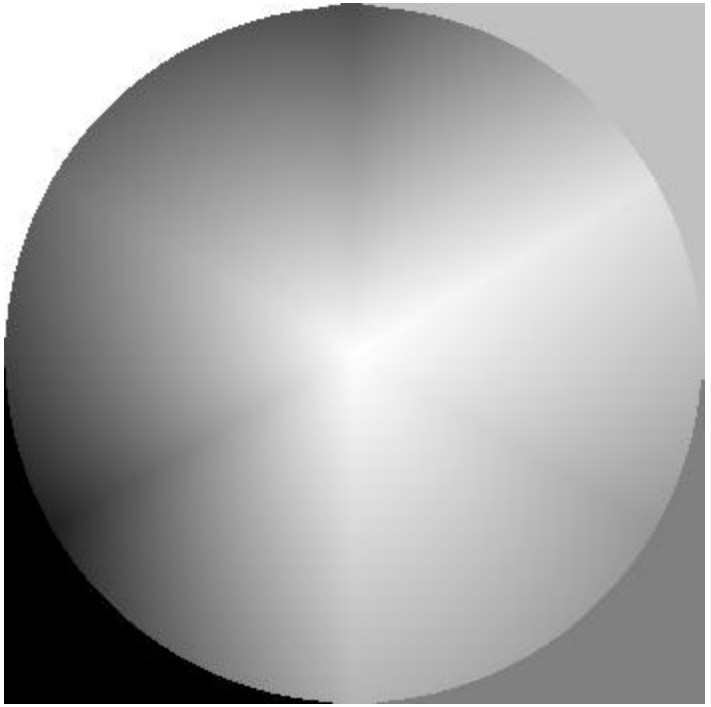


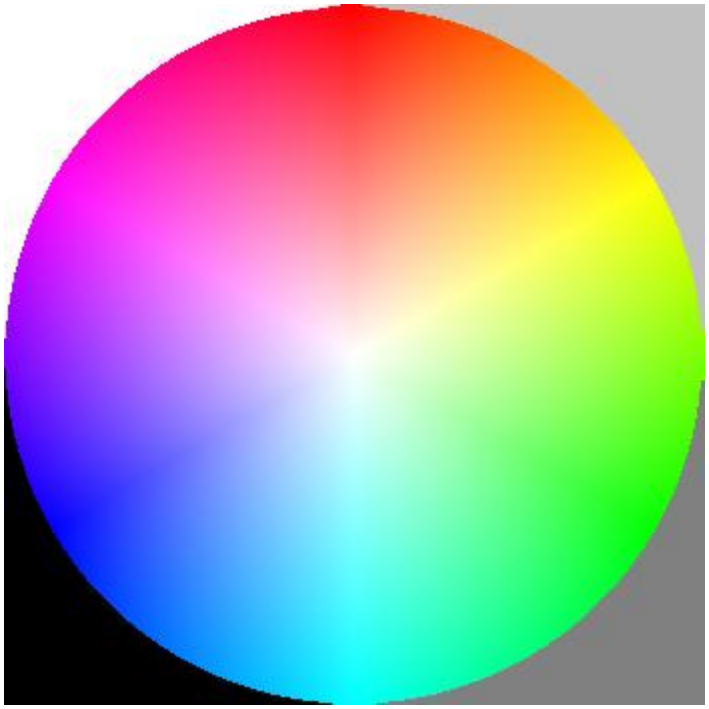
I = (R+G+B)/3
intensywność

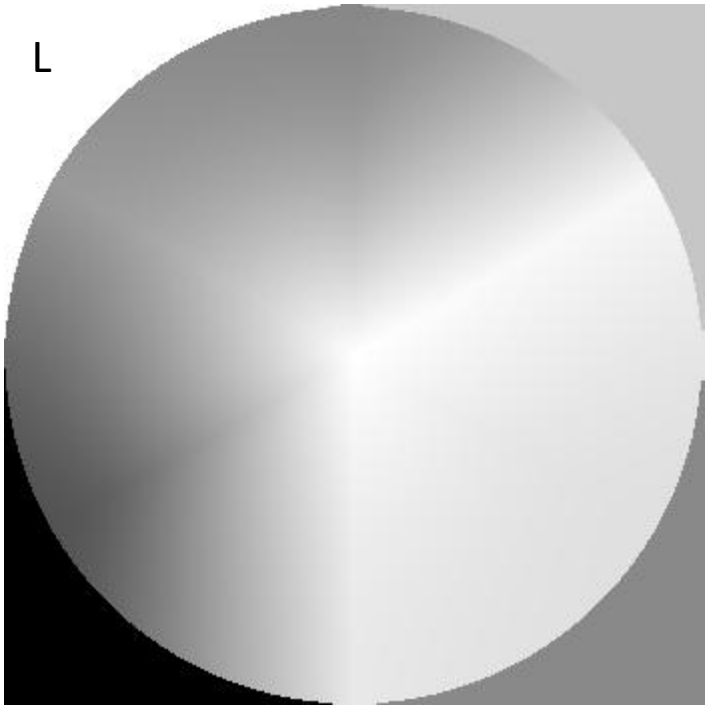


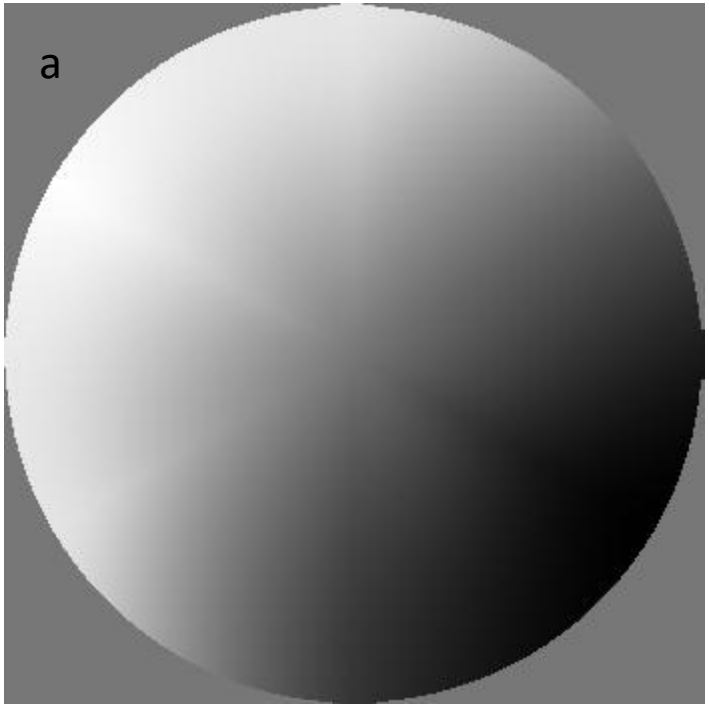
Y' = 0.299*R + 0.587*G + 0.114*B

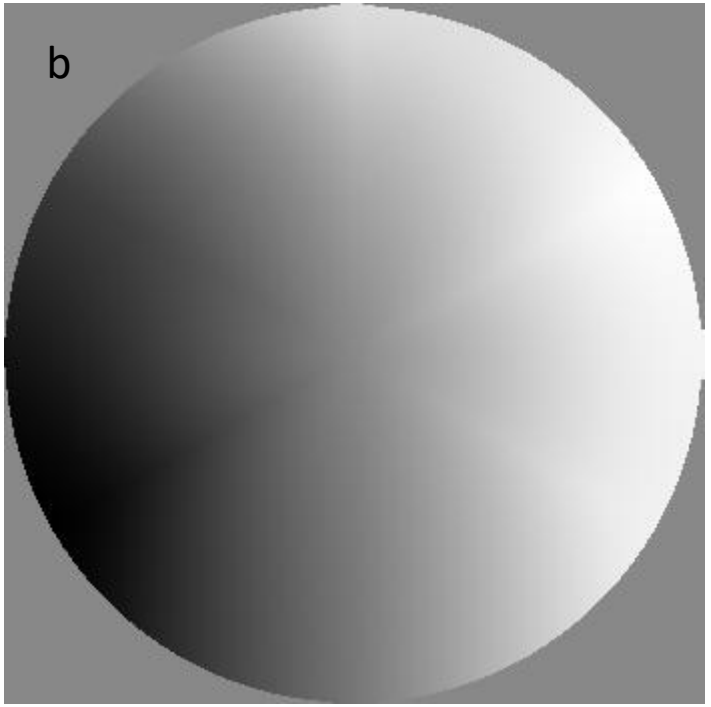












(CIE) Lab

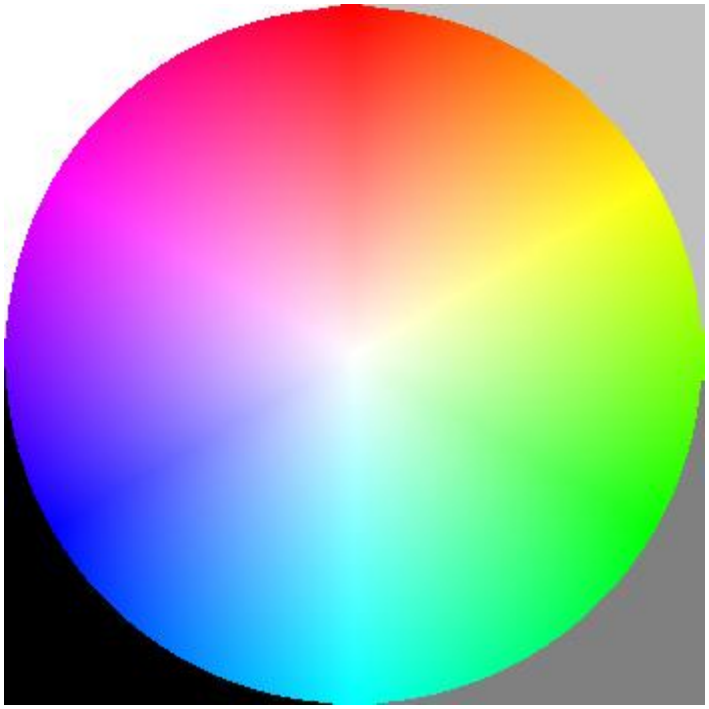
L

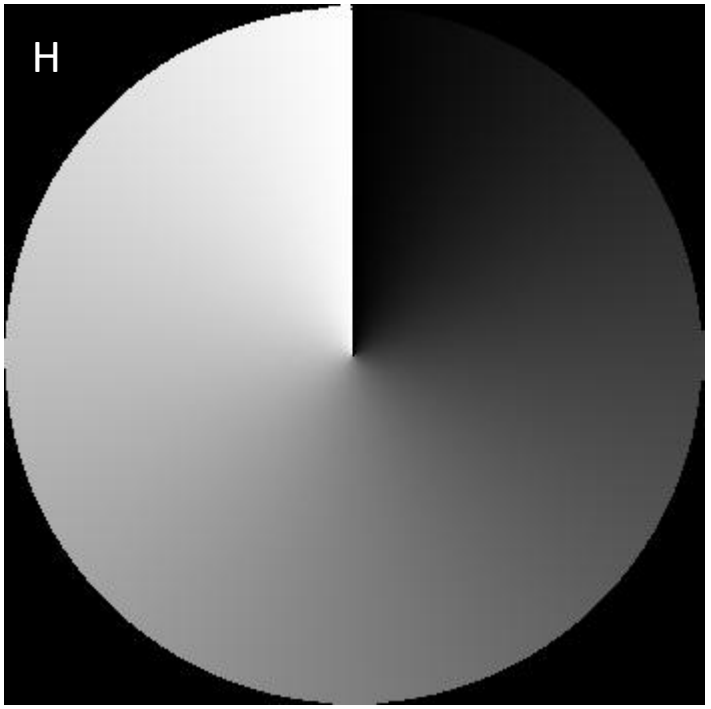
Zależności (przybliżone!)

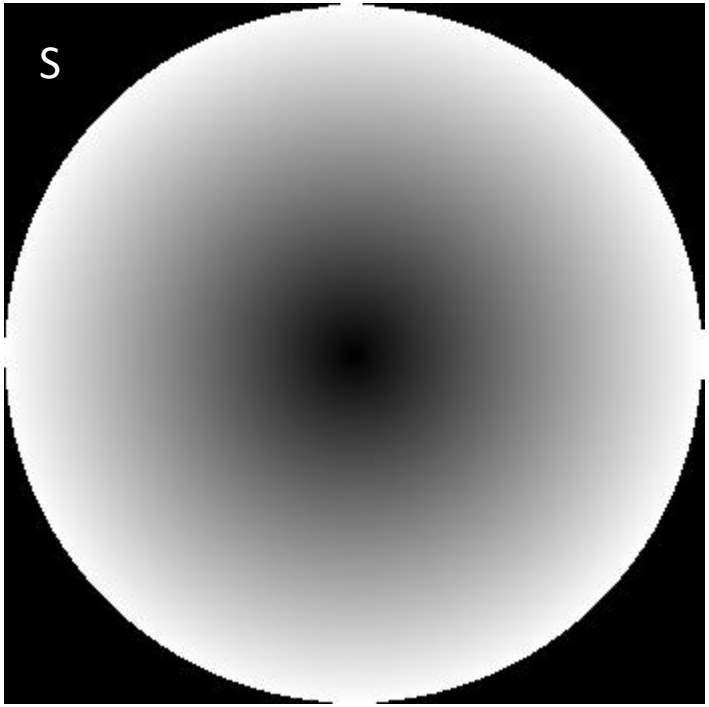
L: R + G + B

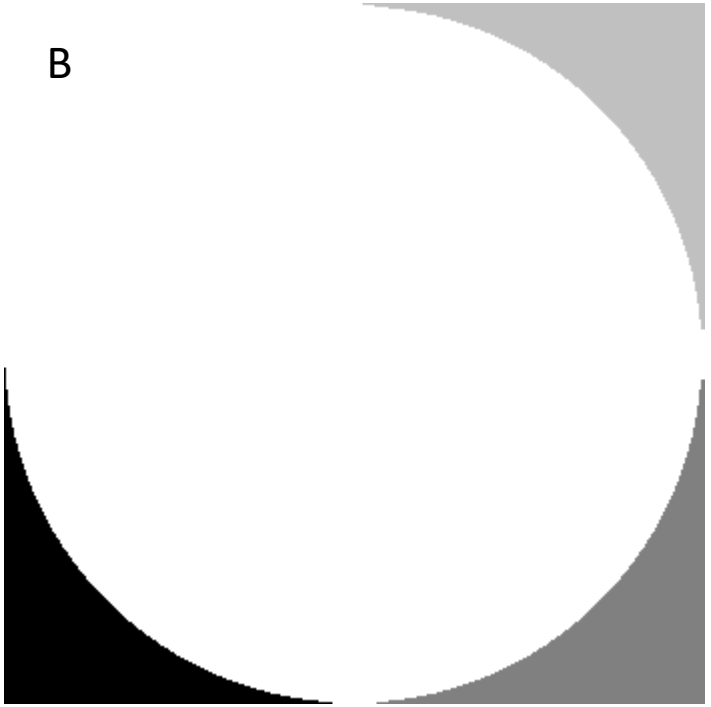
α: R+G-B (yellow-blue)

β: R-G (red-green)









HSB

Hue
Saturation
Brightness

Hue:
odcień,
koło barw –
wartość kątowa

Saturation:
nasycenie

Brightness
Value
(max jest najjaśniejszym kolorem)
a
Lightness
(max jest biały)

Konwersje między przestrzeniami barw

RGB -> XYZ -> LMS -> Lab

$$\begin{bmatrix} X \\ Y \\ Z \end{bmatrix} = \begin{bmatrix} 0.5141 & 0.3239 & 0.1604 \\ 0.2651 & 0.6702 & 0.0641 \\ 0.0241 & 0.1228 & 0.8444 \end{bmatrix} \begin{bmatrix} R \\ G \\ B \end{bmatrix}$$

$$\begin{bmatrix} L \\ M \\ S \end{bmatrix} = \begin{bmatrix} 0.3897 & 0.6890 & 0.0787 \\ 0.2298 & 1.1834 & 0.0464 \\ 0.0000 & 0.0000 & 1.0000 \end{bmatrix} \begin{bmatrix} X \\ Y \\ Z \end{bmatrix}$$

l = log(L)
m=log(M)
s = log(S)

$$\begin{bmatrix} L \\ a \\ b \end{bmatrix} = \begin{bmatrix} \frac{1}{\sqrt{3}} & 0 & 0 \\ 0 & \frac{1}{\sqrt{6}} & 0 \\ 0 & 0 & \frac{1}{\sqrt{2}} \end{bmatrix} \begin{bmatrix} 1 & 1 & 1 \\ 1 & 1 & -2 \\ 1 & -1 & 0 \end{bmatrix} \begin{bmatrix} l \\ m \\ s \end{bmatrix}$$

Konwersje między przestrzeniami barw

RGB -> HSV

r = R/255
g = G/255
b = B/255

M = max(r,g,b)
m = min(r,g,b)
d = M-m = 2(V-L)

V = M

$$\boldsymbol{S} = \begin{cases} \frac{d}{M} & M \neq 0 \\ 0 & M = 0 \end{cases}$$

$$\boldsymbol{H} = \begin{cases} 0^o & d = 0 \\ 60^o \times \left(\frac{g-b}{d} mod 6\right) & M = r \\ 60^o \times \left(\frac{b-r}{d} + 2\right) & M = g \\ 60^o \times \left(\frac{r-g}{d} + 4\right) & M = b \end{cases}$$

Czasem się przydaje ...

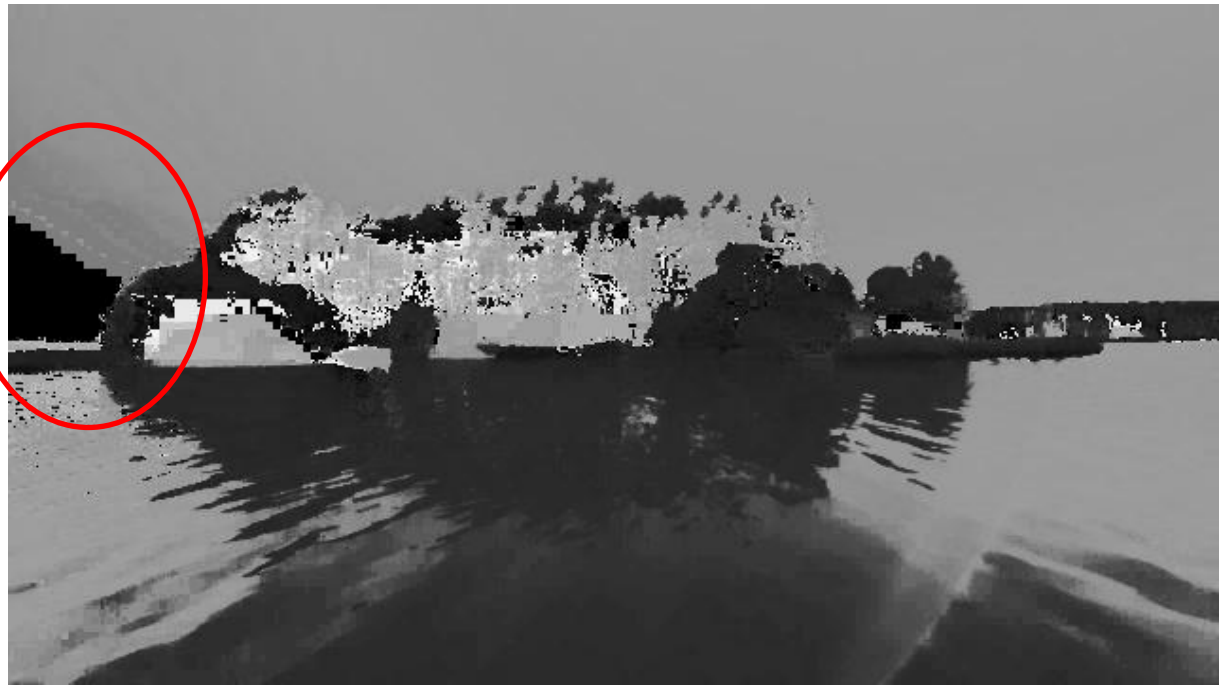
L

Y

HSB: S

Czasem się przydaje ...

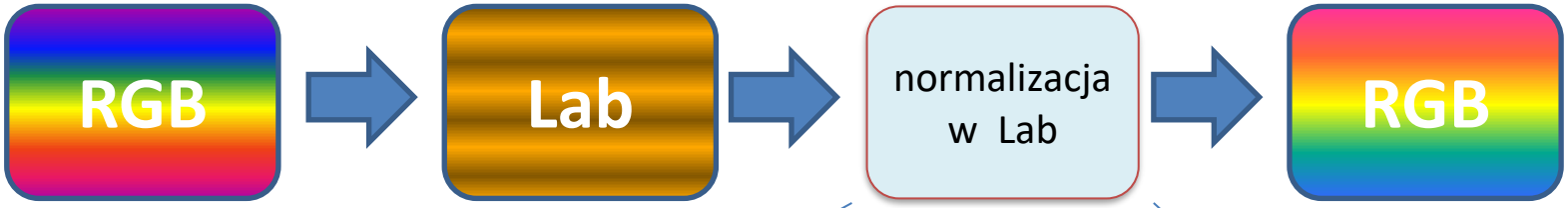
HSB: H



A czasem nie ...

HSB: H

Transfer Kolorów



$$\mu = \frac{1}{N}\sum_{i=1}^{N} A_i$$

$$S = \sqrt{\frac{1}{N-1}\sum_{i=1}^{N} |A_i - \mu|^2}$$

$$L^* = L - < L >$$

$$a^* = a - < a >$$

$$b^* = b - < b >$$

$$L' = \frac{\sigma_t^L}{\sigma_s^L} L^* \qquad a' = \frac{\sigma_t^a}{\sigma_s^a} a^* \qquad b' = \frac{\sigma_t^b}{\sigma_s^b} b^*$$

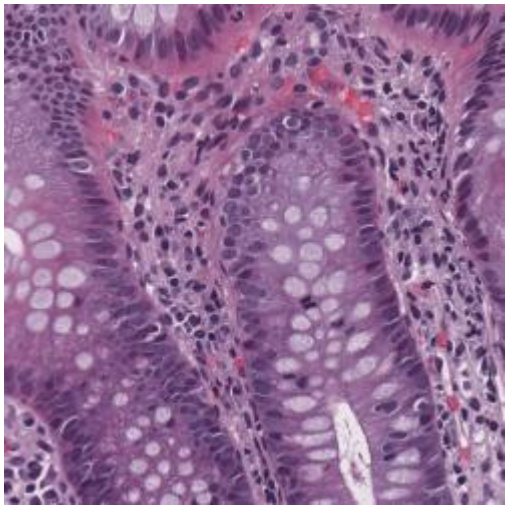
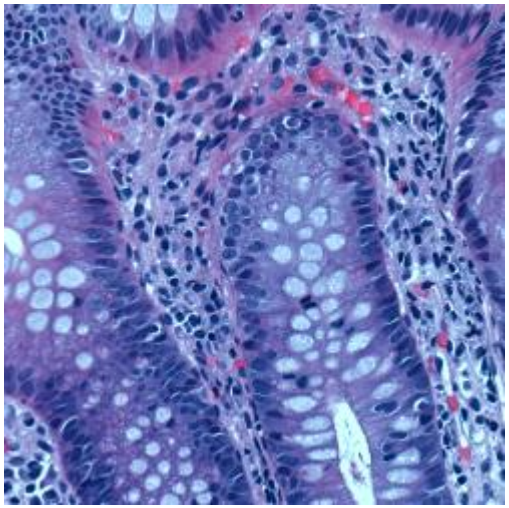
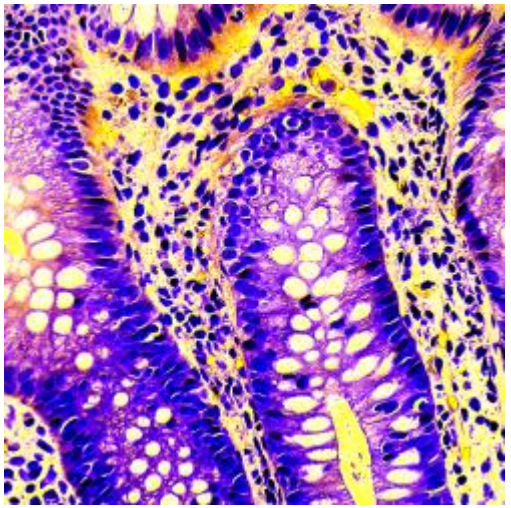
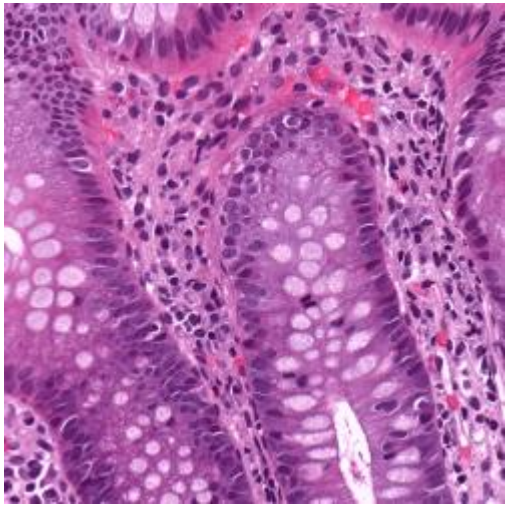
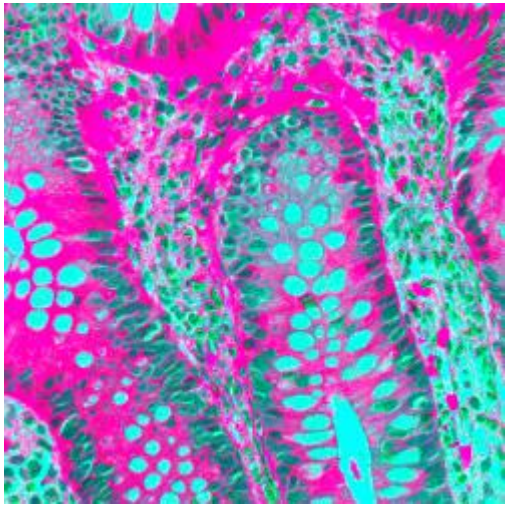
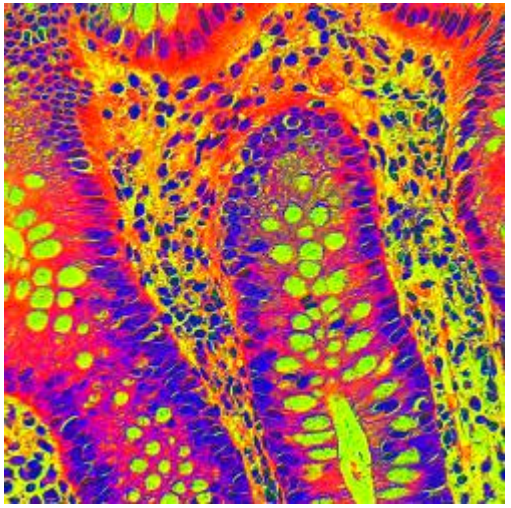
Normalizacja parametrów Lab obrazu docelowego (target) do parametów Lab obrazu źródłowego (source)

Reinhard, E., Adhikhmin, M., Gooch, B., & Shirley, P. (2001):
Color transfer between images. IEEE Computer graphics and applications, 21(5), 34-41.

Onder, D., Zengin, S., and Sarioglu, S. (2014) A review on color normalization and color deconvolution methods in histopathology. Applied Immunohistochemistry & Molecular Morphology 22.10 (2014): 713-719.

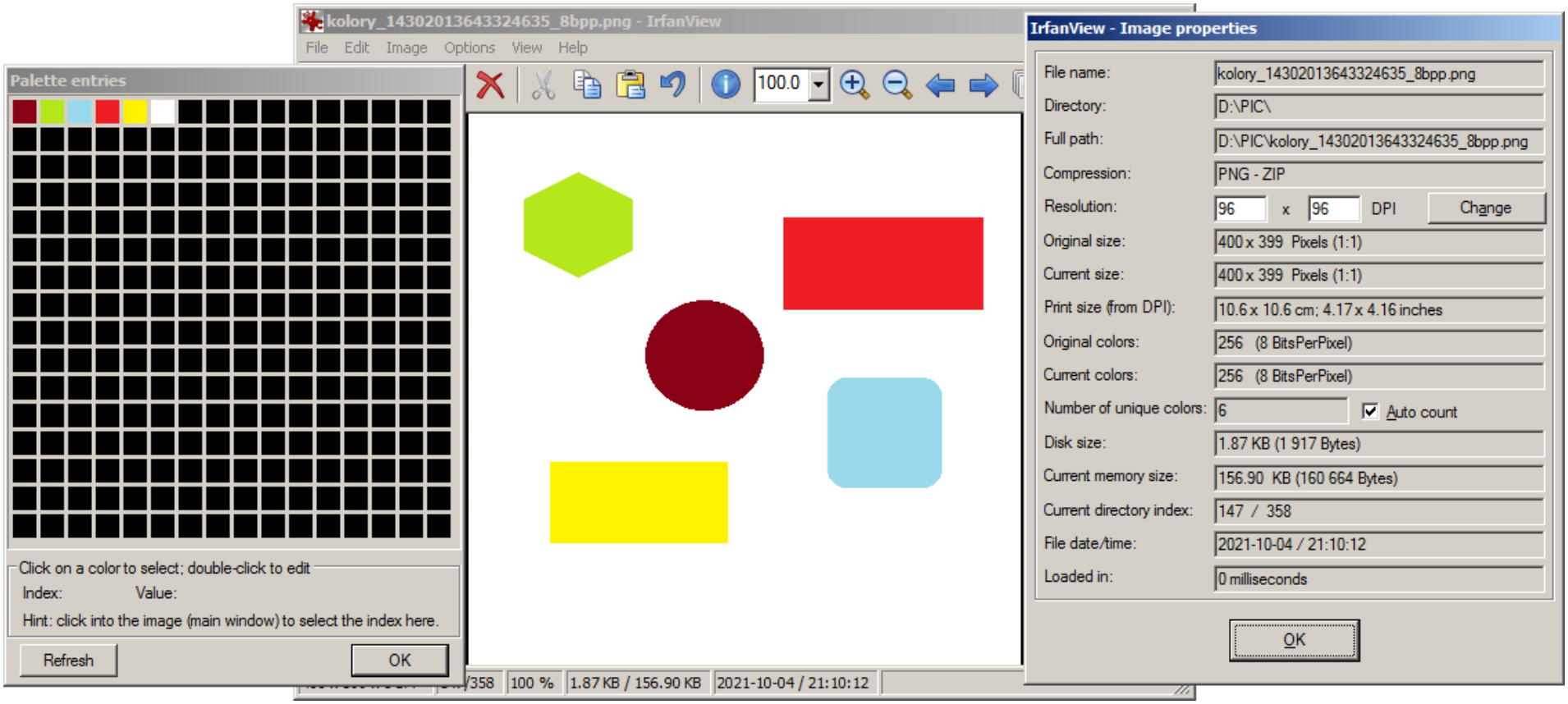
Transfer Kolorów

Transfer Kolorów

GRAFIKA RASTROWA

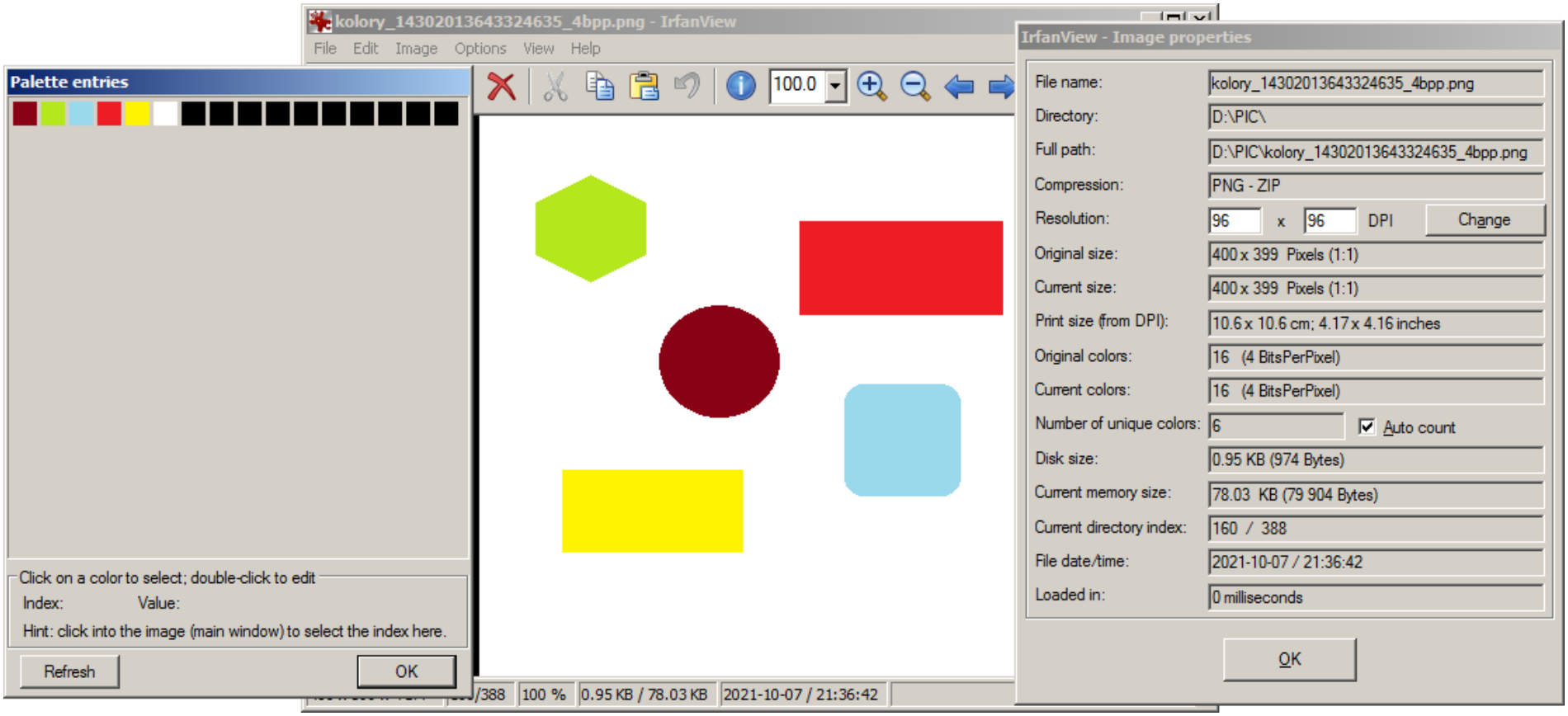
Paleta kolorów
Przykład: 256 (8bit)



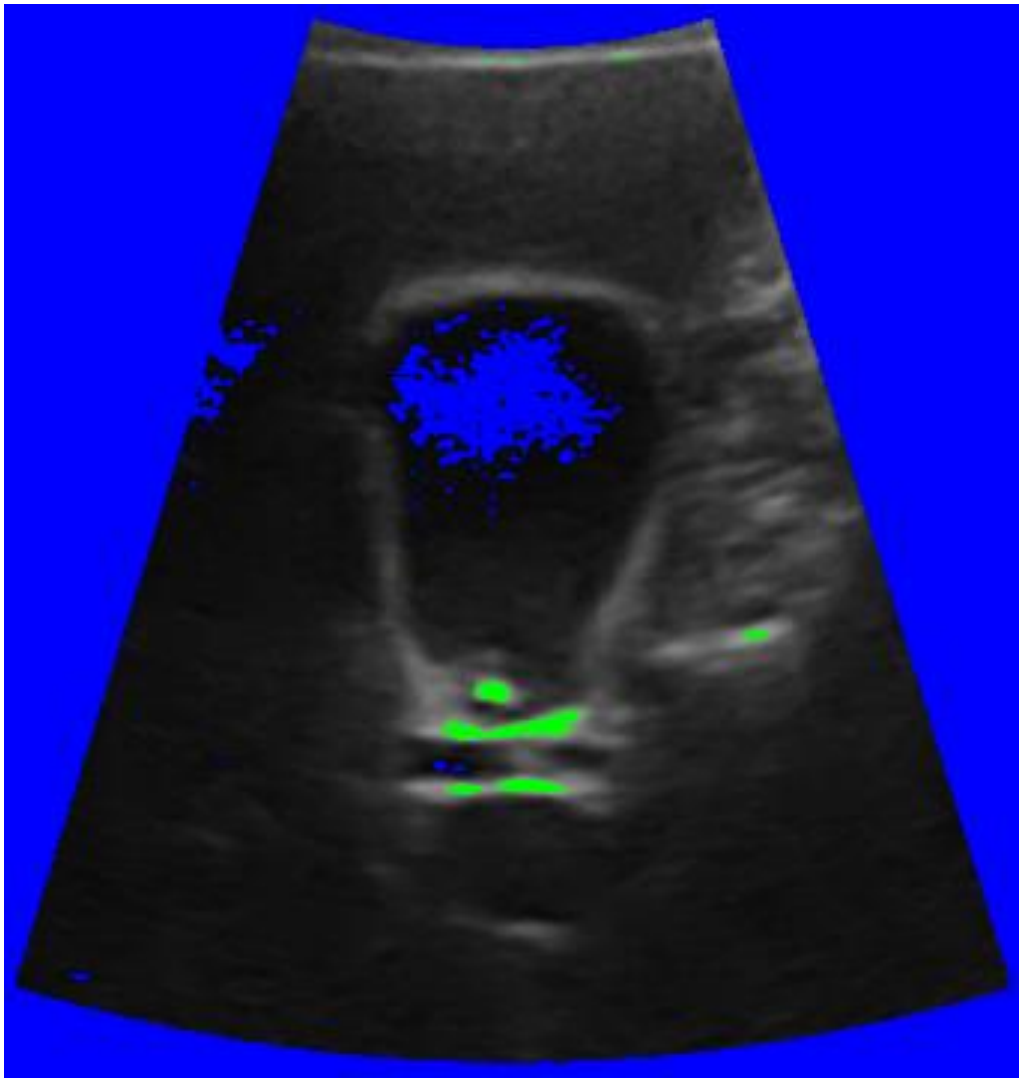
1.87KB

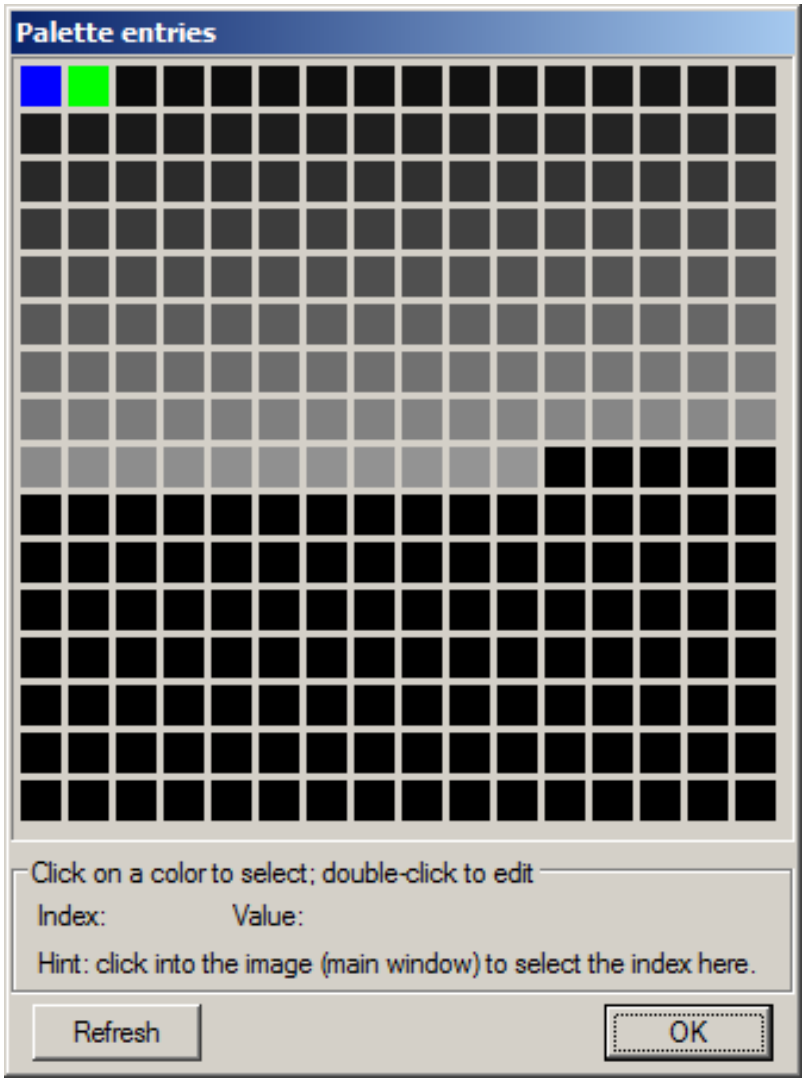
GRAFIKA RASTROWA

Paleta kolorów
Przykład: 16 (4bit)

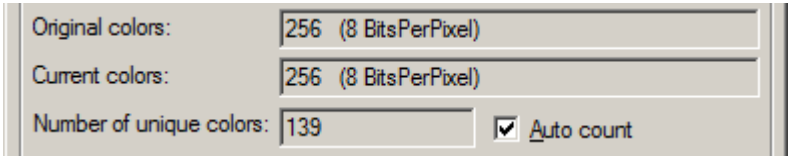


0.95KB

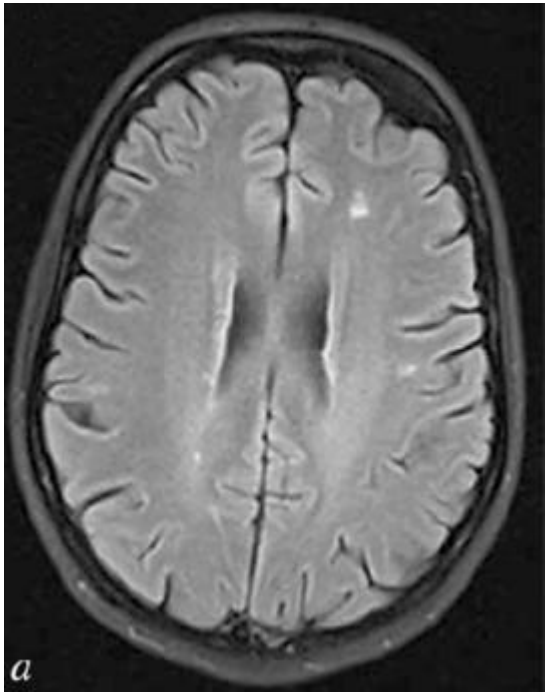



Palette entries
Click on a color to select; double-click to edit
Index:
Value:
Hint: click into the image (main window) to select the index here.
Refresh
OK

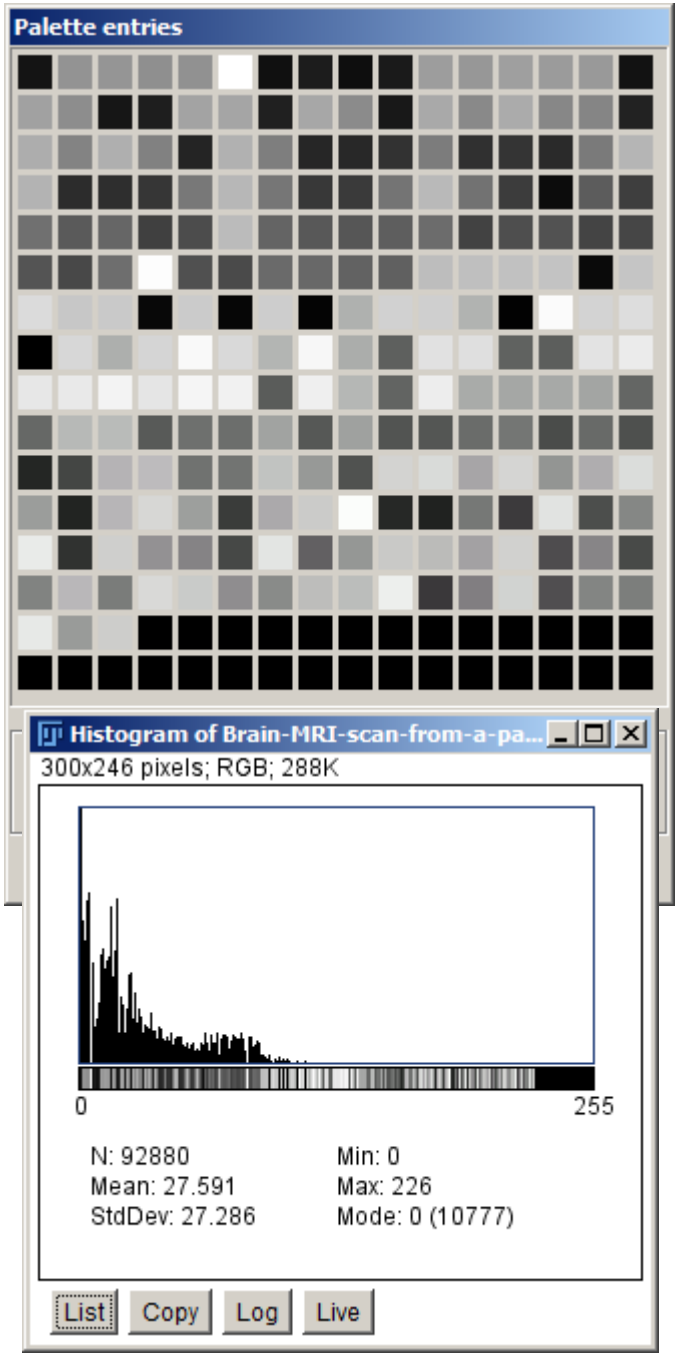

0
255

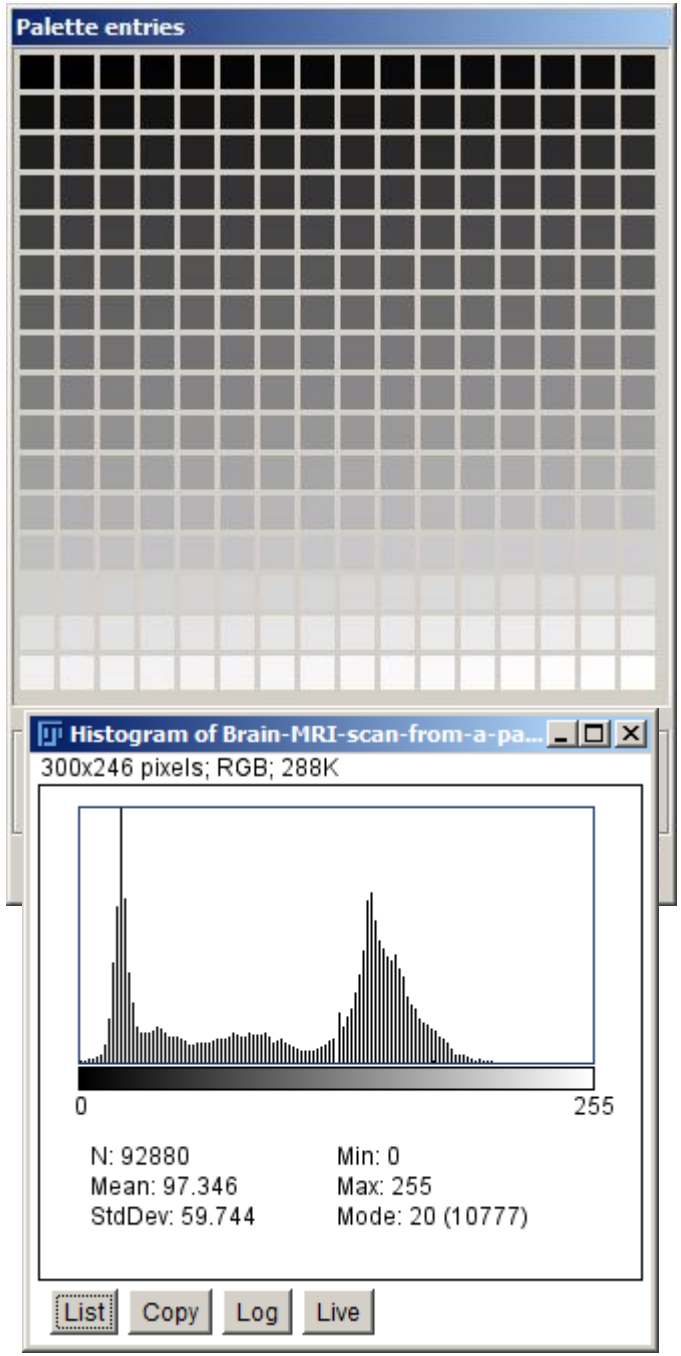

Original colors:
256 (8 BitsPerPixel)
Current colors:
256 (8 BitsPerPixel)
Number of unique colors:
139
Auto count

Ostrożność podczas przetwarzania i interpretacji obrazów z paletą

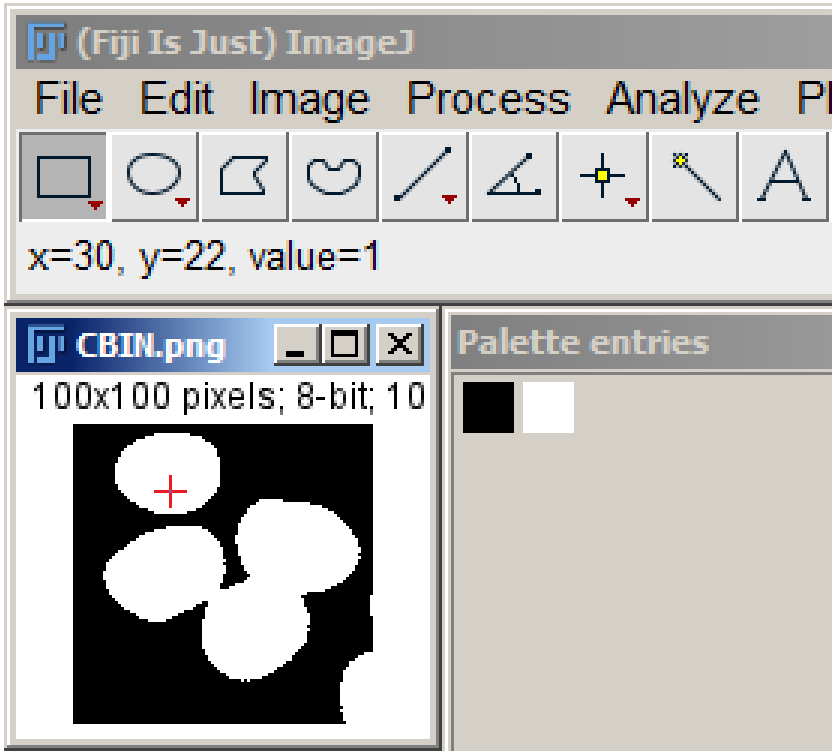


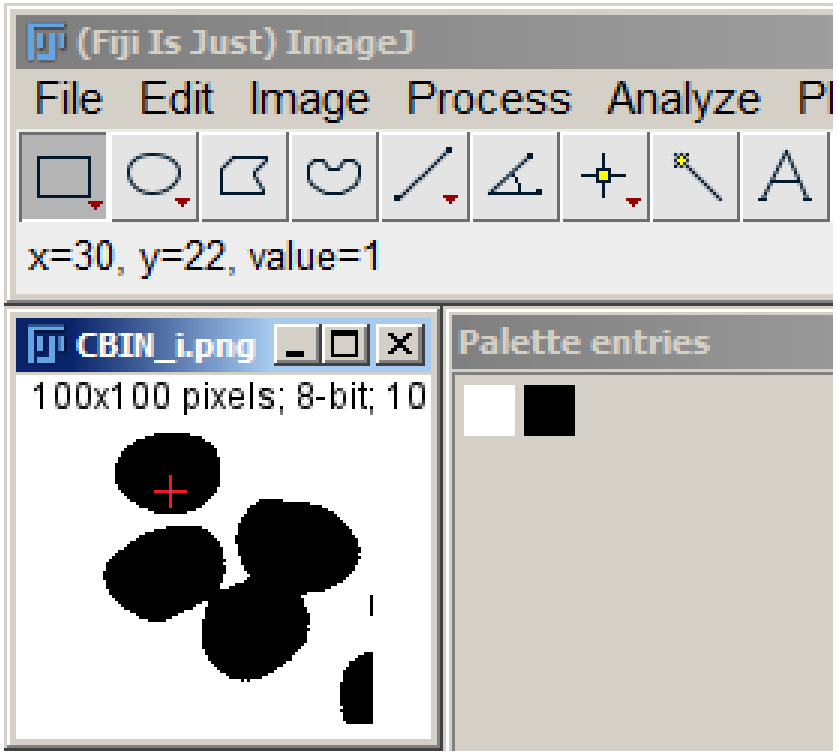
10.1007/s11055-018-0618-0





Ostrożność podczas przetwarzania i interpretacji obrazów z paletą





Głębia

Skala szarości, 8bit

0, 1

0, 10

0, 20

0, 30

0, 40

0, 50

0, 100

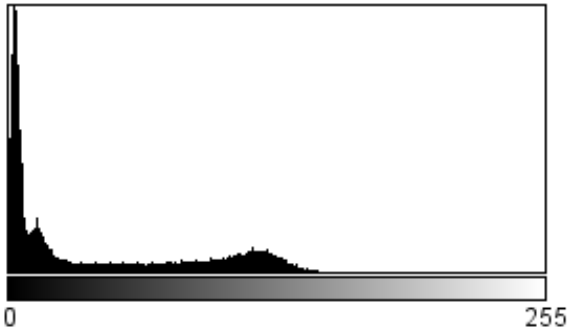
0, 128

0, 192

0, 255

Głębia

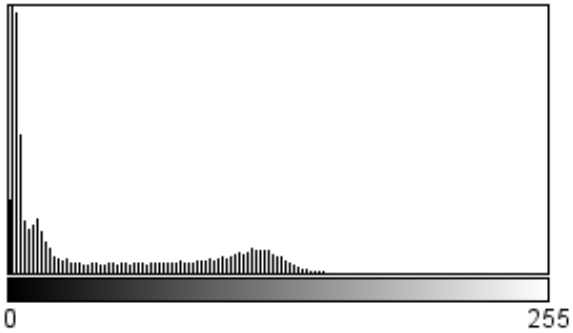
oryginał



N: 147456
Mean: 42.847
StdDev: 47.686
Value: 216

Min: 0
Max: 255
Mode: 2 (11387)
Count: 3

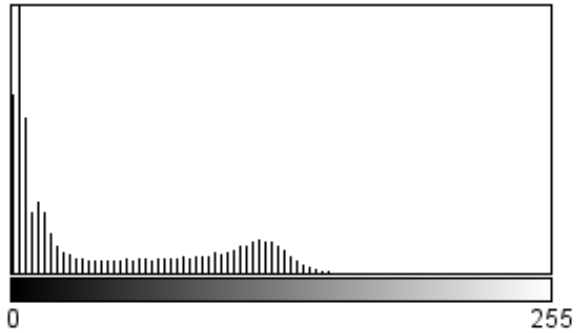
/2, normalizacja



N: 147456
Mean: 42.376
StdDev: 47.660
Value: 118

Min: 0
Max: 255
Mode: 1 (20643)
Count: 0

/3, normalizacja

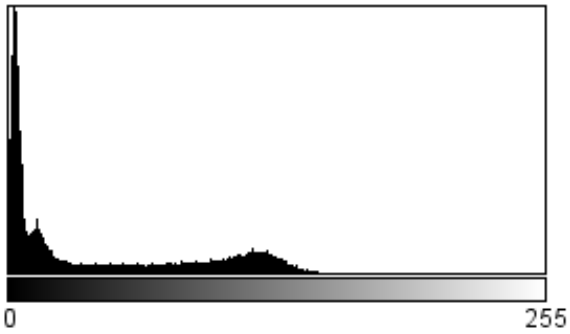


N: 147456
Mean: 42.834
StdDev: 47.707

Min: 0
Max: 255
Mode: 3 (31389)

Głębia

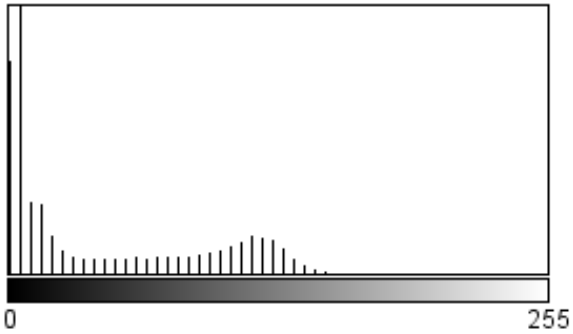
oryginał (u:244)



N: 147456
Mean: 42.847
StdDev: 47.686
Value: 216

Min: 0
Max: 255
Mode: 2 (11387)
Count: 3

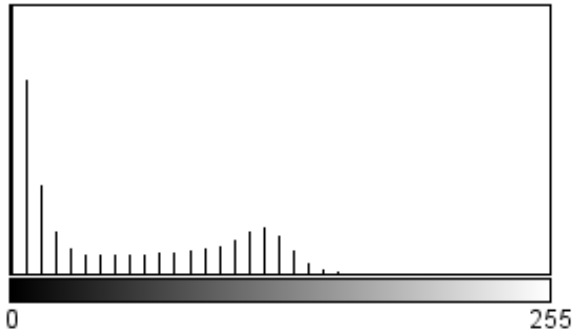
/5, normalizacja



N: 147456
Mean: 42.805
StdDev: 47.738

Min: 0
Max: 255
Mode: 5 (33151)

/7, normalizacja

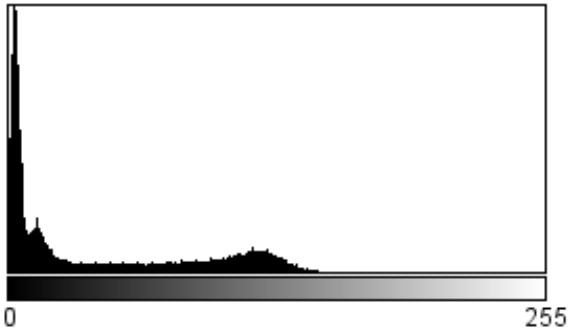


N: 147456
Mean: 42.981
StdDev: 48.310

Min: 0
Max: 255
Mode: 0 (37563)

Głębia

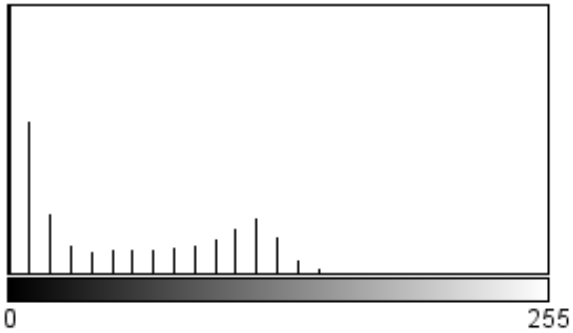
oryginał (u:244)



N: 147456
Mean: 42.847
StdDev: 47.686
Value: 216

Min: 0
Max: 255
Mode: 2 (11387)
Count: 3

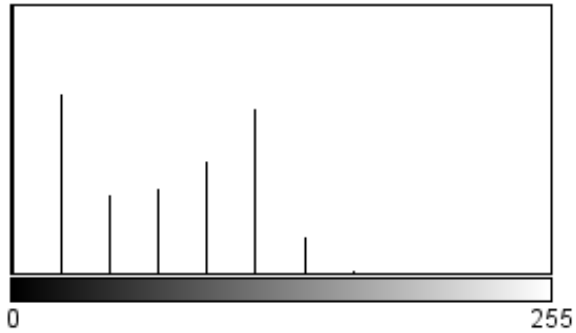
/10, normalizacja



N: 147456
Mean: 41.585
StdDev: 47.218
Value: ---

Min: 0
Max: 255
Mode: 0 (46412)
Count: ---

/24, normalizacja



N: 147456
Mean: 40.437
StdDev: 47.082
Value: ---

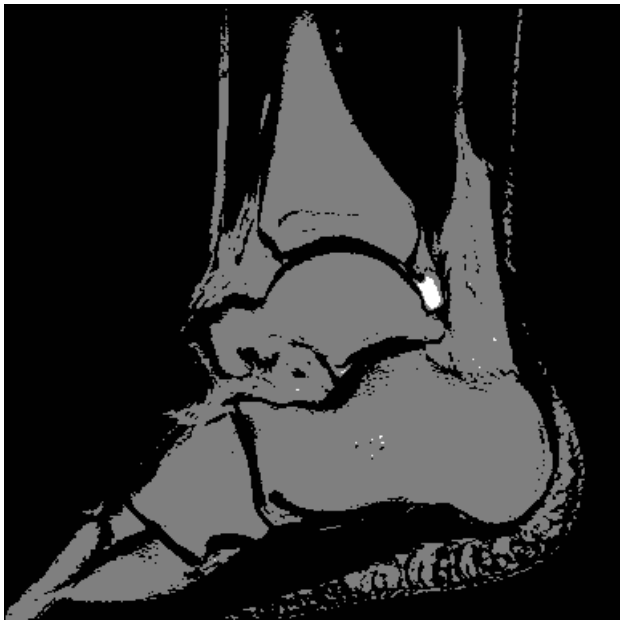
Min: 0
Max: 255
Mode: 0 (66616)
Count: ---

Głębia

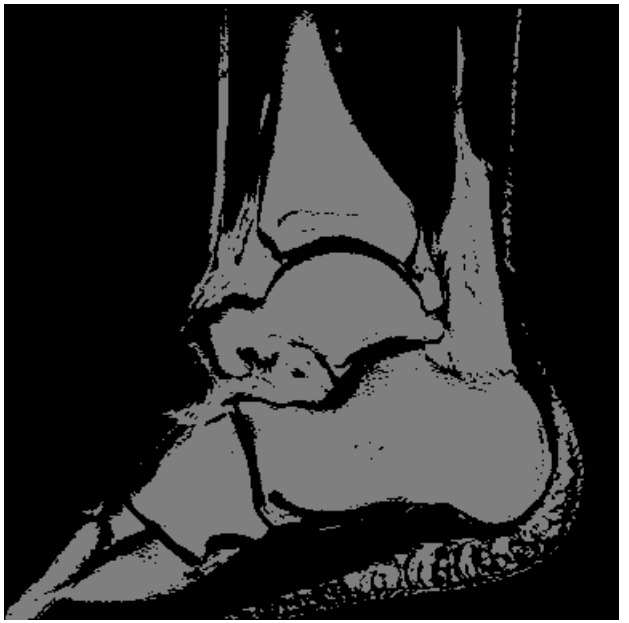
9 kolorów

5 kolorów

3 kolory

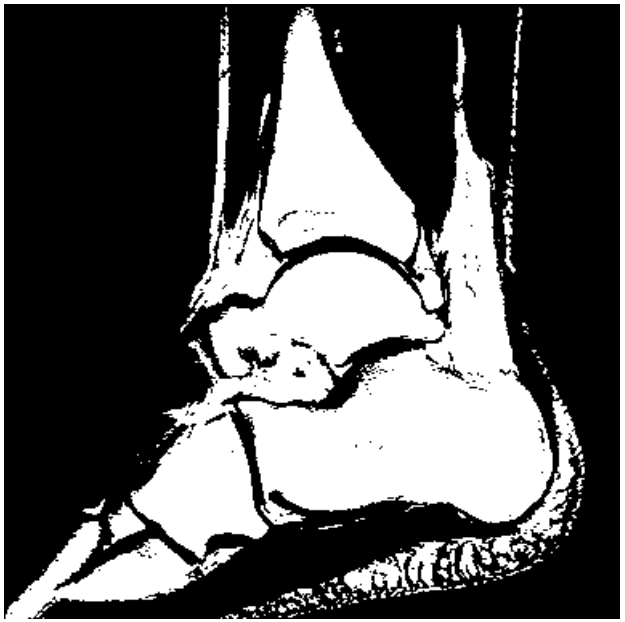


2 kolory

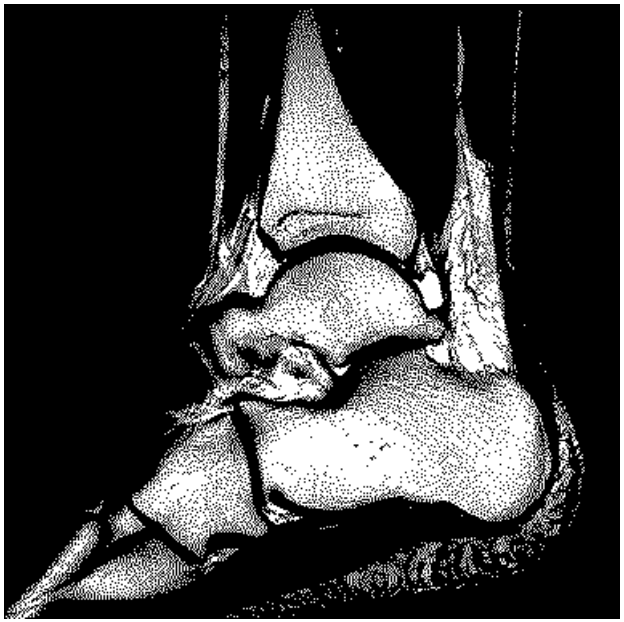


Dithering

oryginał



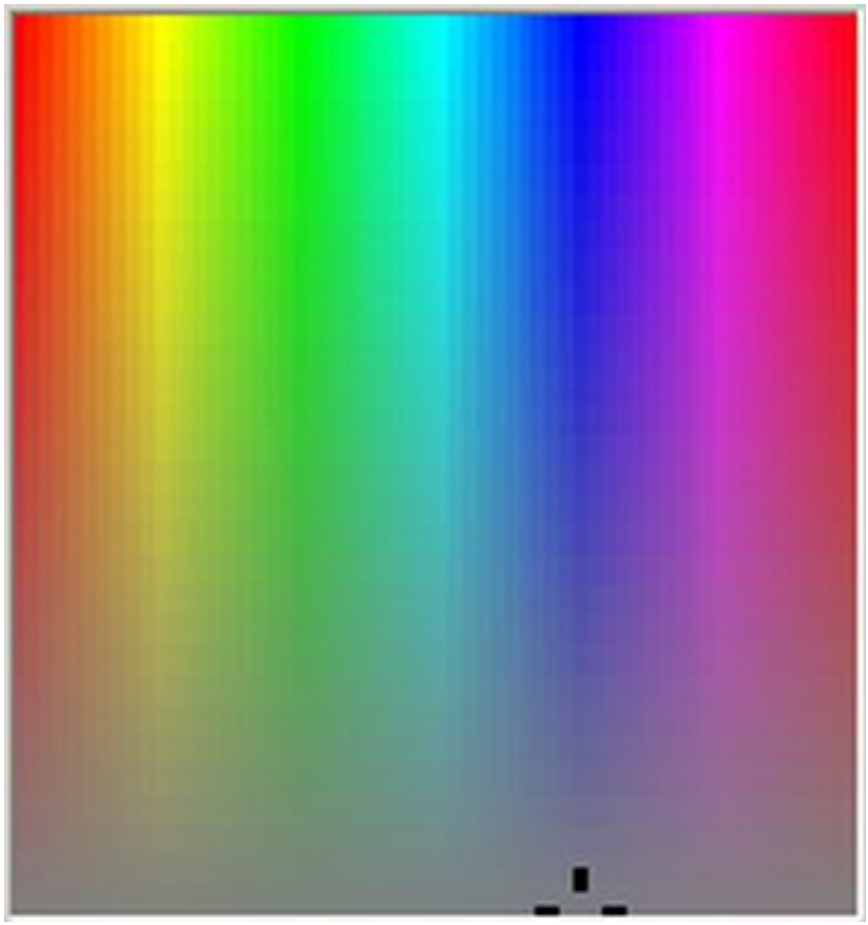
2 kolory - binaryzacja



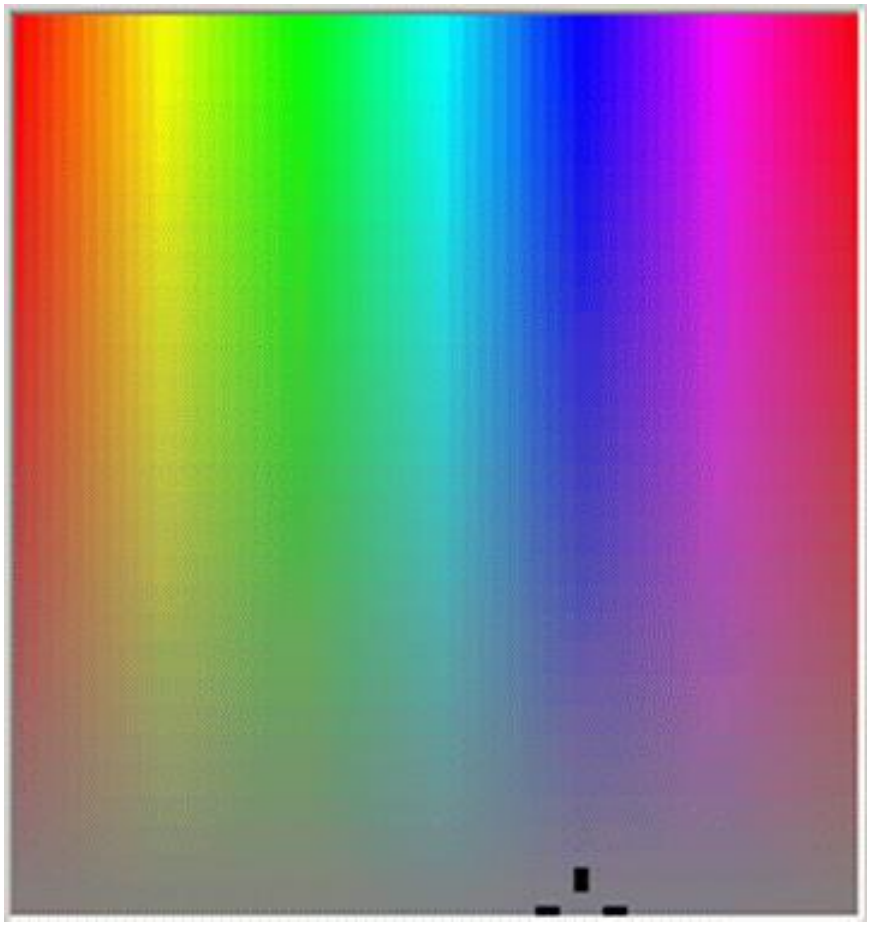
2 kolory - dithering

Dithering

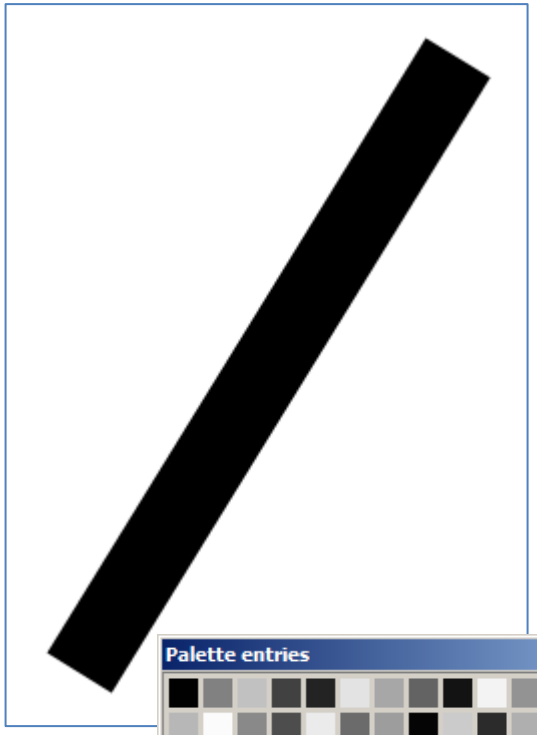
Src, 24335 unikalnych kolorów

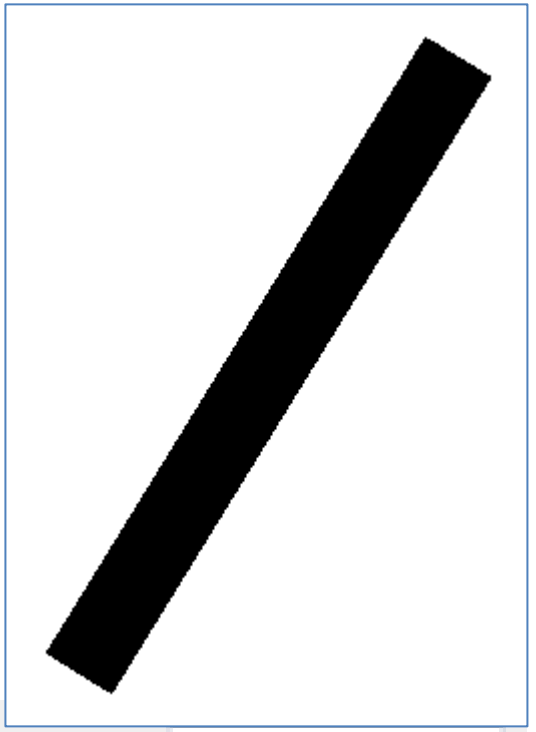


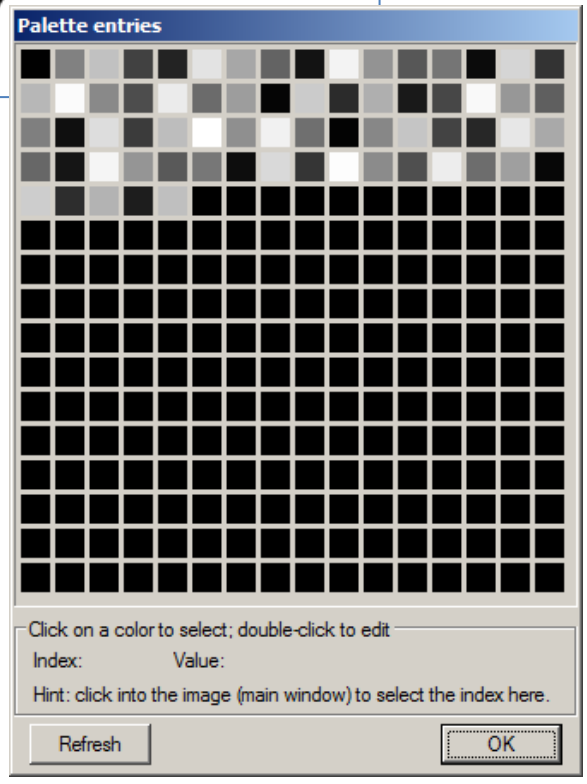
gif, 256 unikalnych kolorów



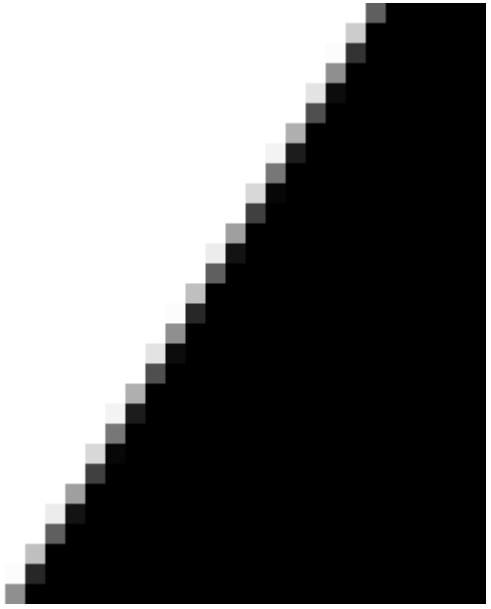
Antyaliasing



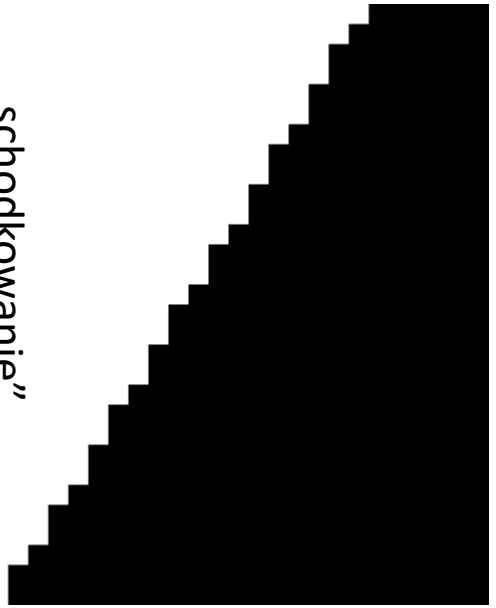




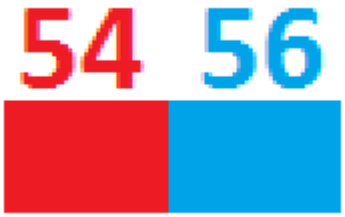
Number of unique colors: 2

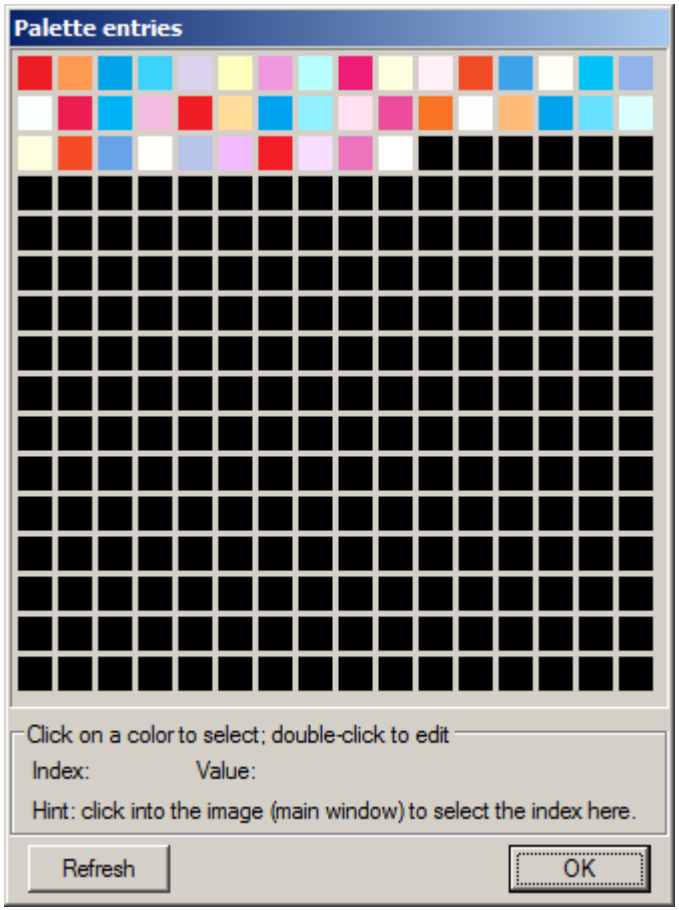


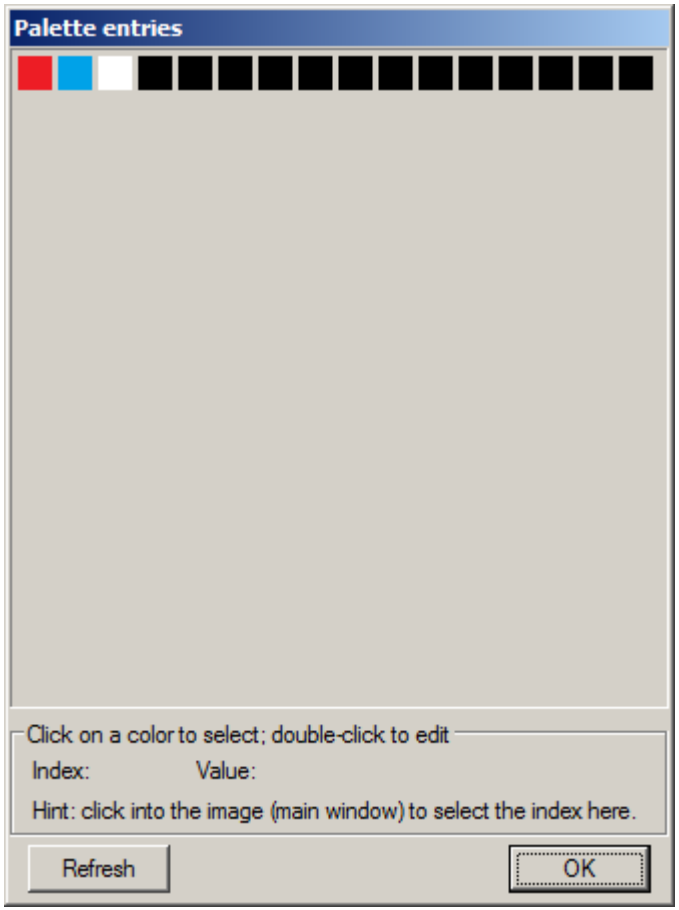
„schodkowanie”



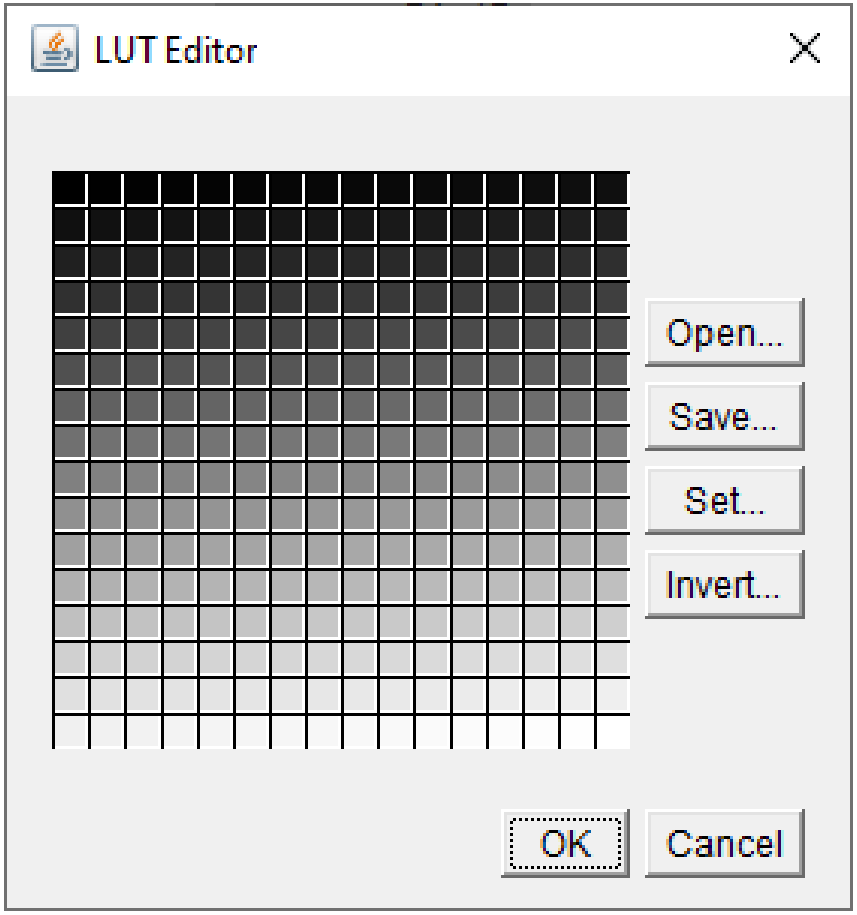
Antyaliasing

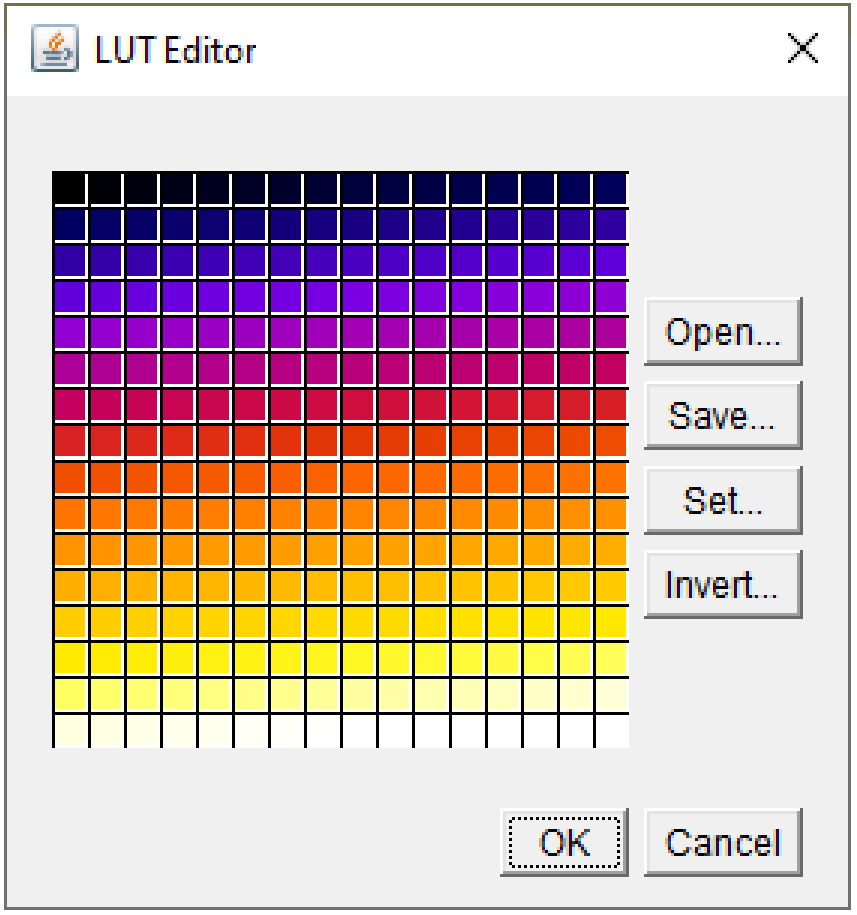




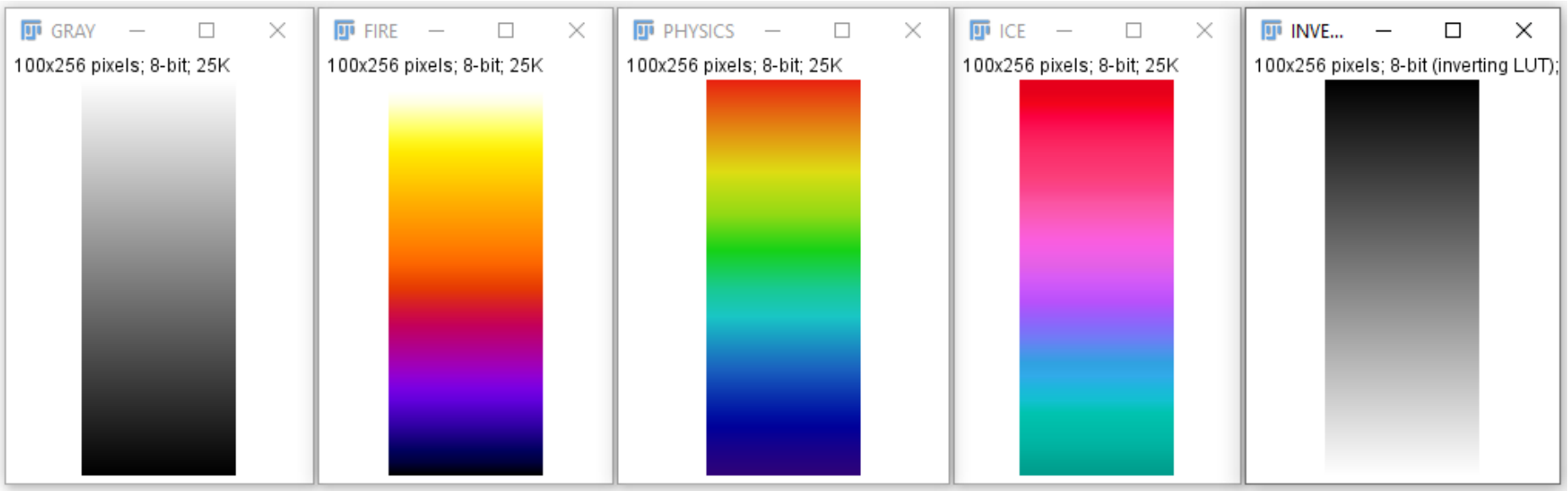


Lookup Tables

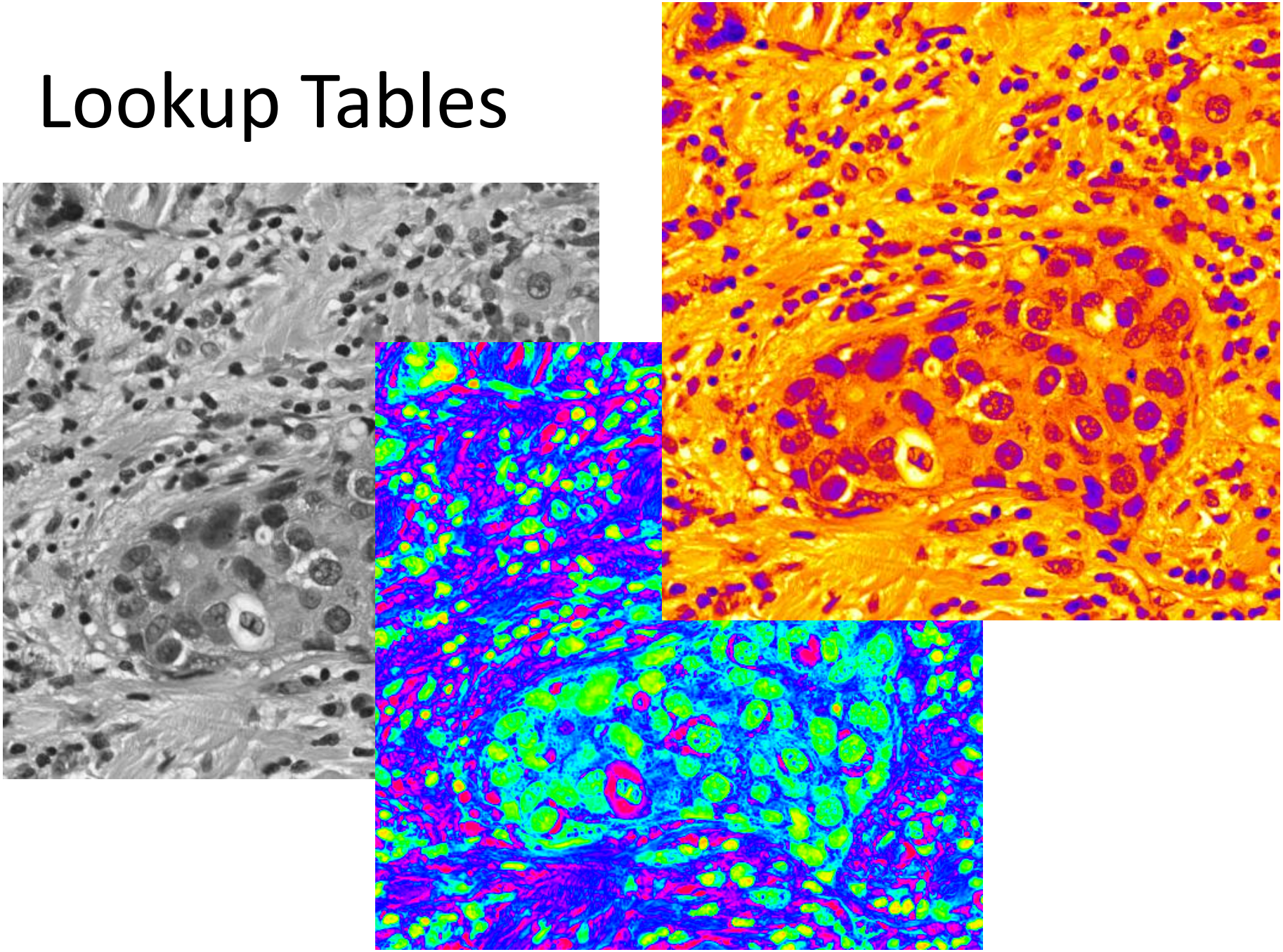




Lookup Tables



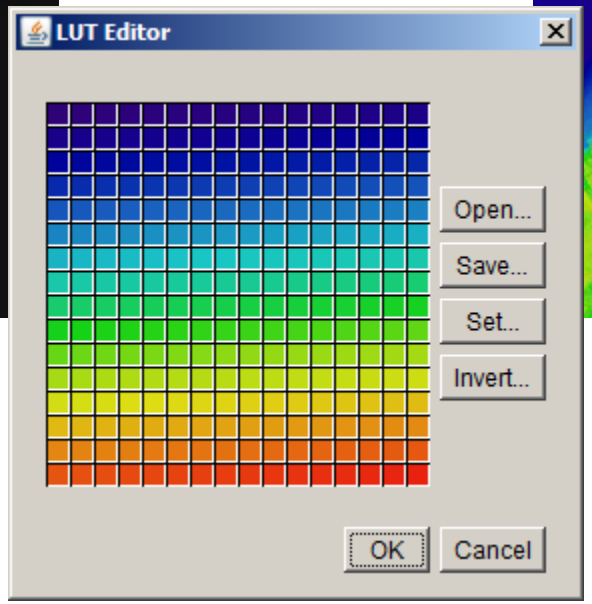
Lookup Tables

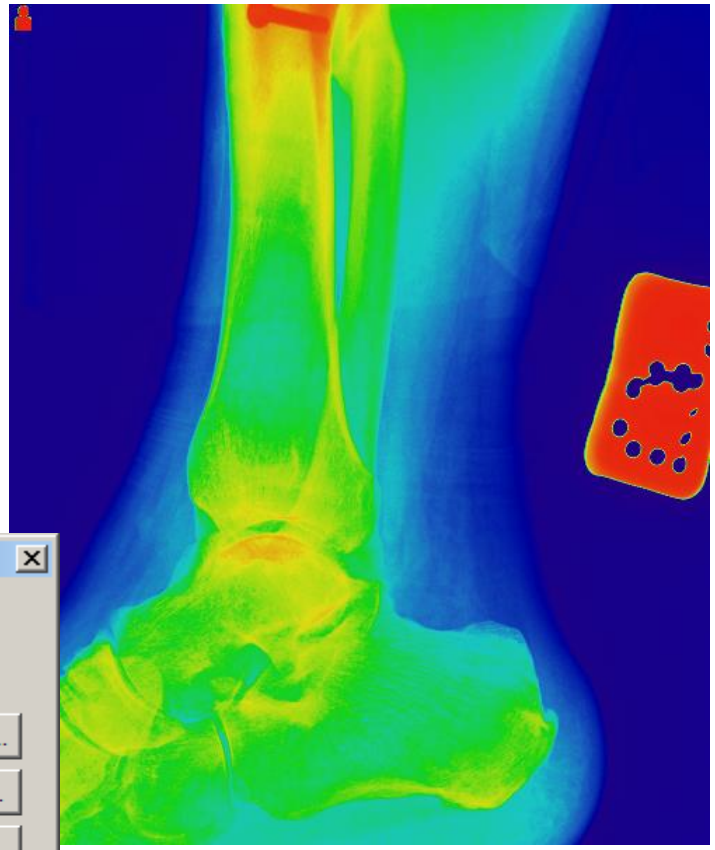


Kumar, N., Verma, R., Sharma, S., Bhargava, S., Vahadane, A., Sethi, A.: A dataset and a technique for generalized nuclear segmentation for computational pathology. IEEE TMI 36(7), 1550–1560 (2017)

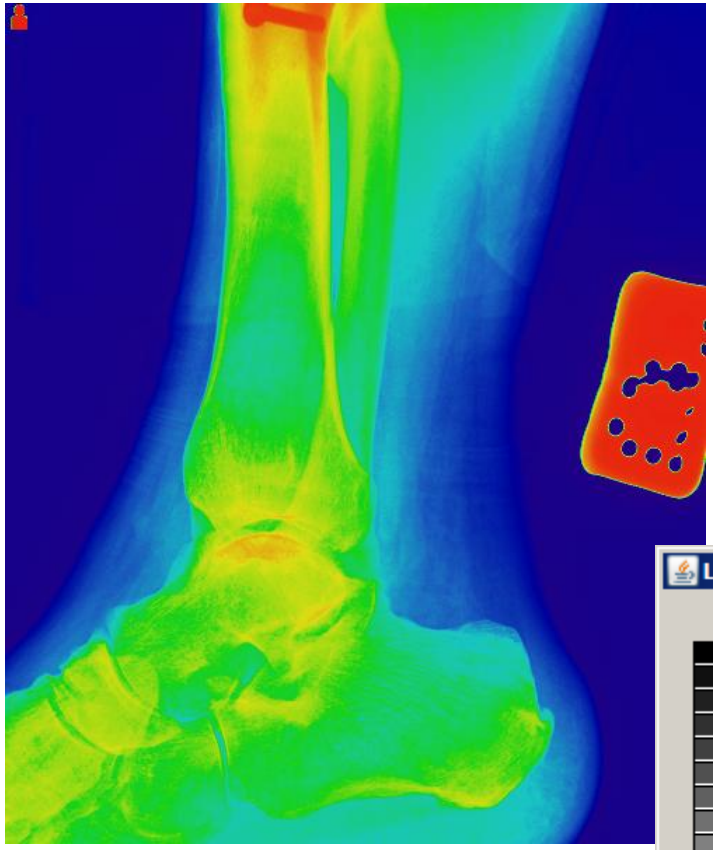
LUT a paleta - zaleta

physics



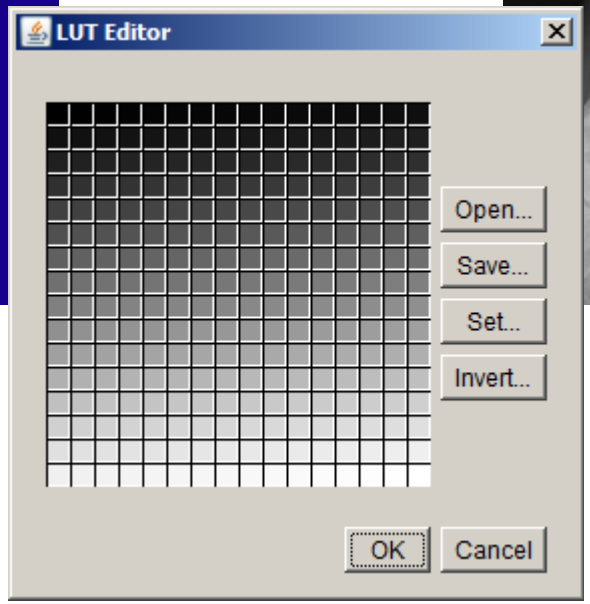


LUT a paleta - zaleta

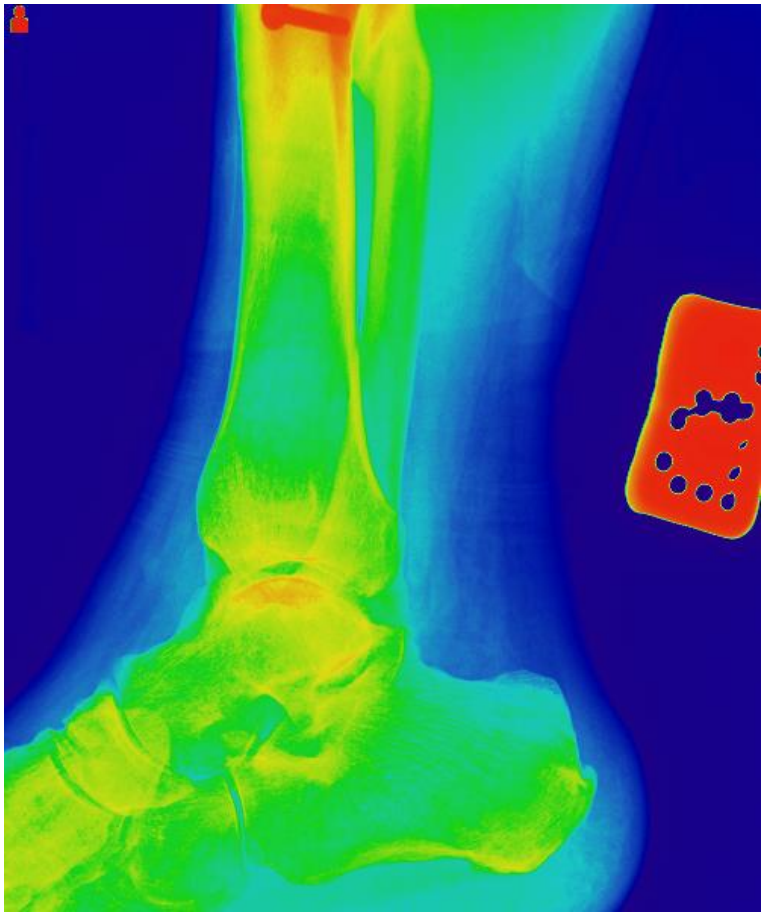


RGB 8-bit (paleta)

gray



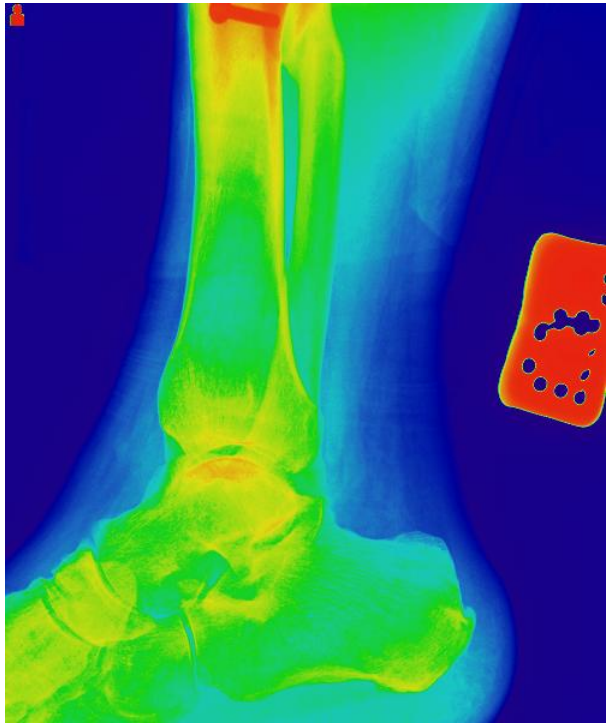
A przejście do RGB 24 bit?



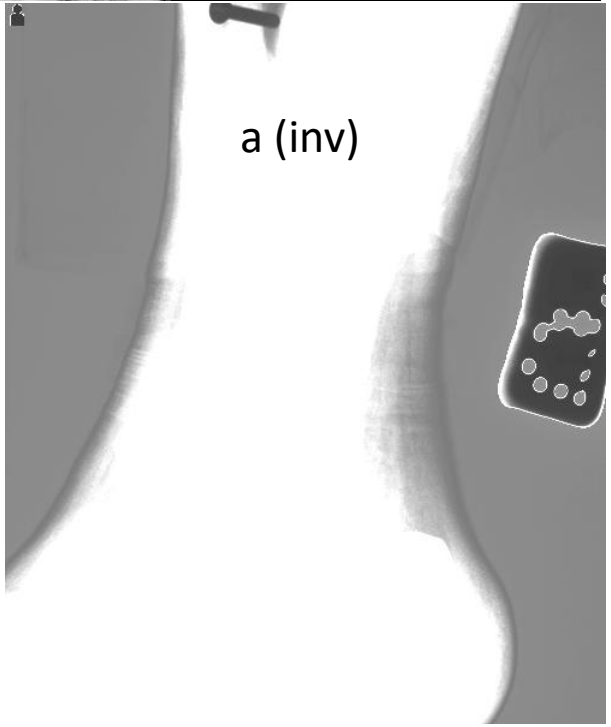
RGB 24-bit

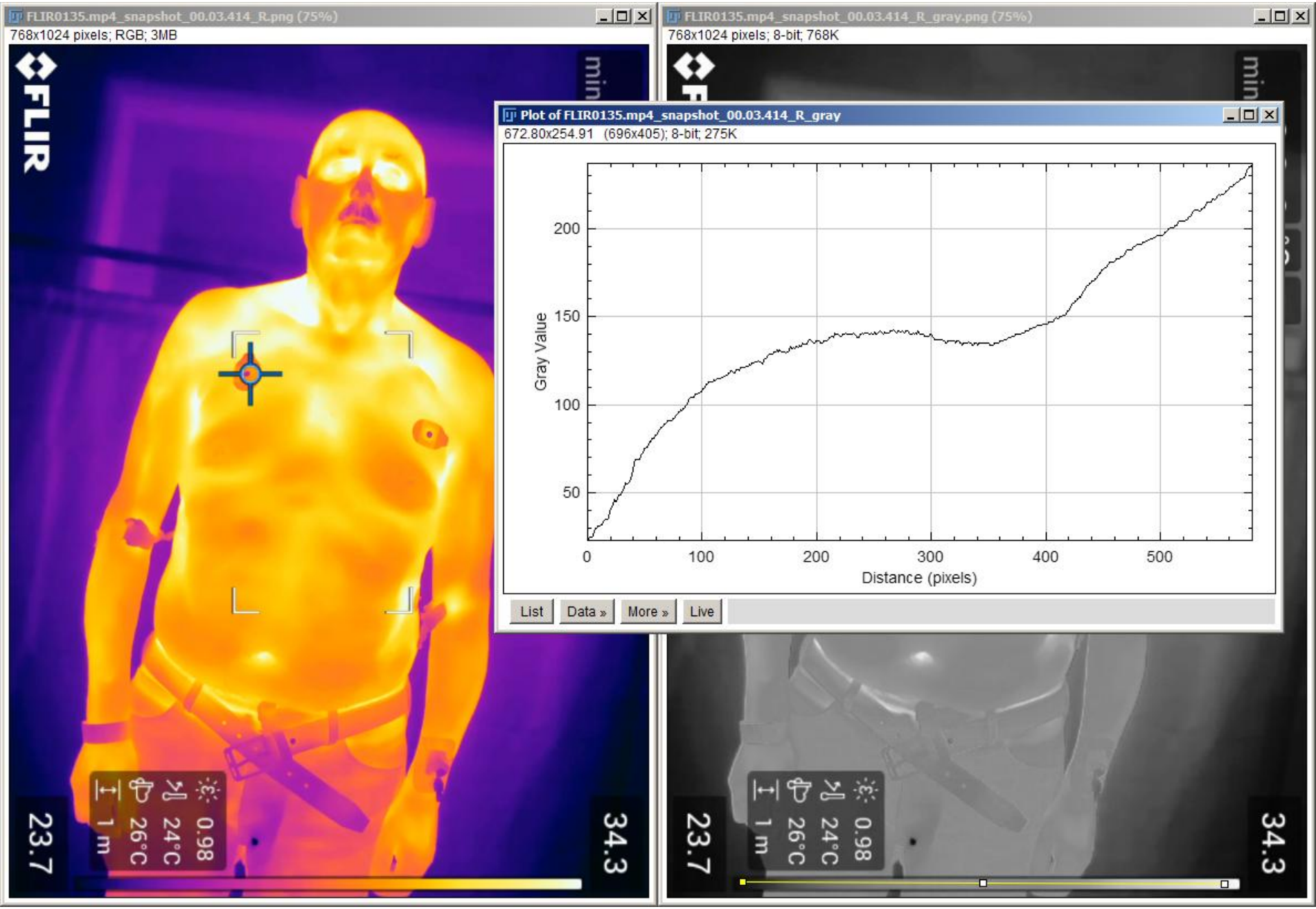
(R+G+B)/3

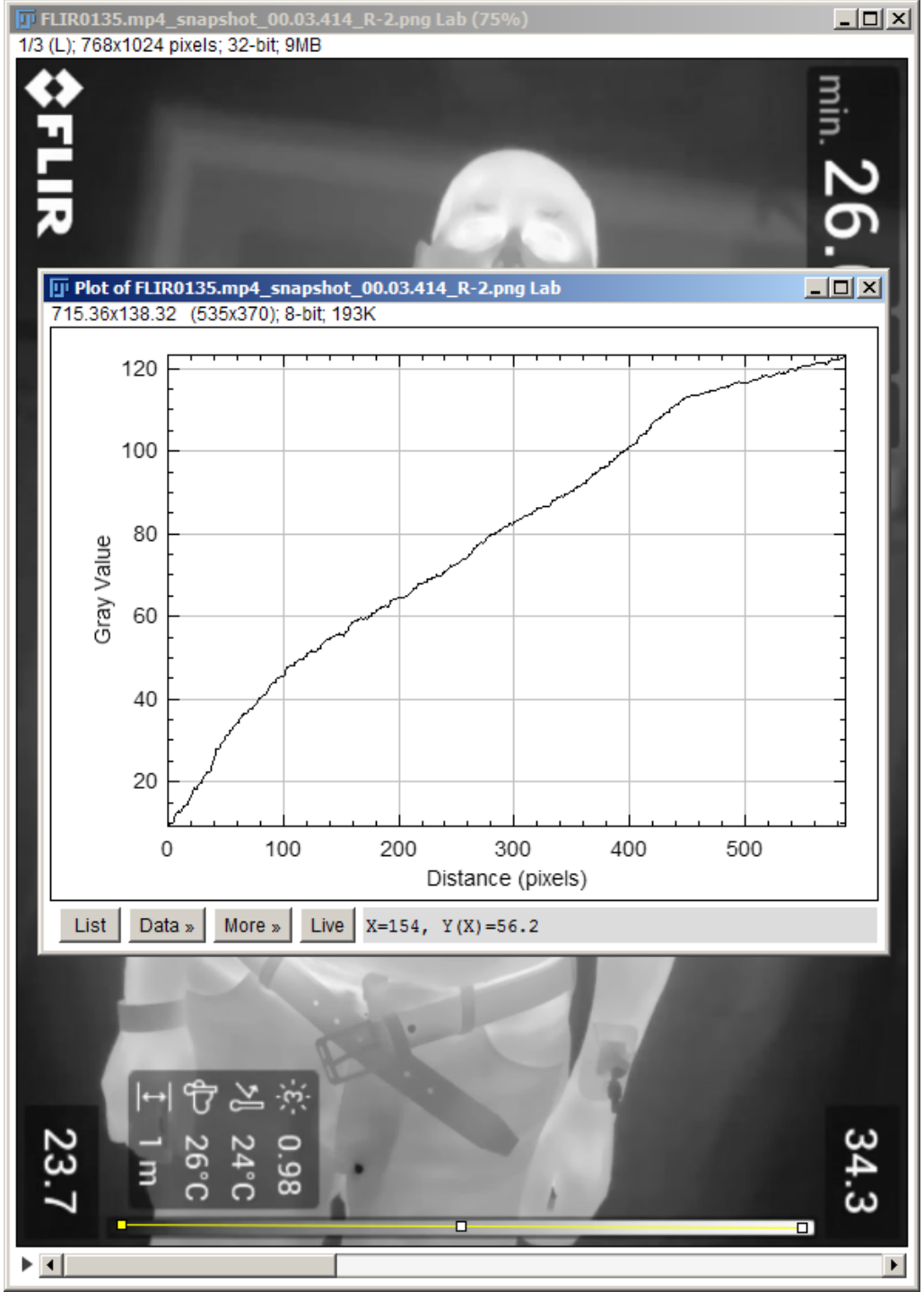
Lab?



RGB 24-bit




FLIR0135.mp4_snapshot_00.03.414_R.png (75%)
768x1024 pixels; RGB; 3MB
FLIR0135.mp4_snapshot_00.03.414_R_gray.png (75%)
768x1024 pixels; 8-bit; 768K
Plot of FLIR0135.mp4_snapshot_00.03.414_R_gray
672.80x254.91 (696x405); 8-bit; 275K
Gray Value
Distance (pixels)
200
150
100
50
0
100
200
300
400
500
List
Data »
More »
Live
23.7
34.3
0.98
24°C
26°C
1 m


FLIR0135.mp4_snapshot_00.03.414_R-2.png Lab (75%)
1/3 (L); 768x1024 pixels; 32-bit; 9MB
FLIR
min. 26.
Plot of FLIR0135.mp4_snapshot_00.03.414_R-2.png Lab
715.36x138.32 (535x370); 8-bit; 193K
Gray Value
120
100
80
60
40
20
0
100
200
300
400
500
Distance (pixels)
List
Data »
More »
Live
X=154, Y(X)=56.2
23.7
34.3
0.98
24°C
26°C
1 m

Format: BMP (bitmap)

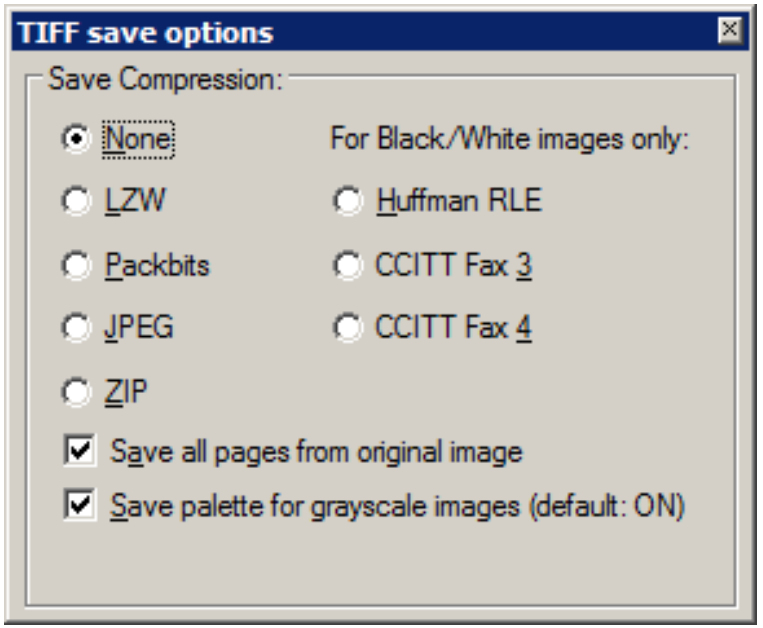
Właściwości:
- formaty:
  - paleta: 1bpp, 2bpp, 4bpp, 8bpp, (z RGB)
  - HighColor: 16bpp, B-5b, G-6b, R-5b,
  - TrueColor: 24bpp, B-8b, G-8b, R-8b
  - RGBA: 32bpp, B-8b, G-8b, R-8b + kanał alfa

Kompresja:
- brak,
- opcjonalna, bezstratna: RLE / Huffman 1D (palety), RLE (24bpp)

Wada: duże pliki

Format: TIFF (Tagged Image File Format)

Właściwości:
- formaty:
  - dwa kolory (cz/b),
  - skala szarości 8bpp/**16bpp**
  - paleta,
  - RGB,
  - kontener obrazów (JPG).



Kompresja:
- brak, RLE, LZW, JPEG, JPEG2000, CCITT, Deflate PKZIP, …

TIFF pozwala na zapisywanie wielu obrazów (stos).

Format: PNG (Portable Network Graphic)

Właściwości:
- formaty:
    - paleta: 1bpp, 2bpp, 4bpp, 8bpp,
    - monochromatyczny (grayscale): 1bpp, 2bpp, 4bpp, 8bpp, **16bpp**
    - monochromatyczny + alfa: 8bpp, 16bpp
    - TrueColor: 24bpp, R-8b, G-8b, B-8b
    - RGBA: 32bpp, R-8b, G-8b, B-8b + kanał alfa

Kompresja:
- bezstratna, deflate (LZ77+Huffman), poprzedzona filtrami*,
Opcjonalna definicja przeźroczystości

* Wyszukiwanie w przestrzeni parametrów filtrów może dać różny rozmiar wynikowy przy braku zniekształceń; `optipng -o7 plik.png`

```
D:\PIC>optipng -o7 obraz_testowy.png
** Processing: obraz_testowy.png
299x280 pixels, 4x8 bits/pixel, RGB+alpha
Input IDAT size = 116997 bytes
Input file size = 117222 bytes

Trying:
  zc = 9  zm = 9  zs = 0  f = 0        IDAT size = 113153
  zc = 9  zm = 8  zs = 0  f = 0        IDAT size = 111965
  zc = 7  zm = 9  zs = 0  f = 0        IDAT size = 111850
  zc = 7  zm = 8  zs = 0  f = 0        IDAT size = 111331
  zc = 6  zm = 9  zs = 0  f = 0        IDAT size = 111203
  zc = 6  zm = 8  zs = 0  f = 0        IDAT size = 110698
  zc = 5  zm = 8  zs = 0  f = 0        IDAT size = 110582
  zc = 4  zm = 9  zs = 0  f = 0        IDAT size = 110165
  zc = 3  zm = 9  zs = 0  f = 0        IDAT size = 109784
  zc = 3  zm = 8  zs = 0  f = 0        IDAT size = 109661
  zc = 2  zm = 9  zs = 0  f = 0        IDAT size = 107461
  zc = 1  zm = 8  zs = 0  f = 0        IDAT size = 106305
  zc = 1  zm = 8  zs = 1  f = 0        IDAT size = 106305
  zc = 9  zm = 9  zs = 0  f = 1        IDAT size = 15391
  zc = 9  zm = 8  zs = 0  f = 1        IDAT size = 15391
  zc = 9  zm = 9  zs = 1  f = 1        IDAT size = 15350
  zc = 9  zm = 8  zs = 1  f = 1        IDAT size = 15350

Selecting parameters:
  zc = 9  zm = 8  zs = 1  f = 1        IDAT size = 15350

Output IDAT size = 15350 bytes (101647 bytes decrease)
Output file size = 15407 bytes (101815 bytes = 86.86% decrease)
```

Wydajne dla:
-MS Paint,
-ImageJ,
-Matlab

BEZSTRATNE!
(ew. redukcja palety)

Ultra, ale zysk to ~ 1%

optipng.exe -preserve -o7 -zm1-9 plik.png

Format: GIF (Graphic Interchange Format)

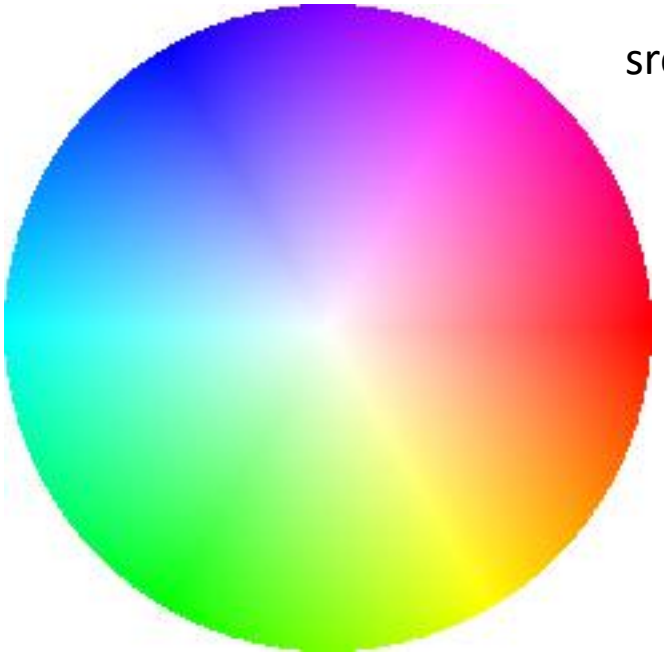
Właściwości:
- formaty:
    - paleta: 8bpp, z RGB, może być skala szarości 0-255 (8bpp),

Kompresja:
- bezstratna, LZW (opatentowana, patent wygasł),
Opcjonalna definicja przeźroczystości
Możliwość animacji

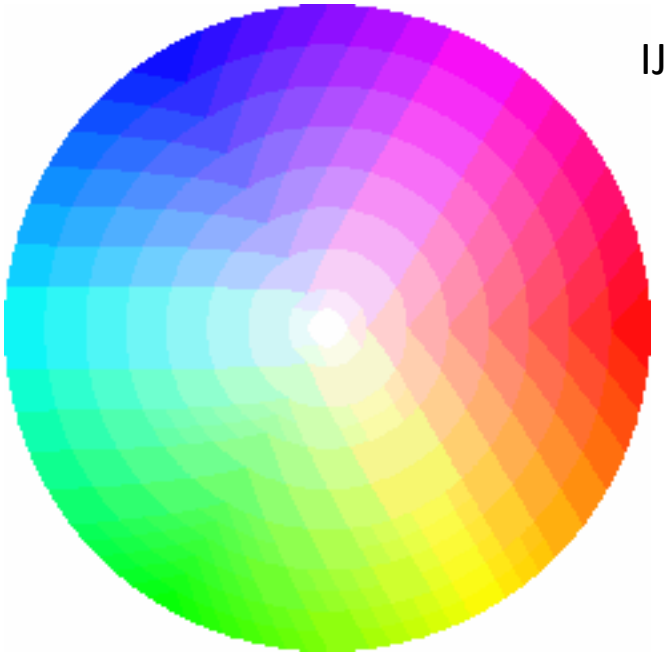
Wady: redukcja liczby kolorów wpływa na jakość,
ew. zastosowanie do obrazów grayscale 8bit.

GIF

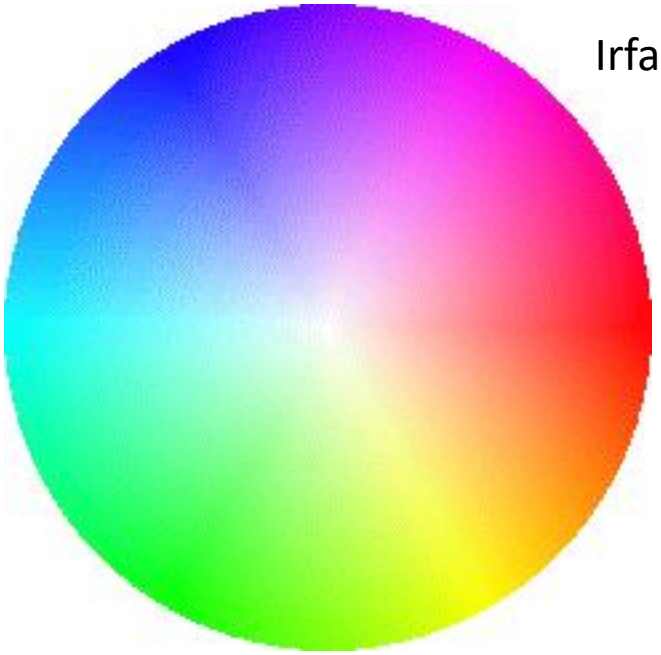
src



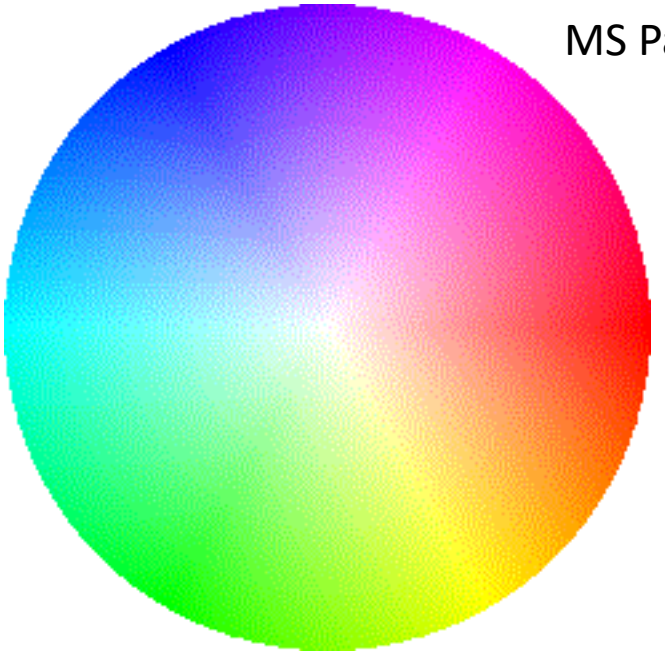
IJ



IrfanView



MS Paint



GIF

Format: JPEG (Joint Photographic Experts Group)

Właściwości:
- formaty:
    - paleta: 24bpp RGB lub 8bit grayscale

Kompresja:
- stratna, zawsze!! Nawet przy jakości 100% !!!,
- w przestrzeni YCb(blue)Cr(red), DCT,
- bloki 8x8 pikseli

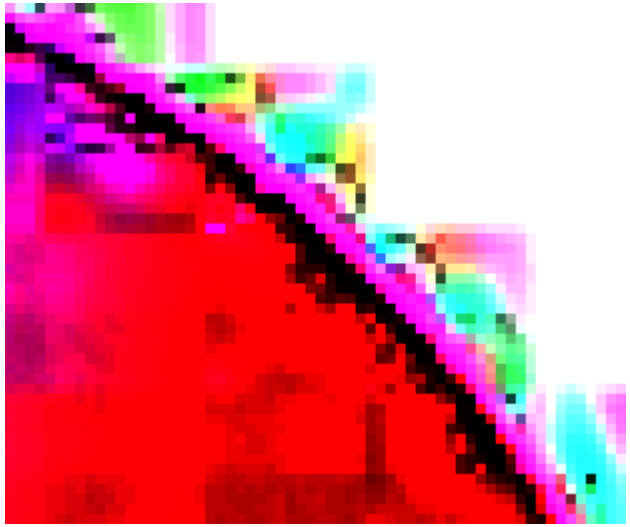
Wady:
-Kompresja stratna

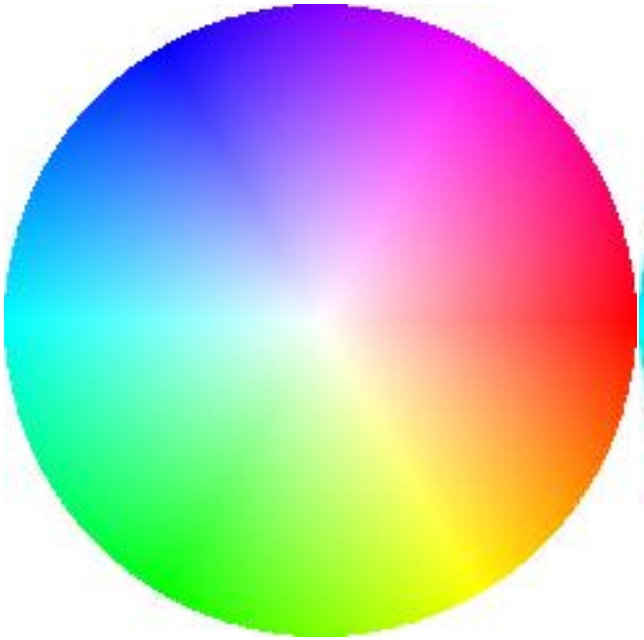
Zastosowania:
Fotografia!!!!!

JPEG2000 - (DWT) – format z wyborem bezstratny/stratny, głębia 1-38 bit, różne przestrzenie kolorów (sRGB, CMYK, Lab, YCbCr, …)

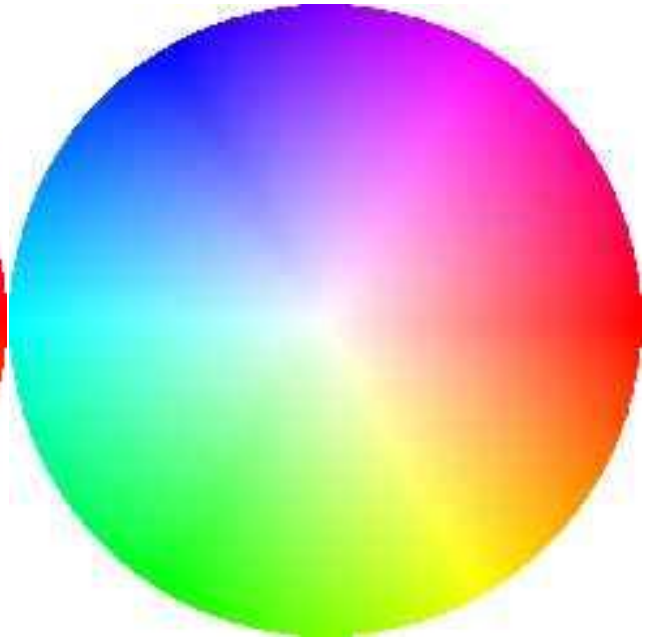
Format: JPEG

(kiedy nie należy stosować JPG)

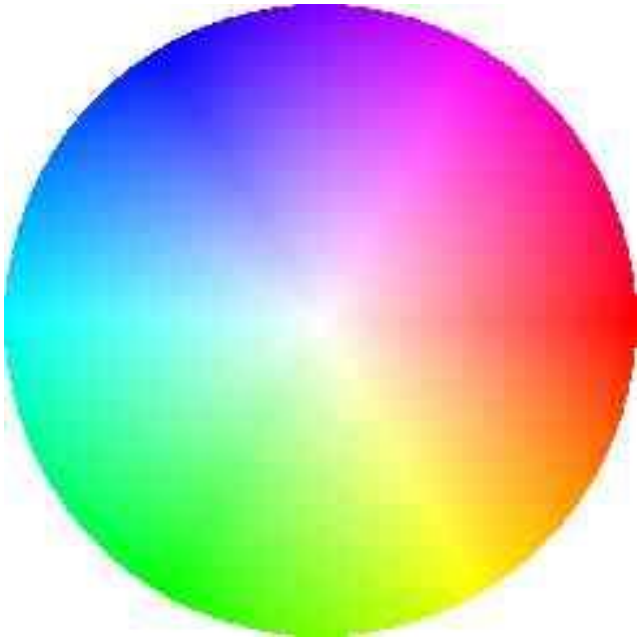




SRC



JPG 40%



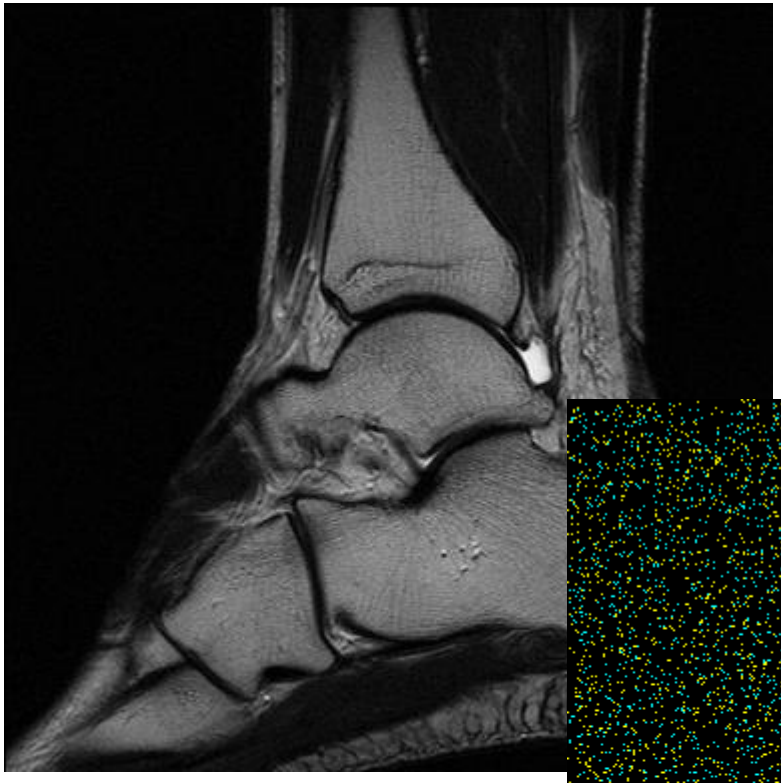
JPG 30%

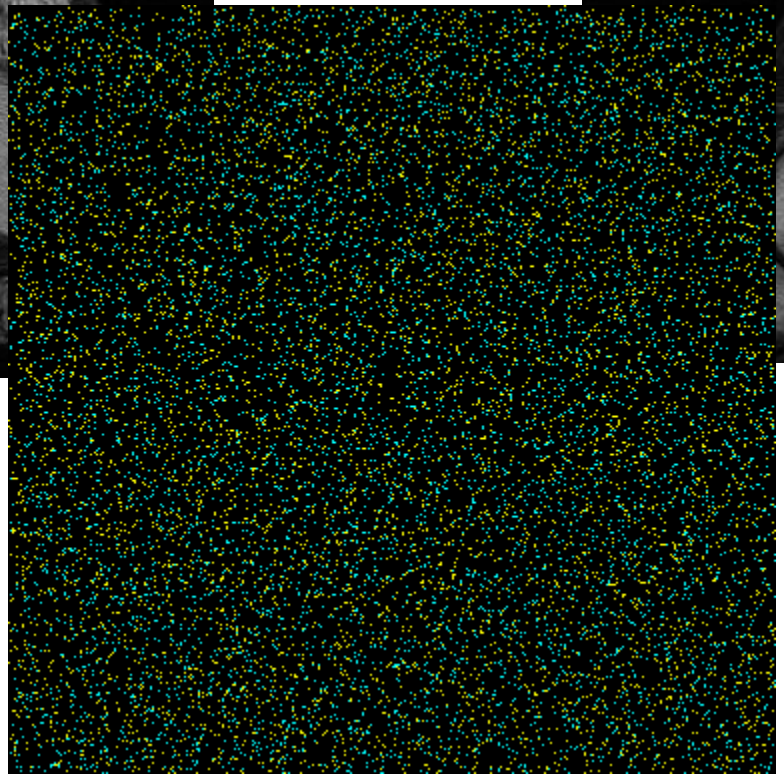
src JPG 10% JPG 20%

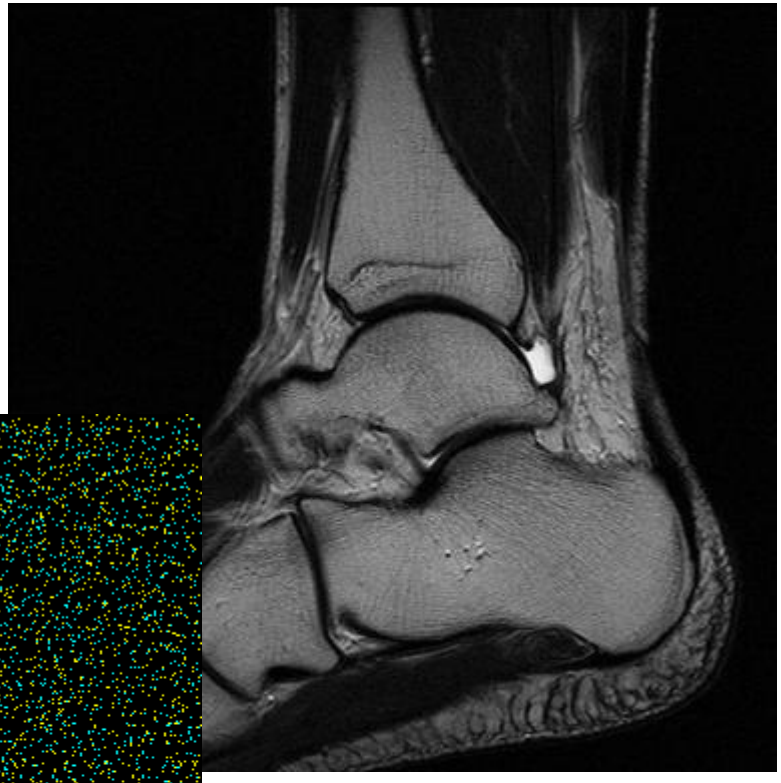
Format: JPEG (kiedy nie należy stosować JPG)

src RÓŻNICA JPG 100%

Format: JPEG (kiedy nie należy stosować JPG)

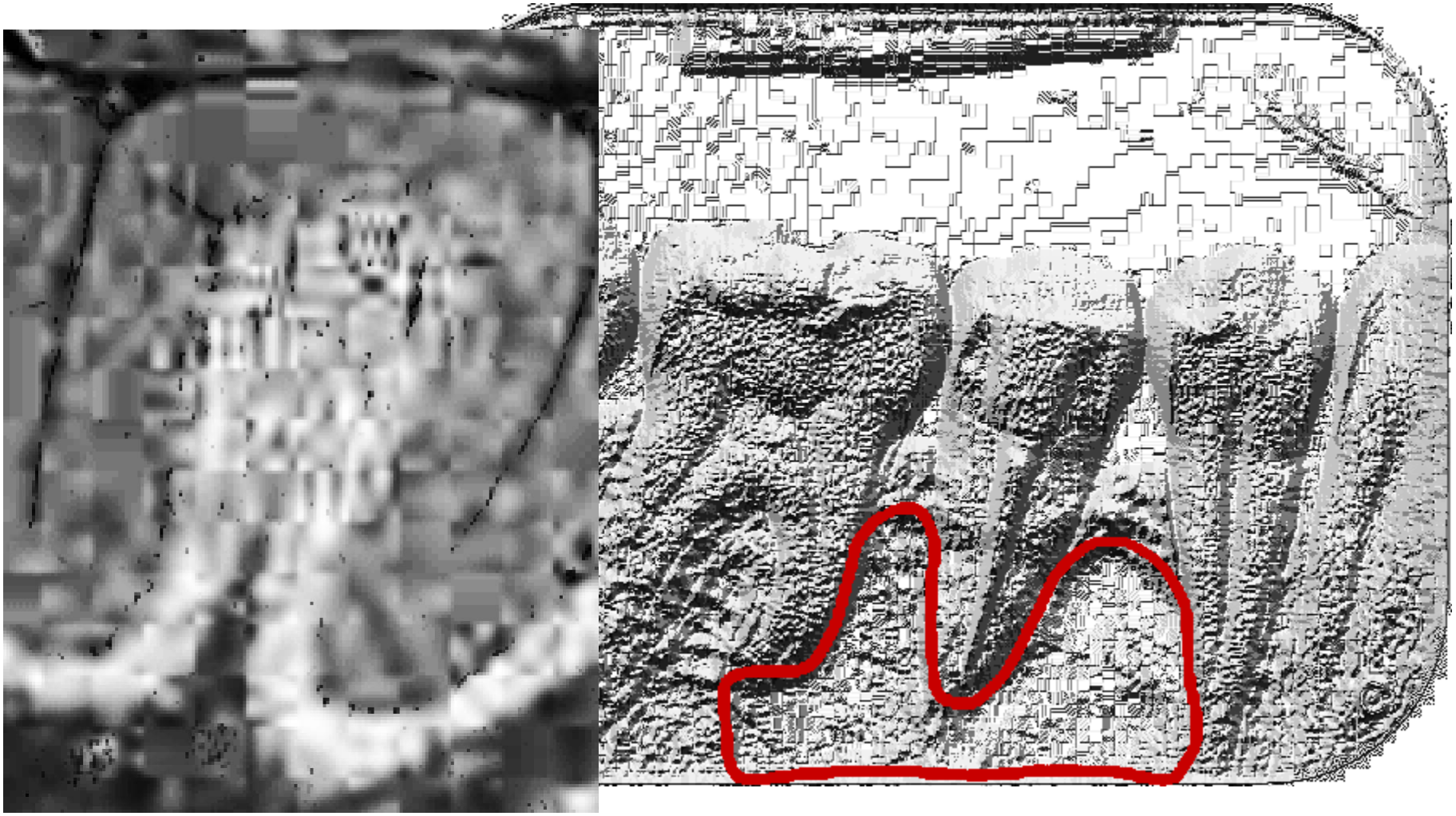






Format: JPEG (kiedy nie należy stosować JPG)

Problemy pojawiają się podczas przetwarzania obrazów

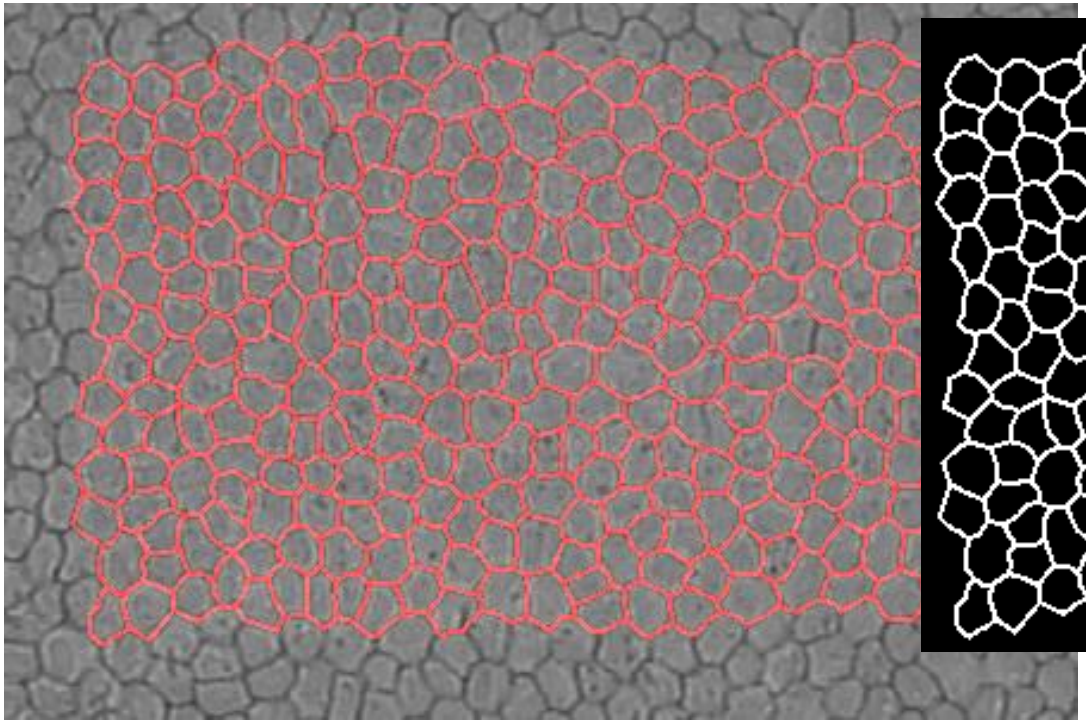


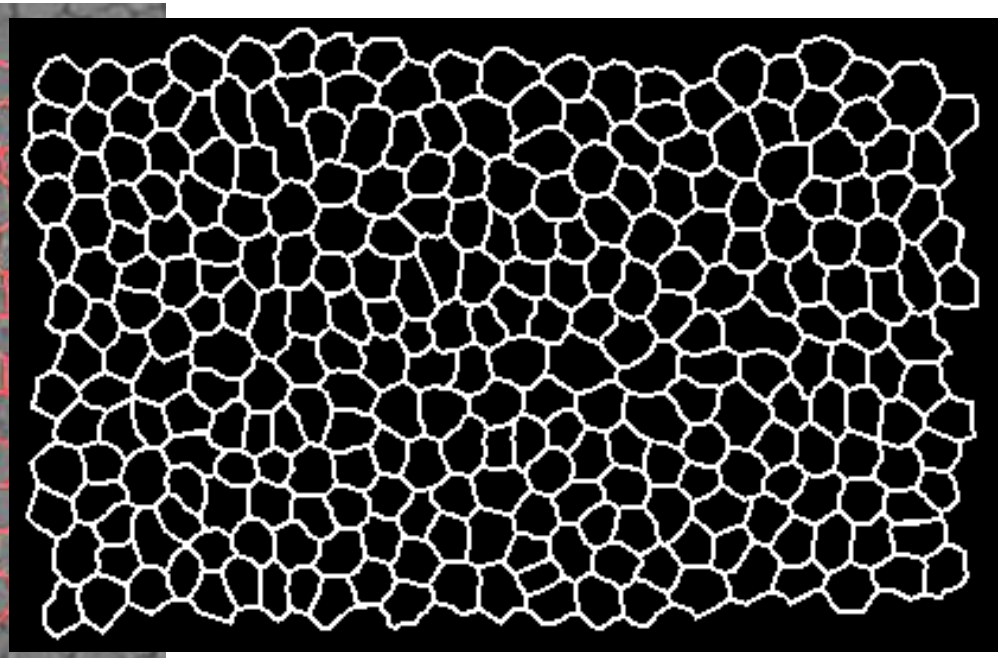
Pociask, E., Nurzynska, K.,Obuchowicz, R., Bałon, P., Uryga, D., Strzelecki, M., Izworski, A., Piórkowski, A.: Differential Diagnosis of Cysts and Granulomas Supported by Texture Analysis of Intraoral Radiographs. Sensors 2021, 21, 7481.

Format: JPEG (kiedy nie należy stosować JPG)

Dataset prof. Alfredo Ruggeri

A. Ruggeri, F. Scarpa, M. De Luca, C. Meltendorf, J. Schroeter. "A system for the automatic estimation of morphometric parameters of corneal endothelium in alizarine red stained images", Br J Ophthalmol, 94:643-7, 2010.

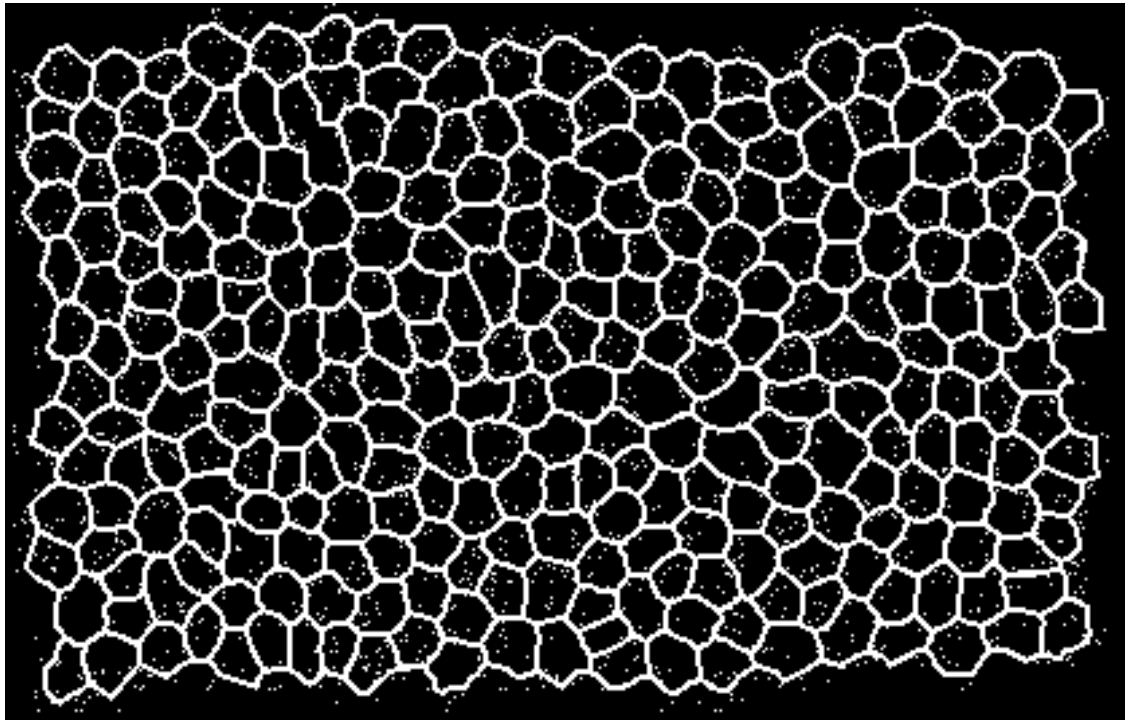




Format: JPEG (kiedy nie należy stosować JPG)

Dataset prof. Alfredo Ruggeri

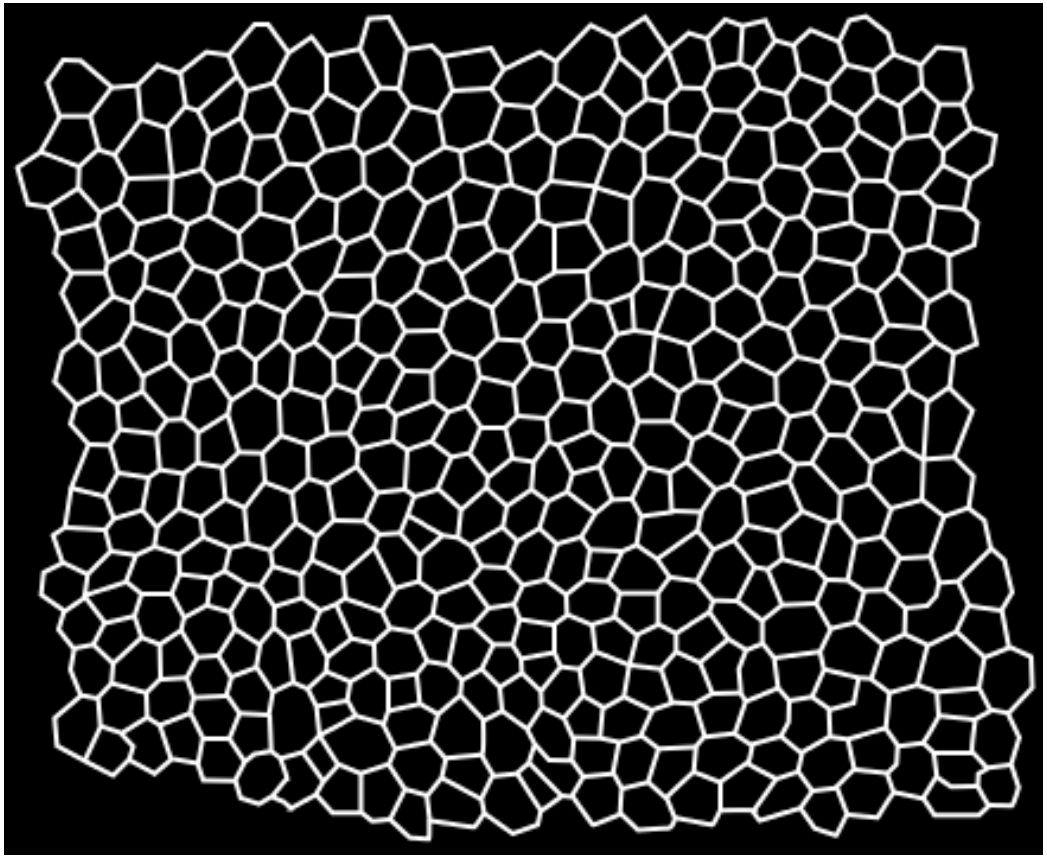
progowanie t=1



Number of unique colors: 4

Obraz 2

offtopic



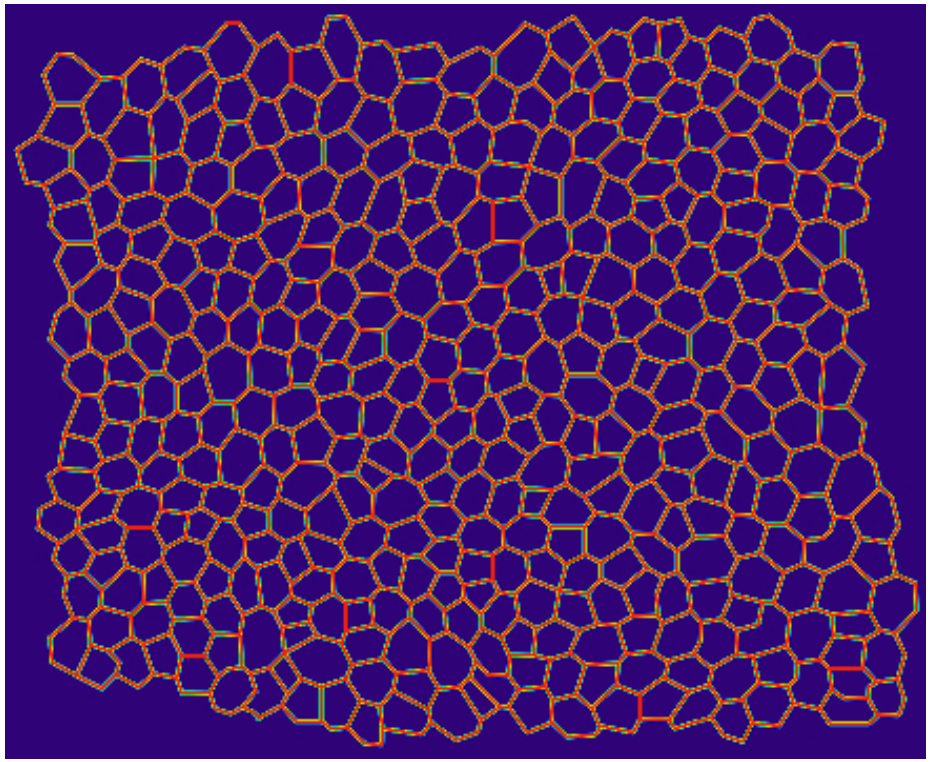
N: 157242
Mean: 43.358
StdDev: 86.724
Value: 235

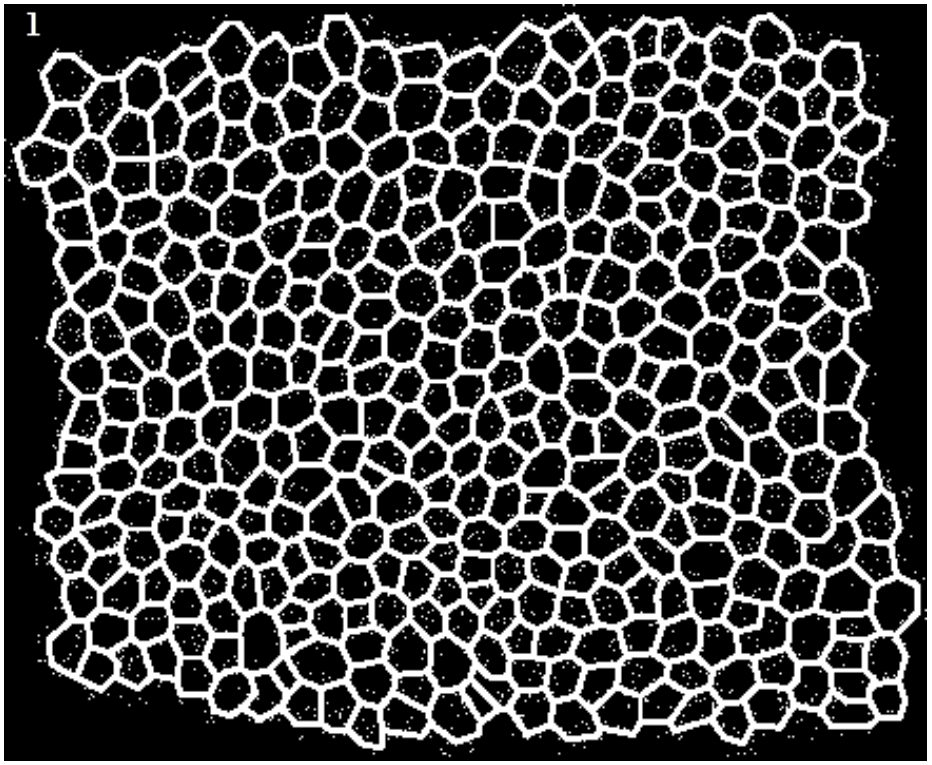
Min: 0
Max: 255
Mode: 0 (113592)
Count: 139

Original colors:	256 (8 BitsPerPixel)
Current colors:	256 (8 BitsPerPixel)
Number of unique colors:	256

Obraz 2

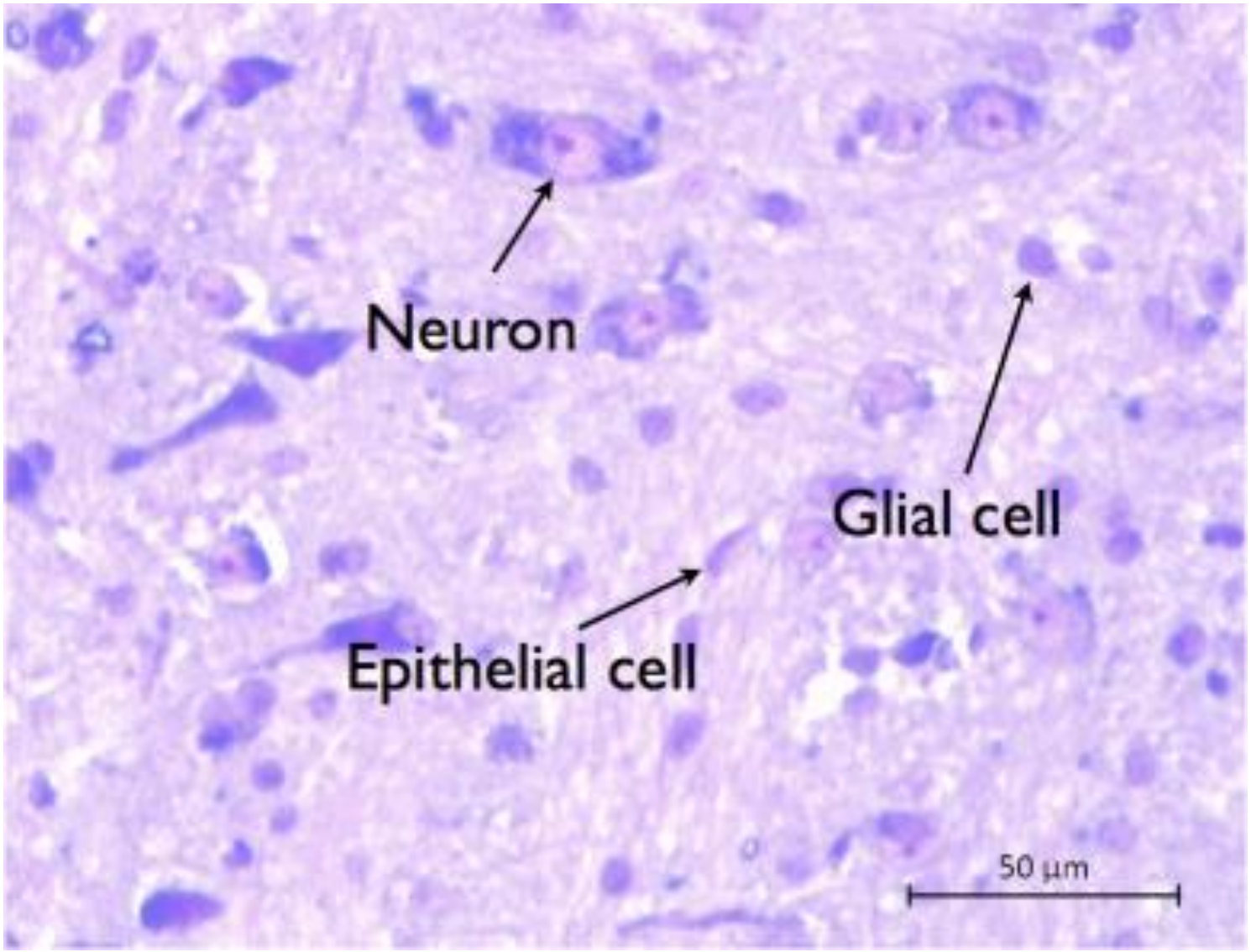
offtopic





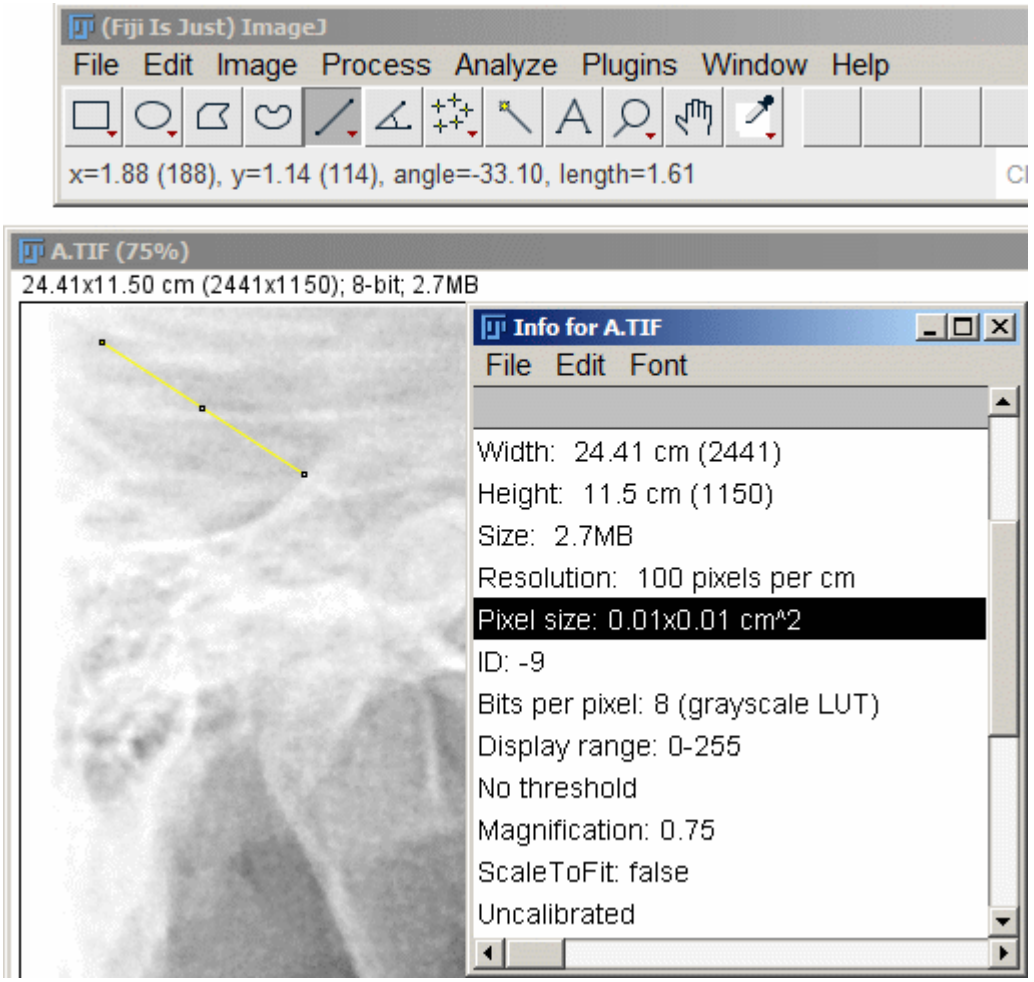
[animacja gif]

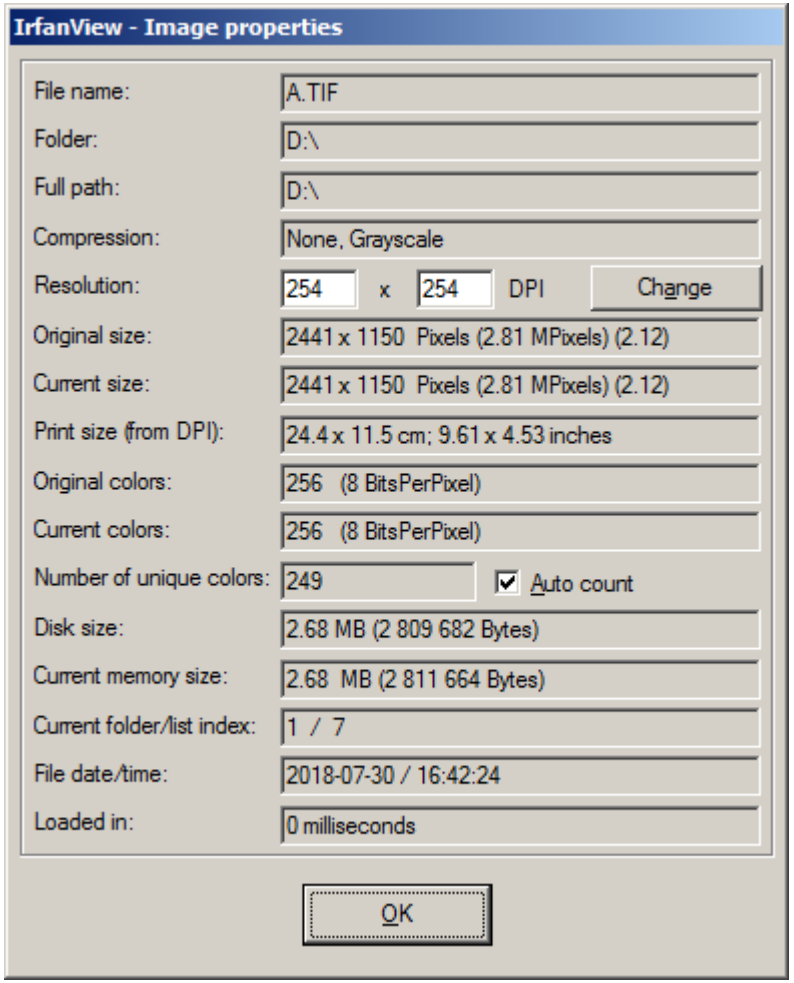
Parametry metryczne



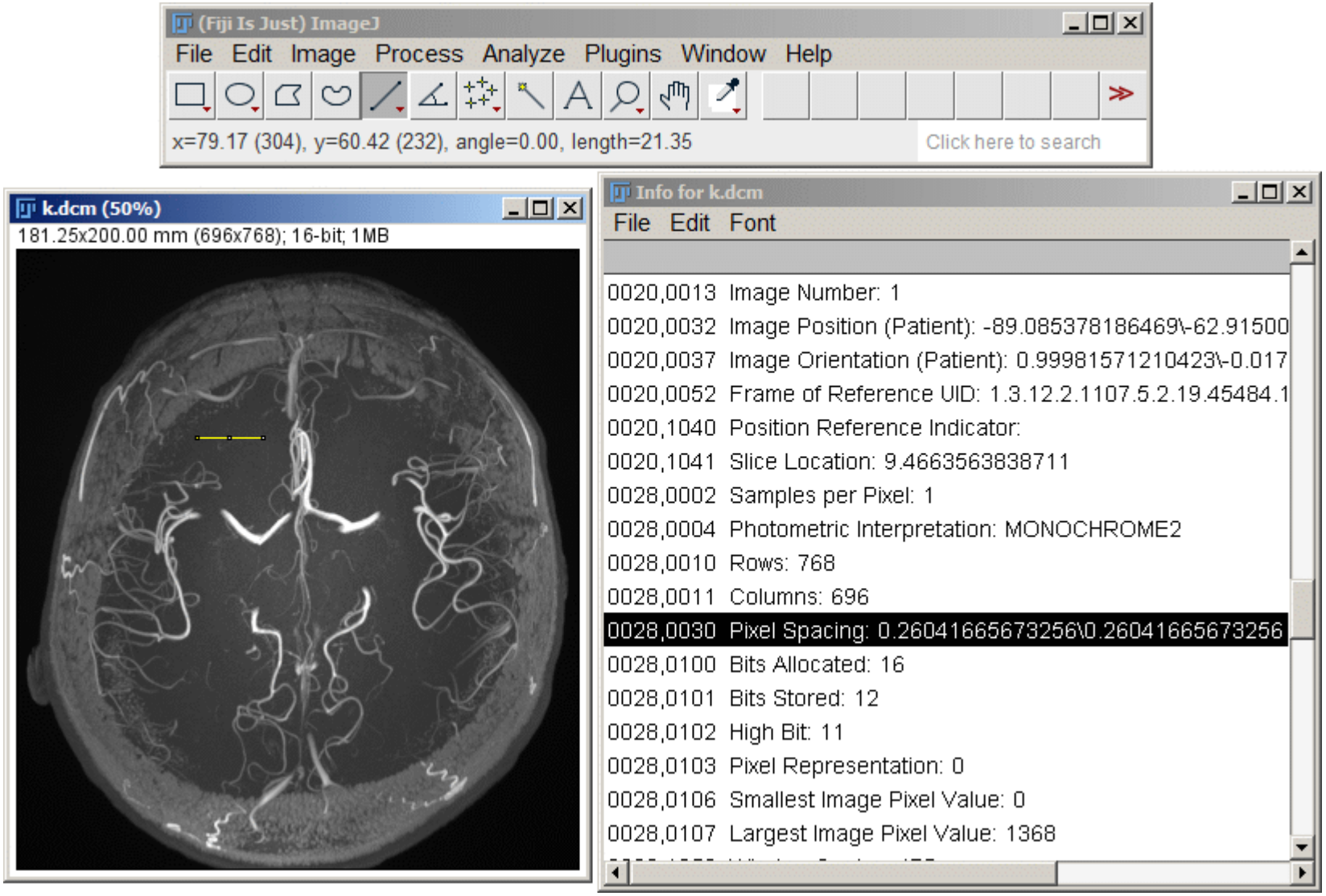
Kołodziejczyk, A., Ładniak, M., Piorkowski, A.: Constructing software for analysis of neuron, glial and endothelial cell numbers and density in histological Nissl-stained rodent brain tissue. JMIT, 23., (2014).

Parametry metryczne

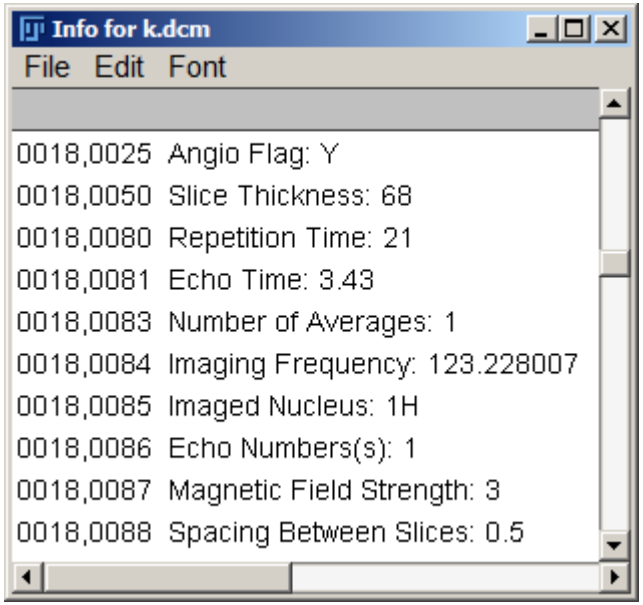


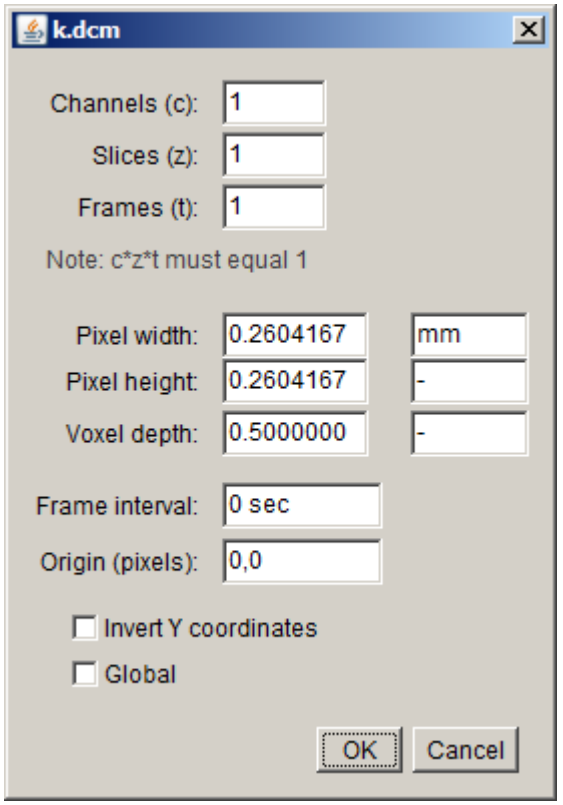


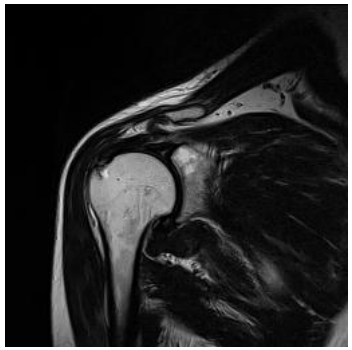
Parametry metryczne



Parametry metryczne

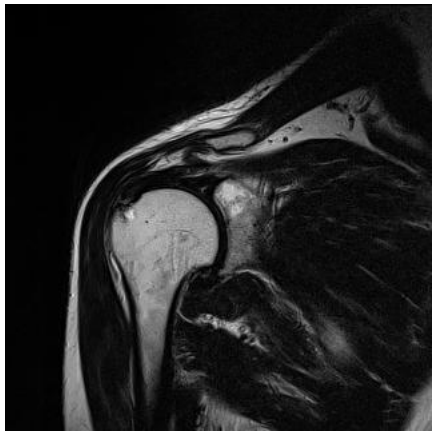






256x256

448x448



320x320

matryca	pix spc
256x256	0.78125
320x320	0.625
384x384	0.520833
448x448	0.446429
512x512	0.390625

384x384

512x512

M. Strzelecki, A.Piorkowski, R. Obuchowicz: Effect of Matrix Size Reduction on Textural Information in Clinical Magnetic Resonance Imaging, 2022

DICOM – struktura pliku

Struktura pliku:

- nagłówek (DICM)
- lista elementów

Struktura elementu:

- nr grupy
- nr elementu
- typ
- długość danych
- dane

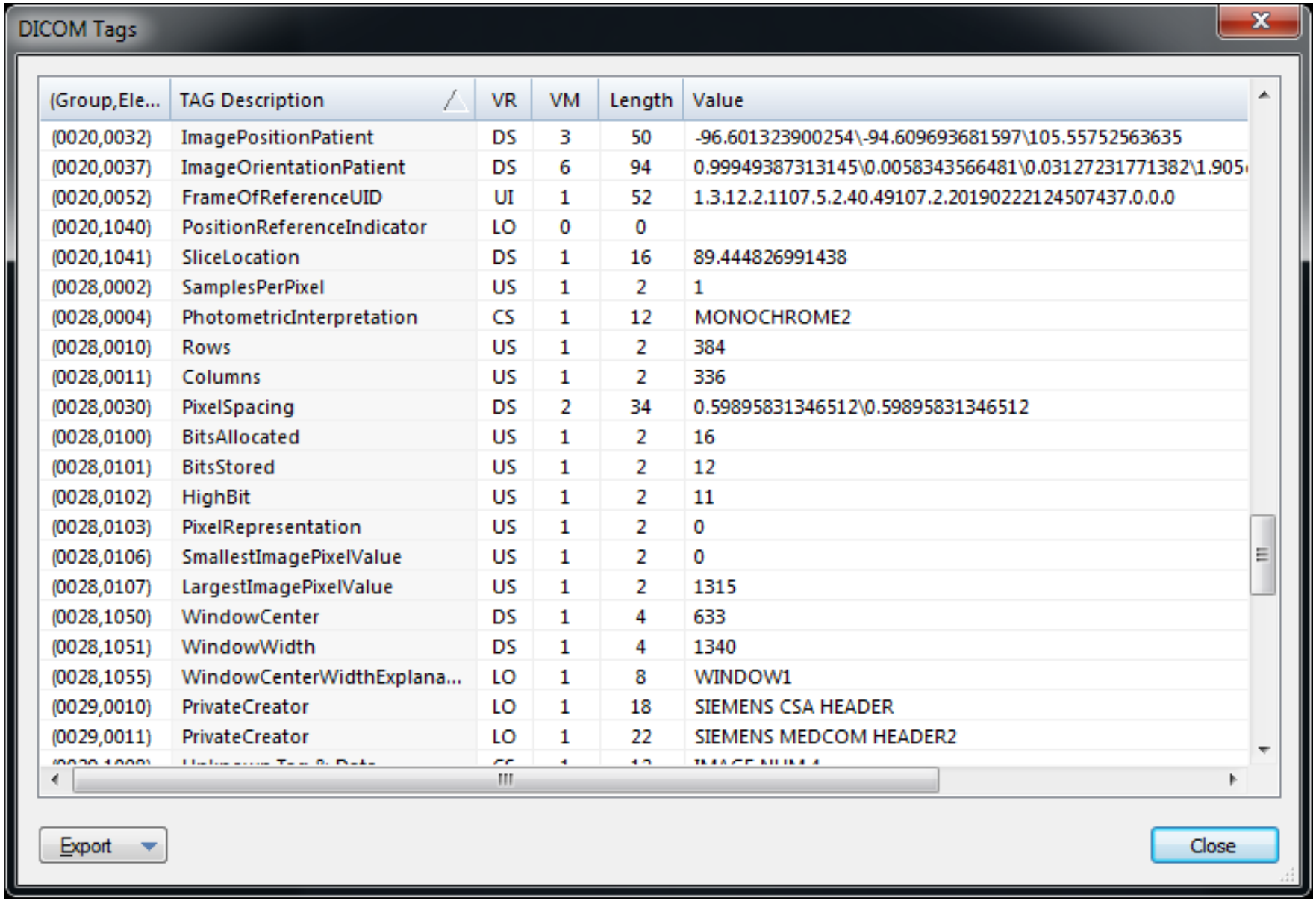
Rozszerzenia:

-*.dcm, *.ima, … , brak ;)

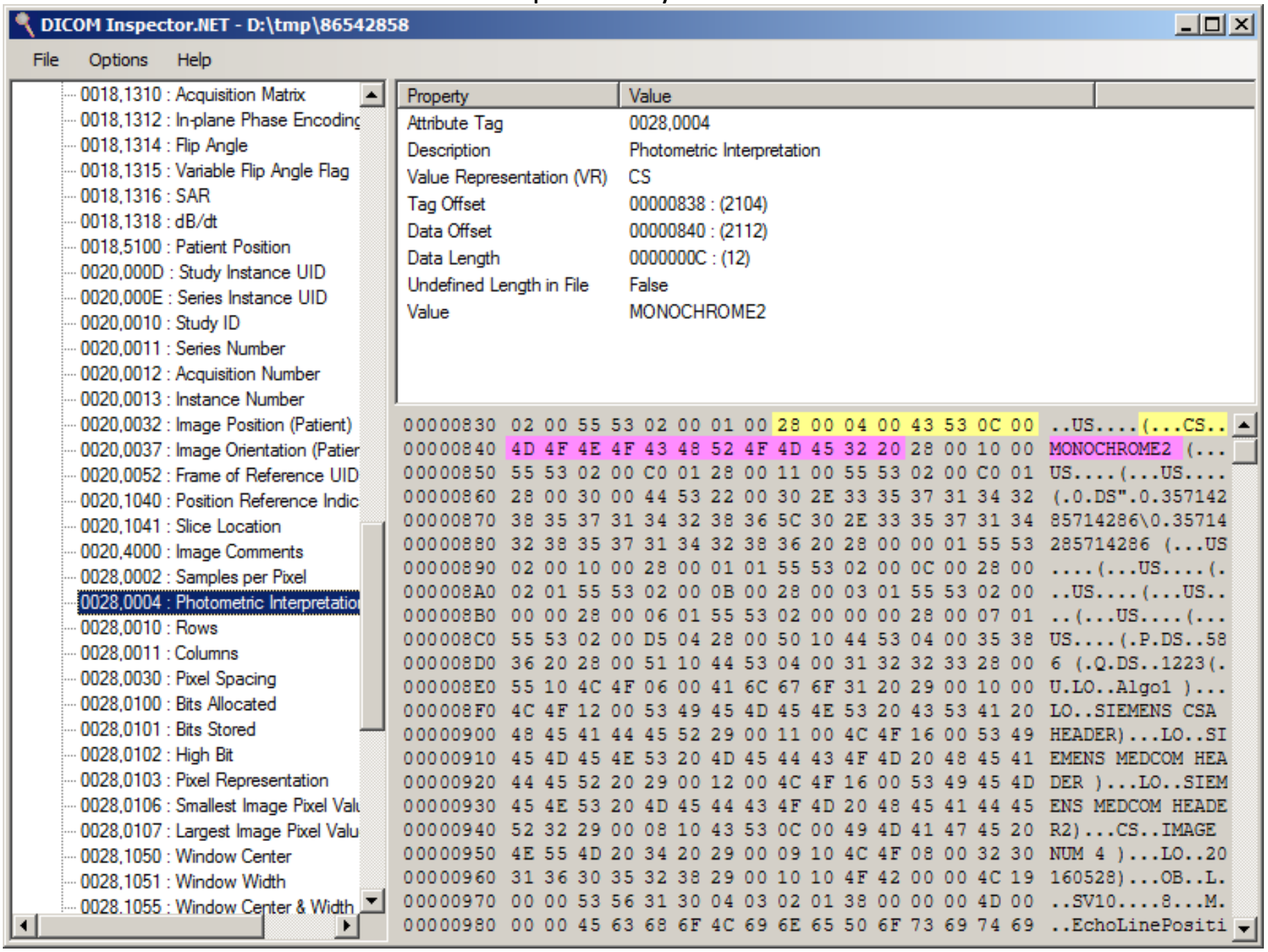
- wielkość pliku – kilka KB - …

```
"AE":  // Application Entity
"AS":  // Age String
"AT":  // Attribute Tag
"CS":  // Code String - ASCII
"DA":  // Date
"DS":  // Decimal String
"DT":  // Date Time
"FL":  // Floating Point Single
"FD":  // Floating Point Double
"IS":  // Integer String
"LO":  // Long String
"LT":  // Long Text
"PN":  // Person Name
"SH":  // Short String
"SL":  // Signed Long
"SS":  // Signed Short
"ST":  // Short Text
"TM":  // Time
"UI":  // Unique Identifier (UID)
"UL":  // Unsigned Long
"US":  // Unsigned Short znaku
"SQ":  // Sequence of Items
"UN":  // Unknown -
"UT":  // Unlimited text
"OF":  // Other Float String
"OB":  // Other Byte String
"OW":  // Other Word String
```

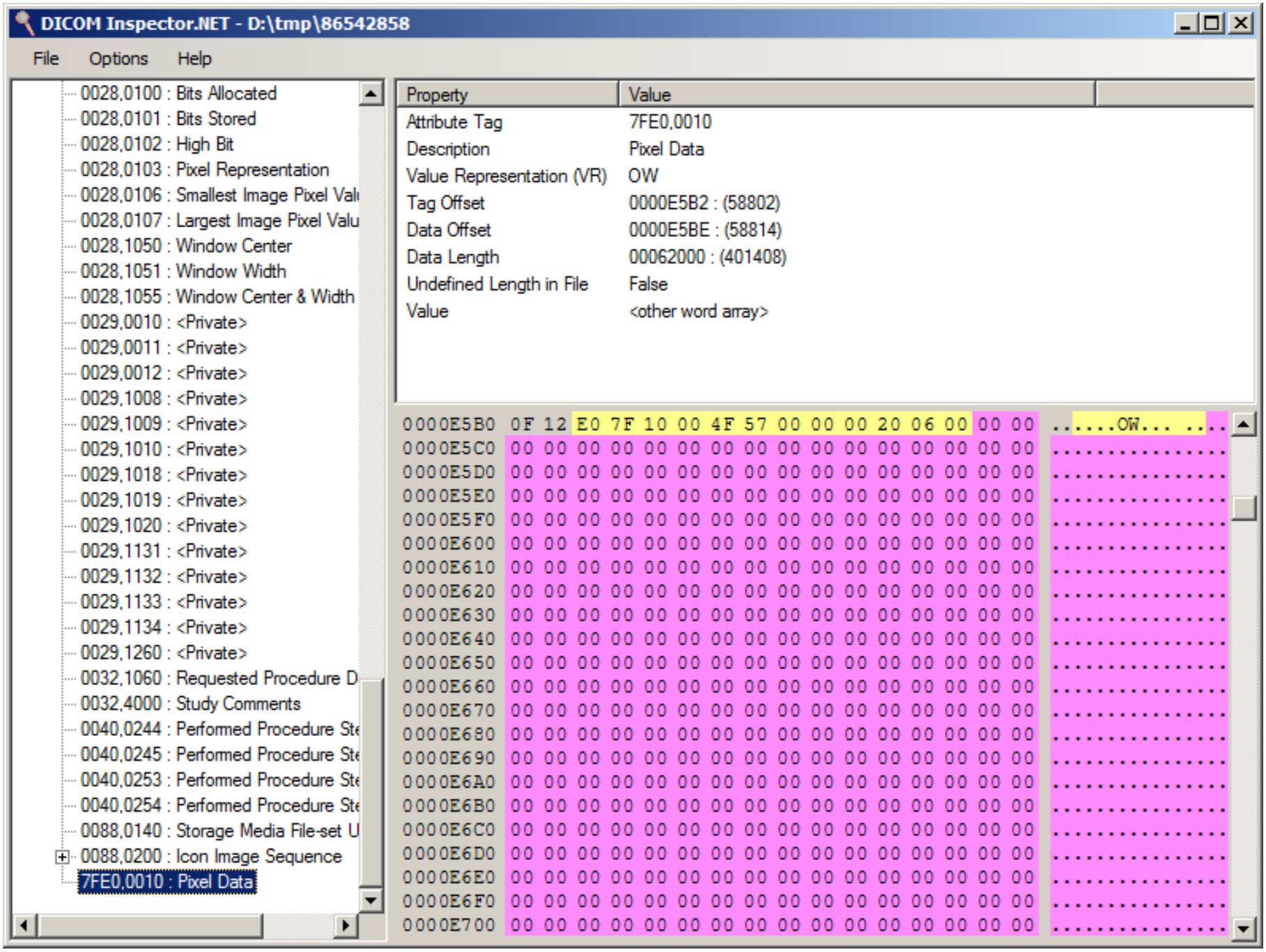
DICOM – przykładowe elementy



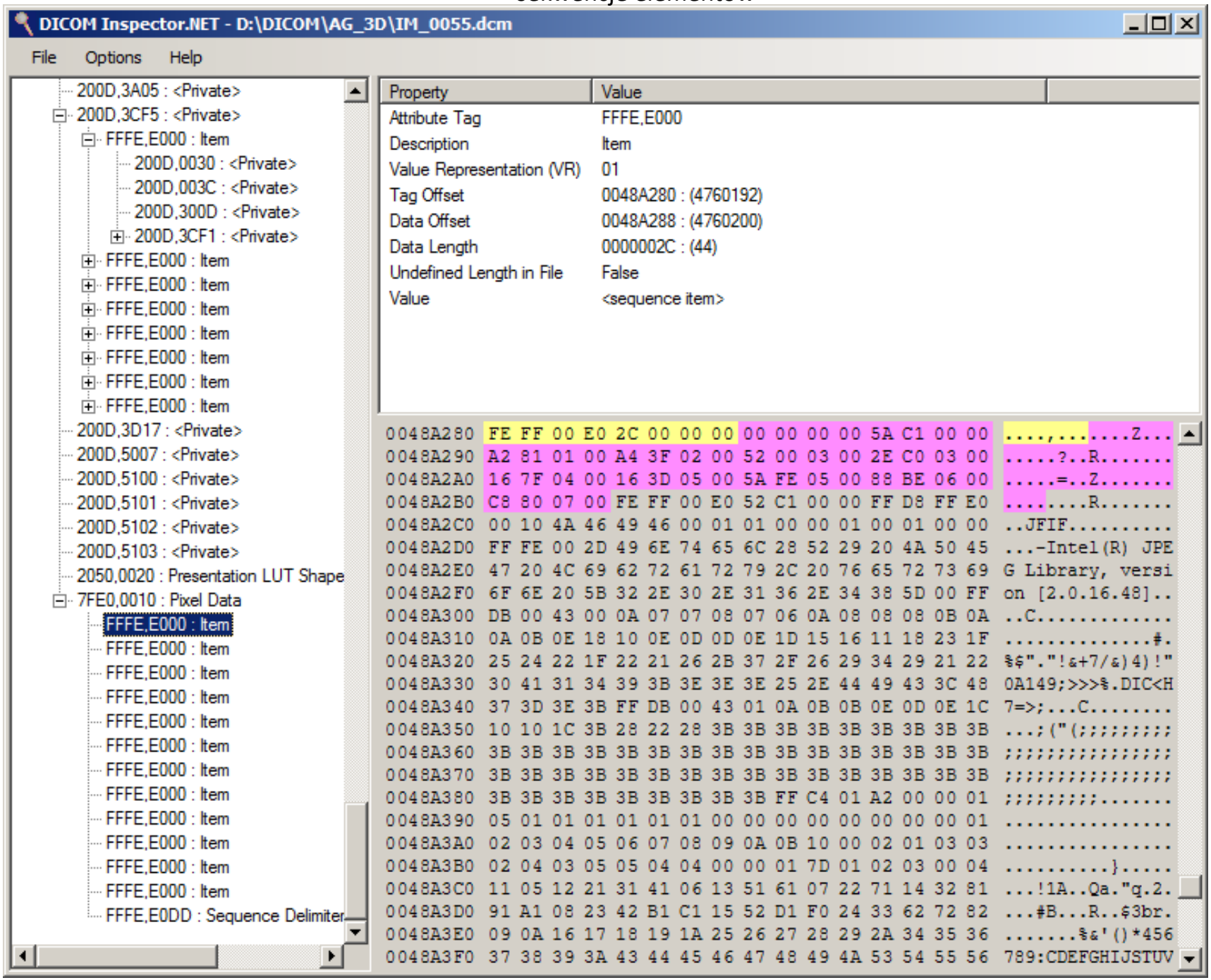
parametry obrazu



dane obrazu

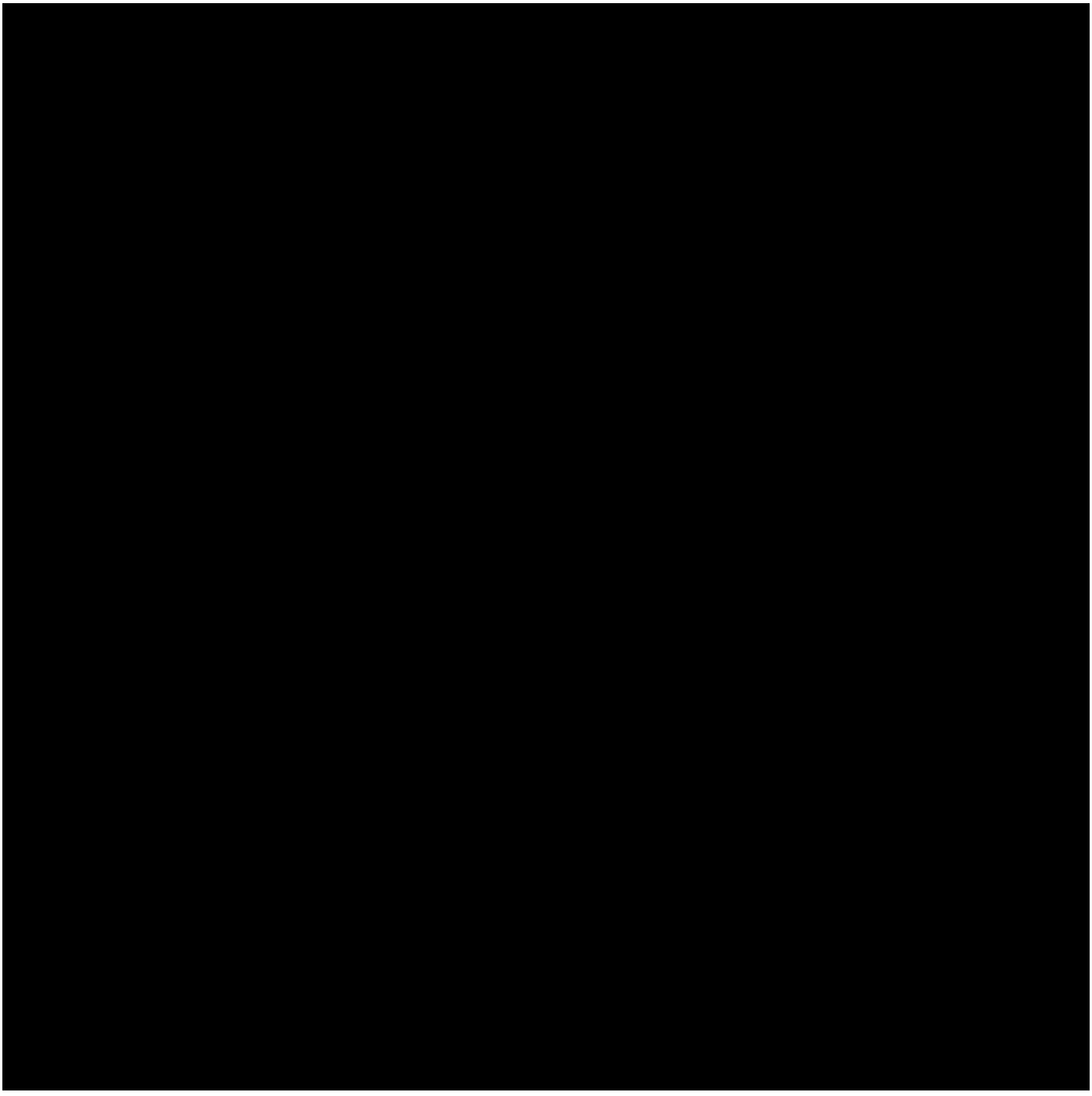

DICOM Inspector.NET - D:\tmp\86542858
File
Options
Help
0028,0100 : Bits Allocated
0028,0101 : Bits Stored
0028,0102 : High Bit
0028,0103 : Pixel Representation
0028,0106 : Smallest Image Pixel Val
0028,0107 : Largest Image Pixel Valu
0028,1050 : Window Center
0028,1051 : Window Width
0028,1055 : Window Center & Width
0029,0010 : <Private>
0029,0011 : <Private>
0029,0012 : <Private>
0029,1008 : <Private>
0029,1009 : <Private>
0029,1010 : <Private>
0029,1018 : <Private>
0029,1019 : <Private>
0029,1020 : <Private>
0029,1131 : <Private>
0029,1132 : <Private>
0029,1133 : <Private>
0029,1134 : <Private>
0029,1260 : <Private>
0032,1060 : Requested Procedure D
0032,4000 : Study Comments
0040,0244 : Performed Procedure Ste
0040,0245 : Performed Procedure Ste
0040,0253 : Performed Procedure Ste
0040,0254 : Performed Procedure Ste
0088,0140 : Storage Media File-set U
0088,0200 : Icon Image Sequence
7FE0,0010 : Pixel Data
Property
Value
Attribute Tag
7FE0,0010
Description
Pixel Data
Value Representation (VR)
OW
Tag Offset
0000E5B2 : (58802)
Data Offset
0000E5BE : (58814)
Data Length
00062000 : (401408)
Undefined Length in File
False
Value
<other word array>
0000E5B0 0F 12 E0 7F 10 00 4F 57 00 00 00 20 06 00 00 00 ..... OW... ....
0000E5C0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 ....
0000E5D0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 ....
0000E5E0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 ....
0000E5F0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 ....
0000E600 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 ....
0000E610 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 ....
0000E620 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 ....
0000E630 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 ....
0000E640 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 ....
0000E650 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 ....
0000E660 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 ....
0000E670 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 ....
0000E680 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 ....
0000E690 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 ....
0000E6A0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 ....
0000E6B0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 ....
0000E6C0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 ....
0000E6D0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 ....
0000E6E0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 ....
0000E6F0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 ....
0000E700 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 ....

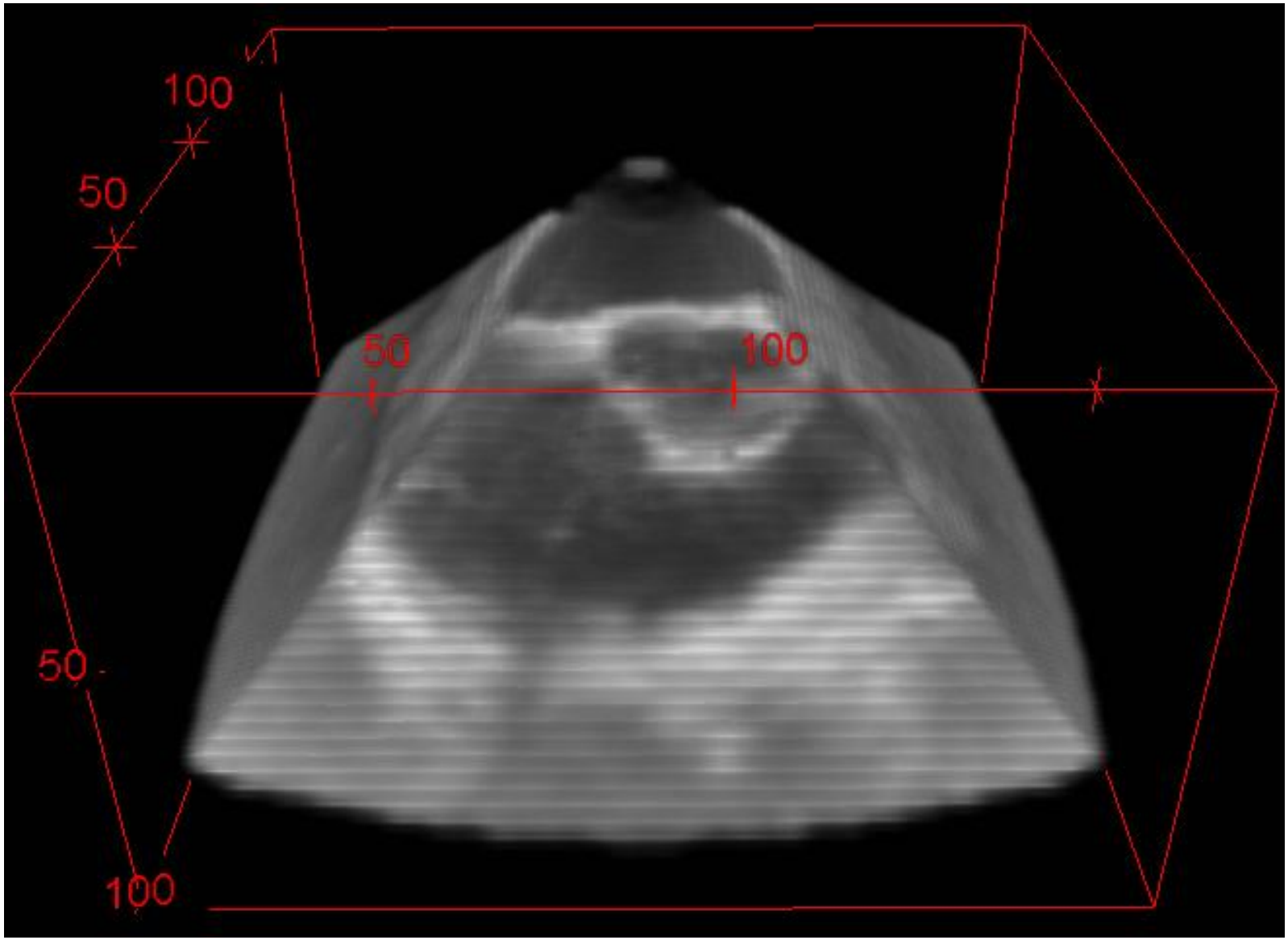
sekwencje elementów



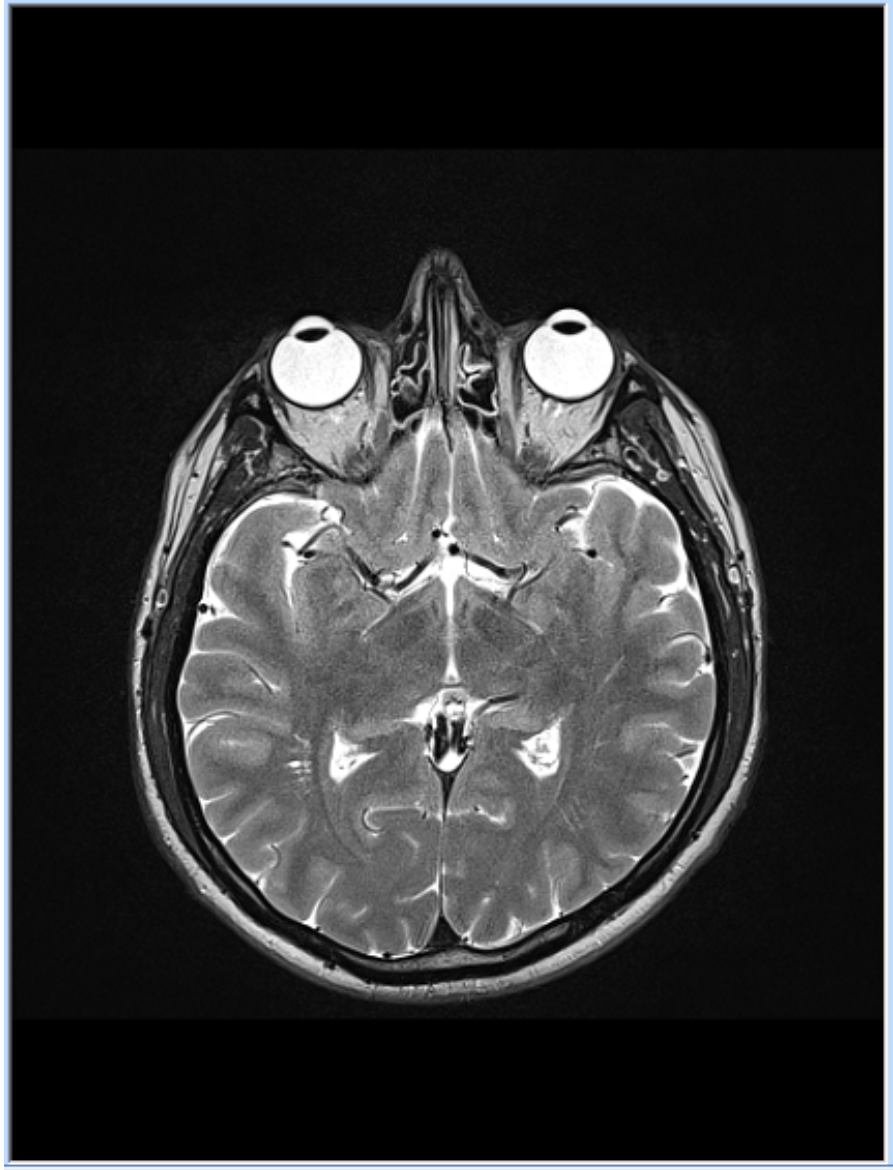
Z uprzejmości prof. A. Gackowskiego – dziękuję ☺

[animacja gif]





ImageJ – 3D Viewer



DICOM Tags

Search...

(Group,Elem...	TAG Description	Value
(0020,0010)	Study ID	1
(0020,0011)	Series Number	5
(0020,0012)	Acquisition Number	1
(0020,0013)	Instance Number	64
(0020,0032)	Image Position Patient	-107.46507210286\-142.89410754904\-
(0020,0037)	Image Orientation Patient	0.9993205442521\0.03383256768023\0.
(0020,0052)	Frame Of Reference UID	1.3.12.2.1107.5.2.30.159046.2.2021082(
(0020,1040)	Position Reference Indicator	
(0020,1041)	Slice Location	19.50261581859
(0028,0002)	Samples Per Pixel	1
(0028,0004)	Photometric Interpretation	MONOCHROME2
(0028,0010)	Rows	448
(0028,0011)	Columns	448
(0028,0030)	Pixel Spacing	0.51339286565781\0.51339286565781
(0028,0100)	Bits Allocated	16
(0028,0101)	Bits Stored	12
(0028,0102)	High Bit	11
(0028,0103)	Pixel Representation	0
(0028,0106)	Smallest Image Pixel Value	0
(0028,0107)	Largest Image Pixel Value	2454
(0028,1050)	Window Center	804
(0028,1051)	Window Width	1736
(0028,1055)	Window Center Width Expl...	WINDOW1
(0029,0010)	Private Creator	SIEMENS CSA HEADER
(0029,0011)	Private Creator	SIEMENS MEDCOM HEADER2
(0029,1008)	Unknown Tag & Data	IMAGE NUM 4
(0029,1009)	Unknown Tag & Data	20210820

Patient information | All Tags | Favorite Tags

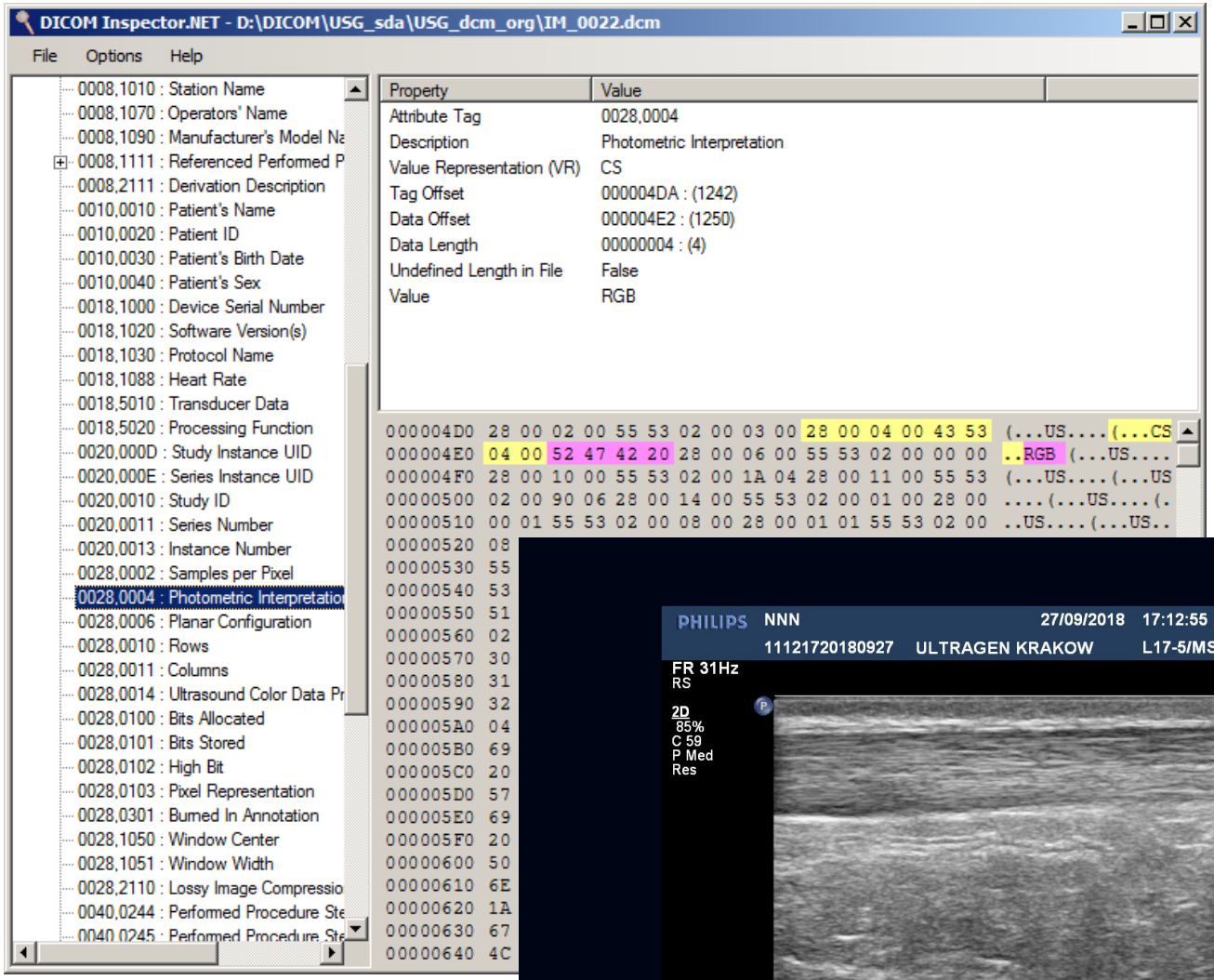
DICOM Tags

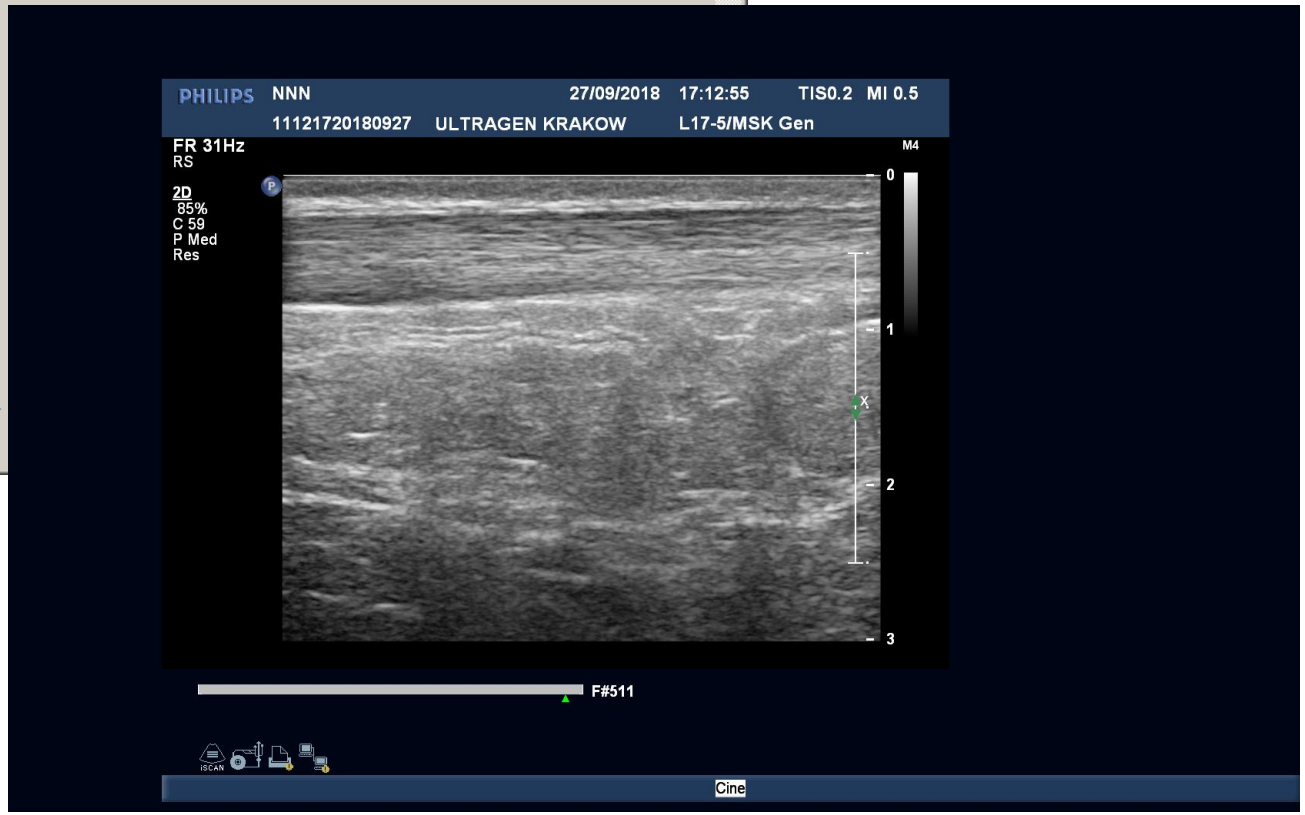
Search...

(Group,Elem...	TAG Description	Value
(0019,10FC)	Unknown Tag & Data	320
(0019,10FD)	Unknown Tag & Data	NO
(0019,10FE)	Unknown Tag & Data	MED
(0020,000D)	Study Instance UID	1.2.124.113532.12.10699.12127.20...
(0020,000E)	Series Instance UID	1.3.51.0.7.12707346244.14092.456...
(0020,0010)	Study ID	000008980151
(0020,0011)	Series Number	1
(0020,0013)	Instance Number	1
(0020,0020)	Patient Orientation	L\F
(0020,0062)	Image Laterality	U
(0028,0002)	Samples Per Pixel	1
(0028,0004)	Photometric Interpretati...	MONOCHROME1
(0028,0010)	Rows	1825
(0028,0011)	Columns	1364
(0028,0030)	Pixel Spacing	0.139\0.139
(0028,0100)	Bits Allocated	16
(0028,0101)	Bits Stored	15
(0028,0102)	High Bit	14
(0028,0103)	Pixel Representation	0
(0028,0300)	Quality Control Image	NO
(0028,0301)	Burned In Annotation	NO
(0028,1040)	Pixel Intensity Relations...	DISP
(0028,1041)	Pixel Intensity Relations...	1
(0028,1052)	Rescale Intercept	0
(0028,1053)	Rescale Slope	1
(0028,1054)	Rescale Type	PVAL
(0028,2110)	Lossy Image Compression	00
(0028,3010)	VOILUT Sequence	
(FFFE,E000)	Item	
(0028,3002)	LUT Descriptor	14149\8217\16
(0028,3003)	LUT Explanation	
(0028,3006)	LUT Data	6\6\6\6\6\7\7\7\8\9\10\11\12\13\1...

Patient information | All Tags | Favorite Tags

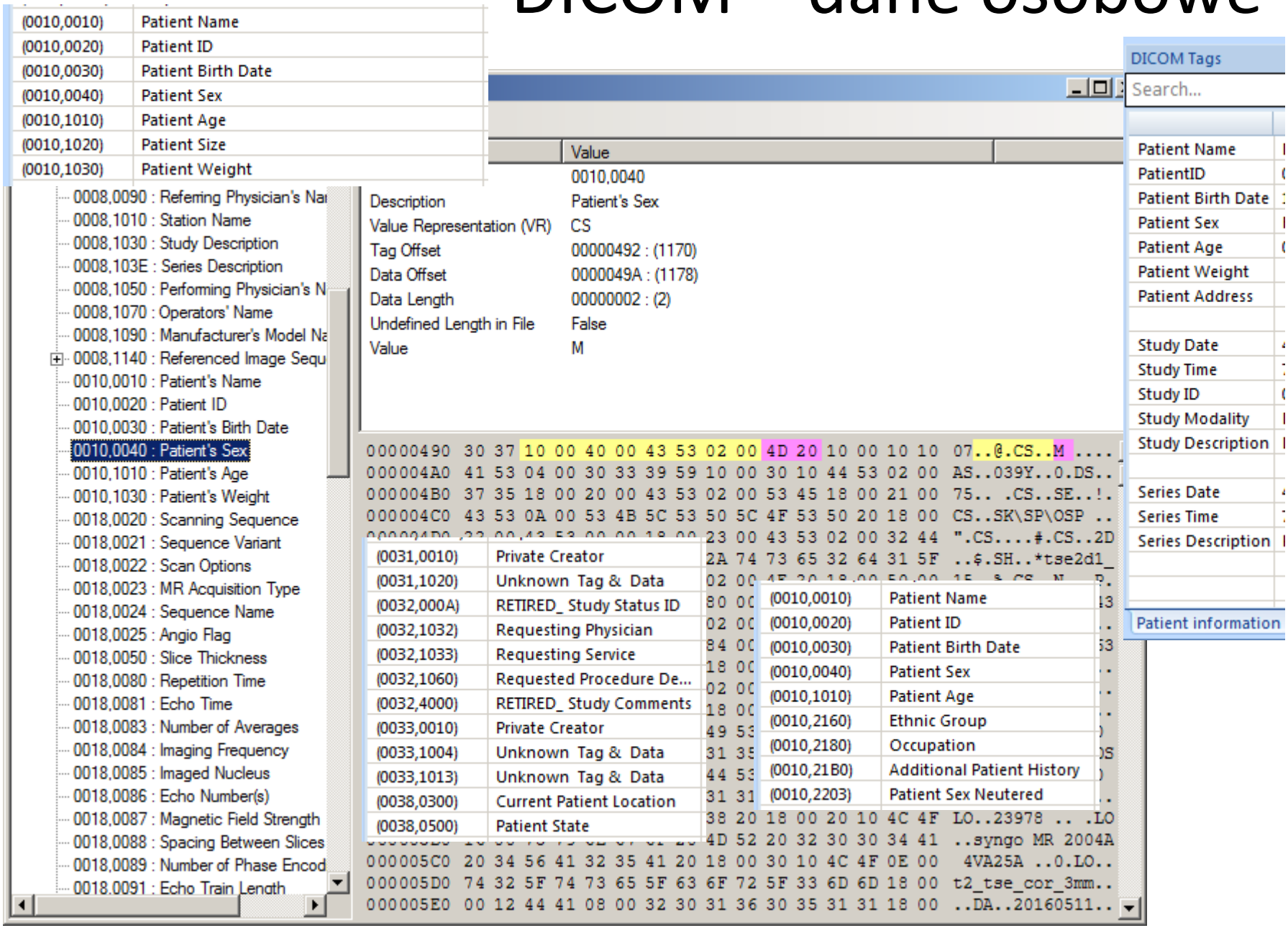
RGB





Z uprzejmości prof. R. Obuchowicza - dziękuję ☺

DICOM – dane osobowe



DICOM – dane osobowe

0008,0050 - AccessionNumber
0008,0080 - InstitutionName
0008,0081 - InstitutionAddress
0008,0090 - ReferringPhysicianName
0008,0096 - ReferringPhysician ID
0008,009C - ConsultingPhysicianName
0008,009D - ConsultingPhysicianName
0008,1040 - InstitutionalDepartmentName
0008,1048 - PhysiciansOfRecord
0008,1050 - PerformingPhysicianName
0008,1060 - NameOfPhysiciansReadingStudy
0008,1070 - Operator
0008,1010 - StationName
0008,1030 - StudyDescription
0008,103E - SeriesDescription
0010,0010 - PatientName (Nazwisko^Imie)
0010,0020 - PatientID
0010,0030 - PatientBirthDate
0010,1000 - PatientID_other,RETIRED_OtherPatientIDs
0010,4000 – Patient Comments
0018,0024 - SequenceName
0018,1000 - DeviceSerialNumber
0018,1030 - ProtocolName
0033,1013 - UnknownTag&Data - AGFA - imie nazw
0031,1020 - Unknown Tag & Data pesel
0031,1101 - Unknown Tag & Data nr ??
0038,0300 - CurrentPatientLocation
0032,1032 - Requesting_Physician
0032,1033 - Requesting_Service
0032,0080 - osrodek
0032,0080 - osrodek
0040,3001 - ConfidentialityConstraintOnPatientDataDescription
0137,1010 - imie_nazwisko_netraad
0137,1020 - ???_netraad
0137,1030 - data_ur_netraad

DICOM - DCMTK: OFFIS DICOM Toolkit

zamiana JPEG2000 na RAW

```
dcmdjpeg plik plik_raw.dcm
```

pobranie danych DCM

```
dcmdump +P 0028,0030 %t >>pikselspacing.txt
```

```
D:\>dcmdump +P 0028,0030 P86542499.dcm
(0028,0030) DS [0.68359375\0.68359375]      22, 2 PixelSpacing
```

ANONIMIZACJA

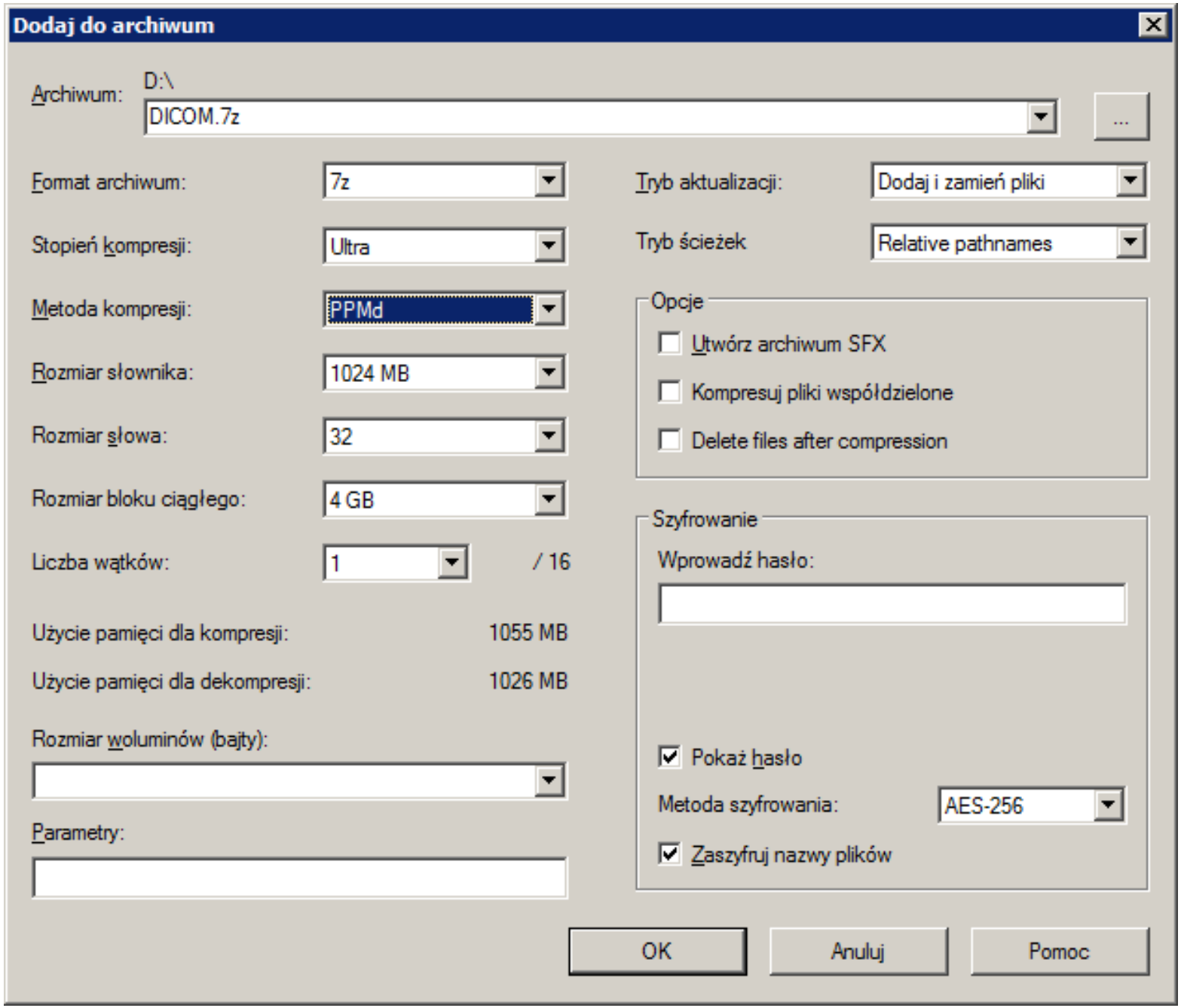
-- wykasowywanie tagu (wykasowanie calego bloku z wewnetrznymi danymi)

```
dcmodify -e "(0010,1000)" plik.dcm
```

-- zmiana danych w tagu

```
dcmodify -m "(0010,0010)=anon" plik.dcm
```

Praktyka ...


Dodaj do archiwum
Archiwum:
D:\
DICOM.7z
...
Format archiwum:
7z
Stopień kompresji:
Ultra
Metoda kompresji:
PPMd
Rozmiar słownika:
1024 MB
Rozmiar słowa:
32
Rozmiar bloku ciągłego:
4 GB
Liczba wątków:
1
/ 16
Użycie pamięci dla kompresji:
1055 MB
Użycie pamięci dla dekompresji:
1026 MB
Rozmiar woluminów (bajty):
Parametry:
Tryb aktualizacji:
Dodaj i zamień pliki
Tryb ścieżek
Relative pathnames
Opcje
Utwórz archiwum SFX
Kompresuj pliki współdzielone
Delete files after compression
Szyfrowanie
Wprowadź hasło:
Pokaż hasło
Metoda szyfrowania:
AES-256
Zaszyfruj nazwy plików
OK
Anuluj
Pomoc

~38%