



Software design of MaZda 3.08

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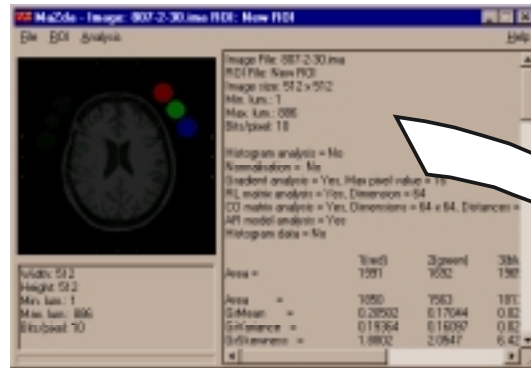
What is MaZda?



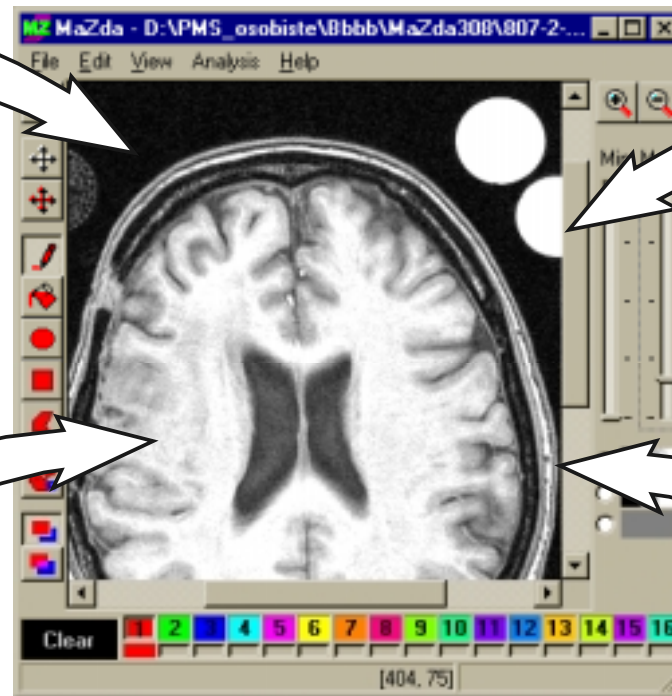
- specialised software tool for calculation of texture features (parameters) in MR images
 - within defined regions of interest
 - as feature maps (image filtration)
- written in C++ and compiled for a graphical user interface of Windows 9x/NT/2k system
- MaZda – acronym for co-occurrence matrix
 - **Macierz Zdarzeń** in polish
- under development since 1996

Integration of MaZda, RoiEdit, BMPView and Convert

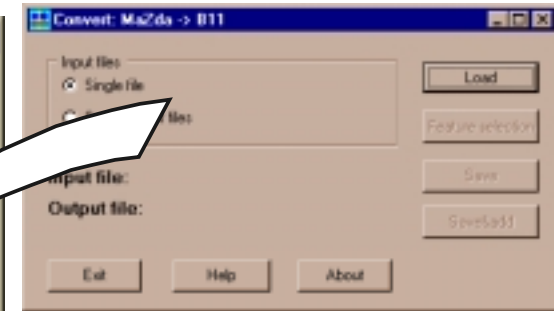
MaZda.exe



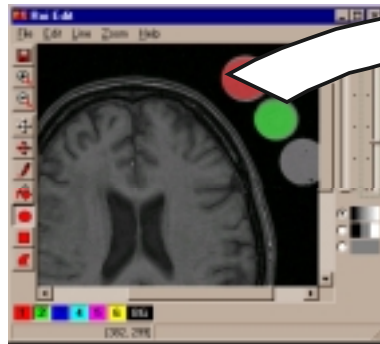
MaZda.exe version 3.08



Convert.exe



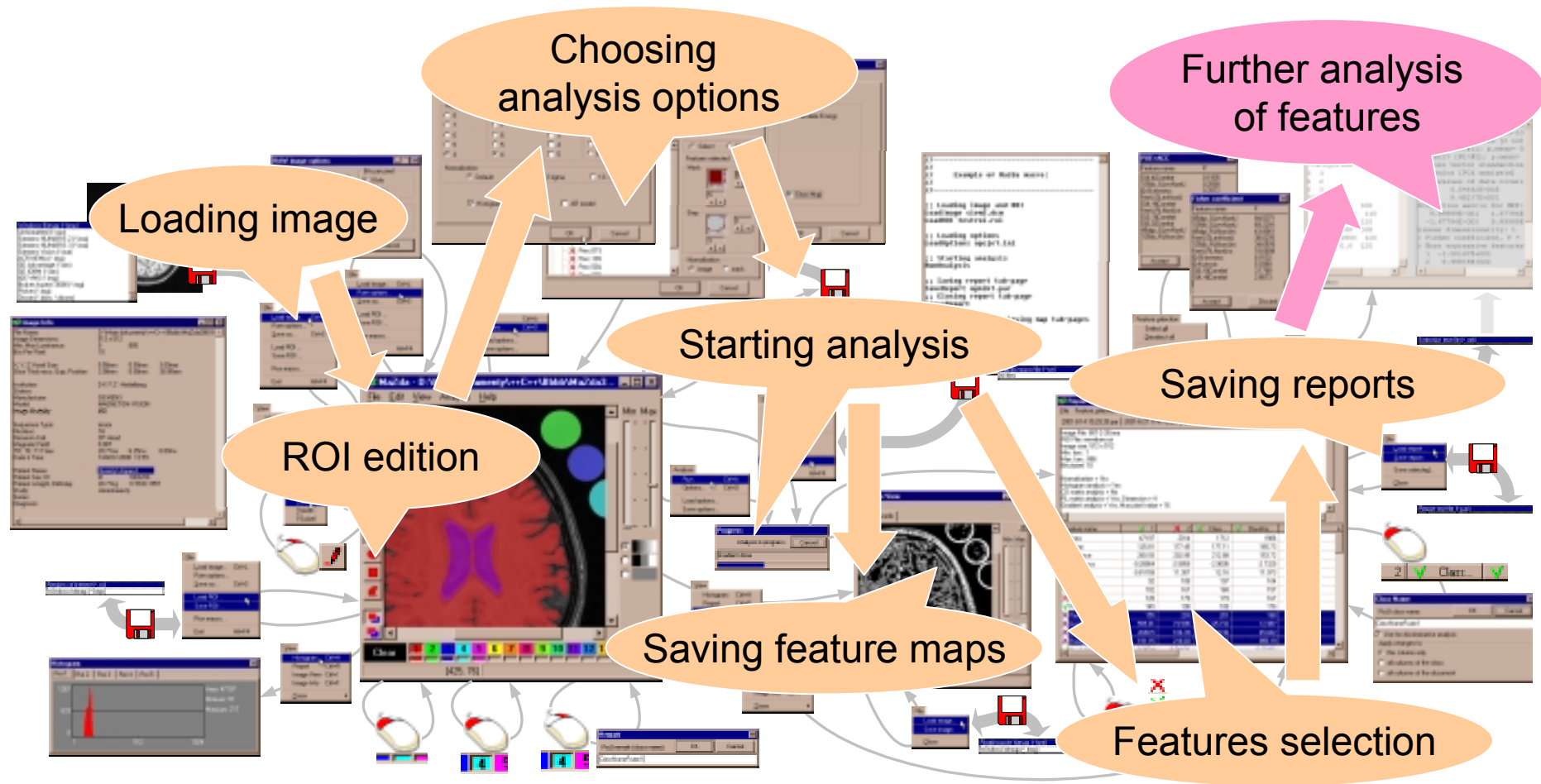
RoiEdit.exe



BMPView.exe



Image analysis with MaZda



Loading and viewing image

The image displays the MaZda software interface for loading and viewing medical images. It includes a file selection menu, an image information window, and a main viewing window with various adjustment tools.

File Selection Menu:

- Windows Bitmap (*.bmp)
- Unformatted (*.raw)
- Siemens NUMARIS 2 (*.ima)
- Siemens NUMARIS 3 (*.ima)
- Siemens Vision (*.ima)
- ACR NEMA (*.img)
- GE Advantage (*.xim)
- GE IDBM (*.xim)
- IGE-YMS (*.img)
- Brucker Aspect 3000 (*.img)
- Picker (*.img)
- Dicom (*.dcm; *.dicom)

Image Info Window:

Window for viewing image info-header

File Name:	D:\Moje dokumenty\++C++\Bbbb\MaZda306\8
Image Dimensions:	512 x 512
Min; Max Luminance:	0 885
Bits Per Pixel:	10
X; Y; Z Voxel Size:	0.50n
Slice Thickness; Gap; Position:	3.00n
Institution:	D K F
Station:	
Manufacturer:	SIEM
Model:	MAGNETOM VISION
Image Modality:	MR
Sequence Type:	mraxx
Nucleus:	1H
Receivin Coil:	CP Head
Magnetic Field:	0.00T

Main Image Viewer:

MaZda - D:\PMS_osobiste\Bbbb\MaZda308\807-2-...

Image size adjustment

Image grey-scale or threshold adjustment tools

Image layer switches:

- grey-scale
- threshold
- hide

Clear 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 [427, 304]

Defining regions of interest

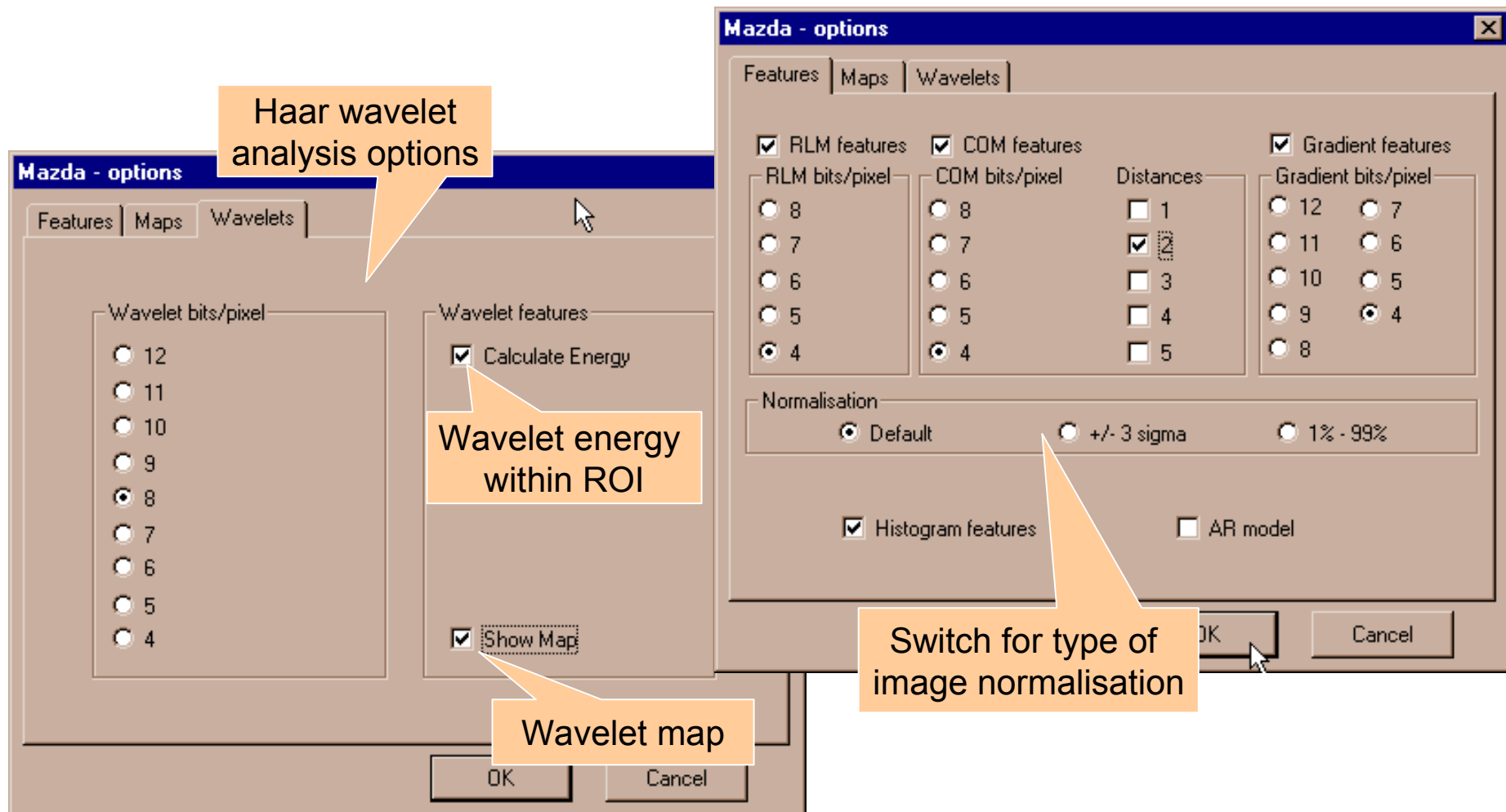
The image displays the MaZda software interface, which is used for defining and editing regions of interest (ROIs) in microscopy images. The main window shows a grayscale image with several ROIs marked in different colors (blue, green, red, purple). The interface includes a menu bar (File, Edit, View, Analysis, Help) and a toolbar with various tools for ROI editing. A status bar at the bottom shows the coordinates [327, 106].

Key features and windows are highlighted with callouts:

- Built-in tools for ROI editing:** A callout pointing to the toolbar on the left side of the main window.
- Morphological operation tools for ROI editing:** A callout pointing to a specific tool in the toolbar.
- Overlapping and non-overlapping ROI mode:** A callout pointing to a button in the toolbar.
- Up to 16 ROI marked with unique colours:** A callout pointing to the color selection bar at the bottom of the main window.
- Viewer for image histogram within ROI:** A callout pointing to the Histogram window, which displays a histogram for the selected ROI (Roi 3) with statistics: Area: 12098, MinLum: 1, MaxLum: 213.
- Saving and loading regions:** A callout pointing to the file menu in the main window.
- Window for changing ROI name (class):** A callout pointing to the Remark window, which allows users to change the class name of a selected ROI (e.g., Roi3 remark (class name): ClassNameFoam1).

ROI editing example

Choosing analysis options (1)



Choosing analysis options (2)

The screenshot shows the 'Mazda - options' dialog box with the 'Features' tab selected. The left pane displays a tree-view for maps selection, showing folders 'RLM' and 'COM', and a list of features under 'Gradient' and 'Histogram'. The right pane contains controls for 'Select' and 'Clear', 'Features selected' (4 (4)), 'Mask' size adjustment (5x5), 'Step' adjustment (1x1), and 'Normalisation' (image or mask). Callouts point to these features: 'Tree-view for maps selection', 'Mask size adjustment', 'Step adjustment', 'Choosing region for normalisation', and 'Saving and loading options' (pointing to a file icon and 'Options (*.ini)' text).

Mazda - options

Features | Maps | Wavelets

Tree-view for maps selection

Mask size adjustment

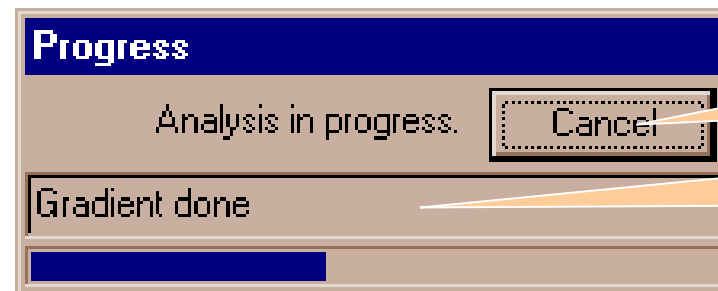
Step adjustment

Choosing region for normalisation

Saving and loading options

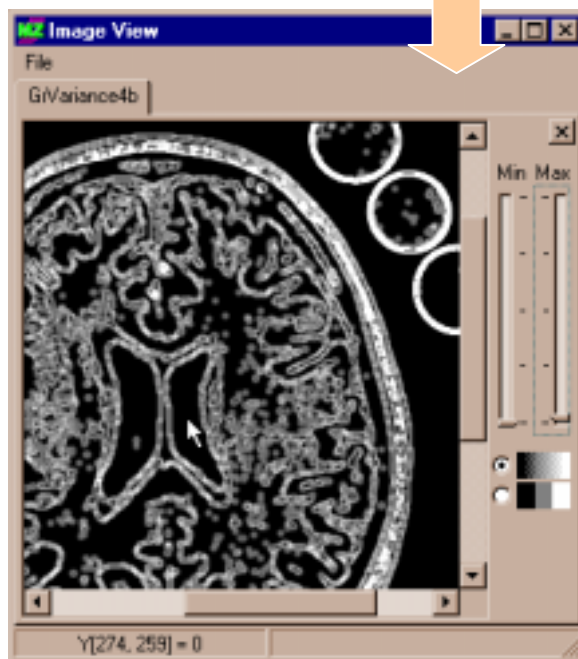
Options (*.ini)

Analysis



Possibility to stop the analysis

More precise information on what have been done



Report

File Feature selection

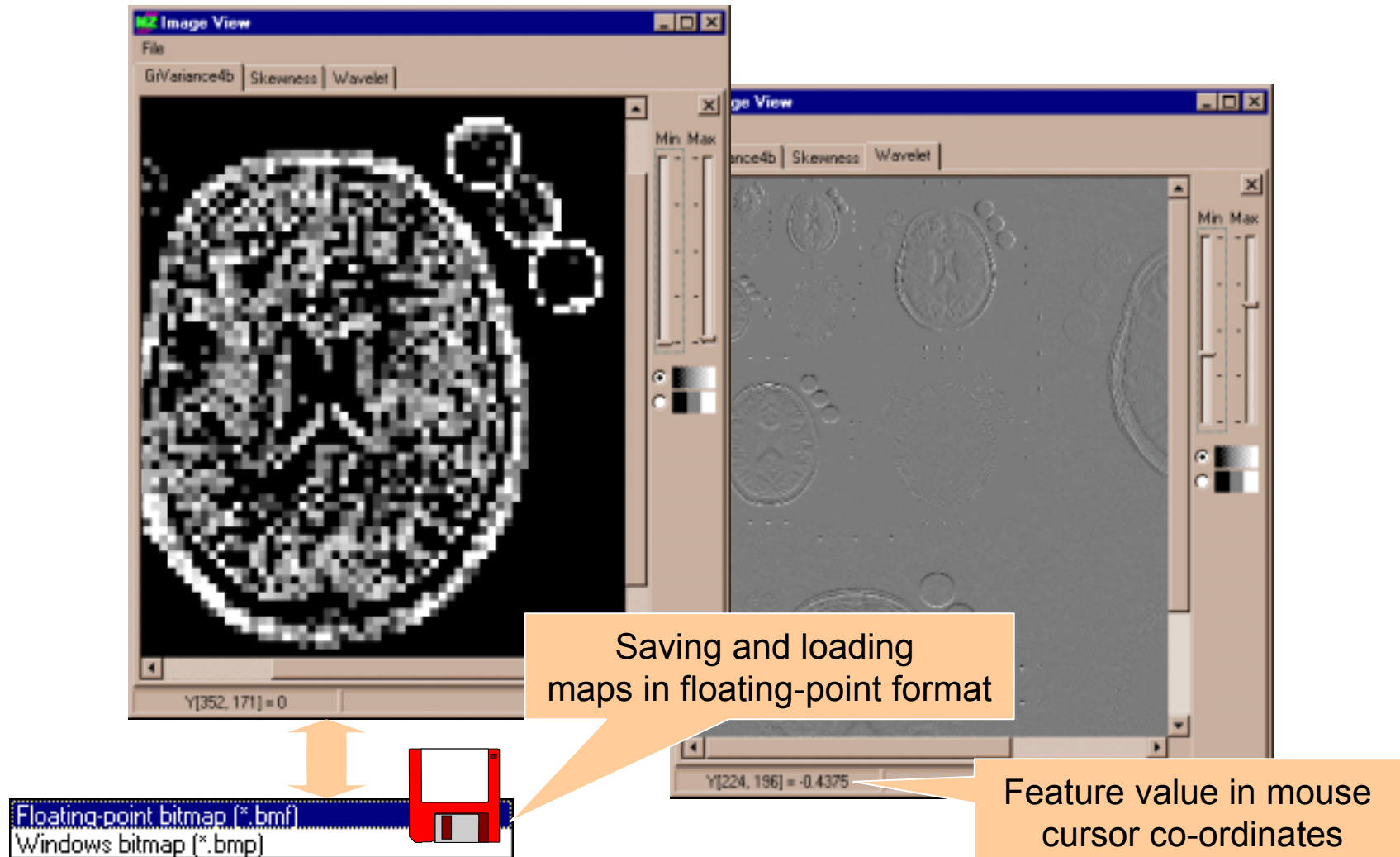
2001-8-14 15:29:35.par | 2001-6-27 11:47:10.par | 2001-11-29 16:00:19.par | 2002-2-12 13:24:00

Image File: 807-2-30.mha
ROI File: newdawn.roi
Image size: 512x512
Min. Ix: 1
Max. Ix: 896
Bits/pixel: 10

Normalisation = No
Histogram analysis = Yes
CD matrix analysis = No
RL matrix analysis = Yes, Dimension = 4
Gradient analysis = Yes, Max pixel value = 16

Feature name	✓ 1	✗ 2	✓ Class	✓ ClassNo	✓ 5
Area	47197	2014	1712	1986	4516
✗ Mean	125.81	177.45	177.11	165.73	48.846
✓ Variance	260.93	202.95	212.88	153.72	213.78
✓ Skewness	-0.28064	-2.5859	-2.9095	-2.7329	1.0991
✗ Kurtosis	-0.81159	11.307	12.16	11.973	0.66767
✗ Perc.01%	92	108	107	104	26
✓ Perc.10%	102	167	168	157	34
✗ Perc.50%	128	179	179	167	45
✓ Perc.90%	145	190	189	175	73
✗ Perc.99%	195	201	201	186	89
✗ Host_L_NonUni	555.91	73.595	65.733	12.957	29.037
✗ Host_GL_NonUni	2680.5	106.39	78.96	45.602	188.05
✗ Host_LngEmph	191.15	218.03	231.5	655.19	252.54
✗ Host_LngEmph	0.0004	0.0001	0.0001	0.0001	0.0001

Feature maps window



Report window (1)

The screenshot shows the MZ Report window with a menu bar (File, Feature selection, Tools) and a tabbed interface. The active tab is labeled '2001-8-14 15,29,35.par'. The window displays image file information, analysis parameters, and a features table.

Data header

Image File: 807-2-30.ima
ROI File: newdraw.roi
Image size: 512 x 512
Min. lum.: 1
Max. lum.: 886
Bits/pixel: 10

Normalisation = 3 sigma
Histogram analysis = Yes
CO matrix analysis = Yes, Dimensions = 4 x 4, Distances = 2 4
RL matrix analysis = Yes, Dimension = 4
Gradient analysis = Yes, Max pixel value = 16

Tab-page keeps the analysis result

Features table

Feature name	✓ 1	✓ 2	✓ 3	4	5
Area	44043	9553	12098	0	0
MinNorm	84	-62	-95	0	0
MaxNorm	171	227	228	0	0
✓ Mean	2022.4	2037.6	2039.9	0	0
✓ Variance	4.6122e+05	4.6759e+05	4.6853e+05	0	0
✓ Skewness	-0.21718	-0.23011	0.28397	0	0
✓ Kurtosis	-0.91426	-1.2226	-1.3215	0	0
✓ Perc.01%	707	908	1218	0	0
✓ Perc.10%	1037	1007	1269	0	0
✓ Perc.50%	2119	2155	1966	0	0

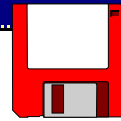
Saving and loading reports (tab-pages)

Report text file (*.par)

Report window (2)

Selection text file (*.sel)

Saving selected features



Class Name

ROI class name:

☒ Use for discriminative analysis

Apply changes to:

☒ this column only

☐ all columns of the class

☐ all columns of the document

OK Cancel

POE+ACC

Feature name P

S(4,4)Correlat
135dr_GLevNonU
GrSkewness
VertL_GLevNonU
S(4,-4)Correlat
VertL_RLNonUni
S(3,-3)Correlat
S(0,3)Correlat
45dgr_GLevNonU
135dr_RLNonUni

Accept

Fisher coefficient

Feature name F

45dgr_GLevNonU 84.0371
135dr_GLevNonU 69.2291
45dgr_RLNonUni 43.8061
VertL_GLevNonU 38.0276
135dr_RLNonUni 34.6578
VertL_RLNonUni 18.6699
GrSkewness 8.9132
GrKurtosis 5.0360
S(5,-5)Correlat 3.1780
S(4,-4)Correlat 2.6673

Accept Discard

mz Report

File Feature selection Tools

2001-8-14 15,29,35.par | 2001-6-27 114710.par | 2001-11-29 16,00,19.par | 2002-2-12 13,24,00

Image File: 807-2-30.ima
ROI File: newdraw.roi
Image size: 512 x 512
Min. lum.: 1
Max. lum.: 886
Bits/pixel: 10

Normalisation = No
Histogram analysis = Yes
CO matrix analysis = No
RL matrix analysis = Yes, Dimension = 4
Post analysis = Yes, Max pixel value = 16

Feature name	✓ 1	✗ 2	✓ Class...	✓ ClassNa...	✓ 5
Area	47197	2014	1712	1986	4516
✗ M...	177.11	165.73	48.846		
✓ V...	212.88	153.72	213.78		
✓ Skewness	-0.20004	-2.0005	-2.9095	-2.7329	1.0991
✗ Kurt...	-0.81159	11.307	12.16	11.973	0.66767
✗ Perc.01%	92	108	107	104	26
✓ Perc.10%	102	167	168	157	34
✗ Perc.50%	128	179	179	167	45
✓ Perc.90%	145	190	189	176	73
✗ Perc.99%	155	203	201	188	89
✗ Horzl_RLNonUni	555.91	73.595	65.733	12.957	29.037
✗ Horzl_GLevNonU	2690.5	106.39	78.96	45.602	188.05
✗ Horzl_LngREmph	191.15	218.03	231.5	855.19	252.54
✗ M...	0.20004	0.51100	0.50005	0.20000	0.20000

Region (class) selection icons

Feature selection icons

Automation of analysis

Script language commands:

LoadImage file_path_and_name

LoadROI file_path_and_name

LoadOptions file_path_and_name

RunAnalysis

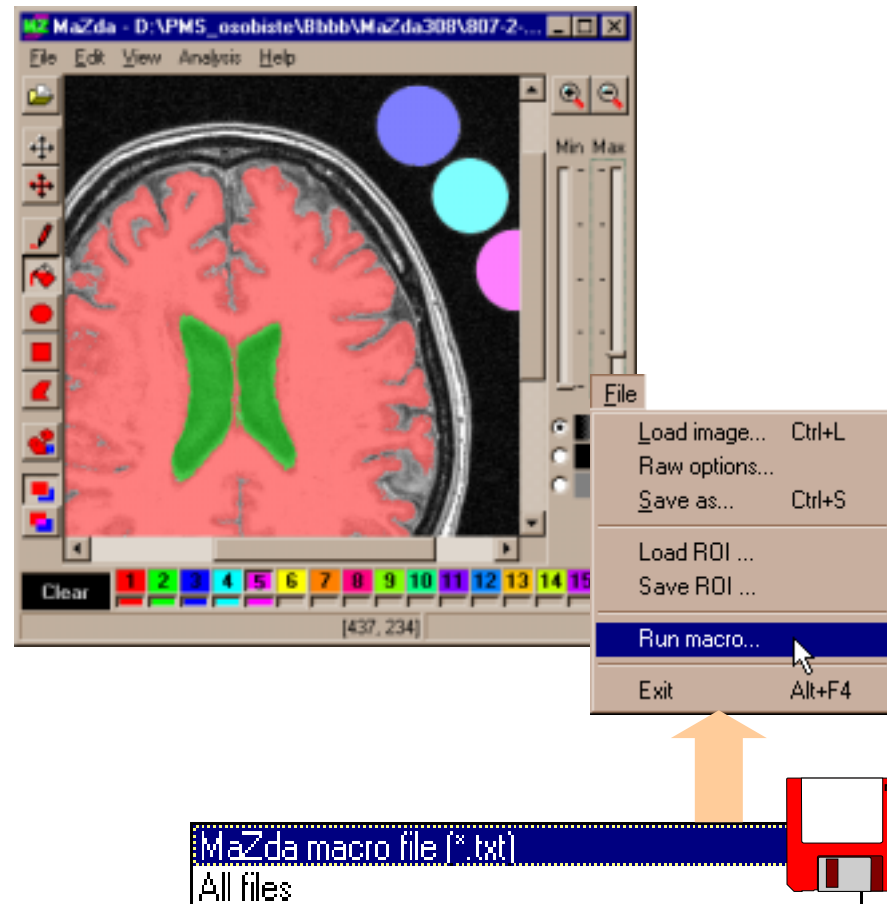
SaveReport file_path_and_name

CloseReport

SaveMap file_path_and_name

CloseMap

/ and ; for remarks



Script example

Automation example

Further analysis

b11

b11 - 2001-10-25 12,08,45.sel

Files Options Analysis Classification About Exit Help

Input (data)

```
*label
converted data: 2001-1
*features
1  Cecha12
2  Cecha123
*categories
1  1
2  2
3  3
*data
1 1  700  100
2 2  1800 110
3 3  0.4  120
4 1  800  100
5 2  1800 120
6 3  0.6  120
*end
```

Output (report)

```
* b11 report file [PCA ana
* Data file name: "2001-10
* Selected features [2 out
Cecha12 [#1/#1]; p.mean= 8
Cecha123 [#2/#2]; p.mean=
Feature vector standardize
* Results [PCA analysis]
Eigenvalues of data covari
6.54662E+005
9.48237E+001
Projection matrix for MEF:
9.99999E-001  1.67796E
-1.67796E-003  9.99999E
Linear dimensionality: 1
> Fisher coefficient, F =
> Most expressive features
1  -1.50147E+002
2   9.49835E+002
```

PCA analysis

Tools

B11 analysis

MZ Report

File Feature selection Tools

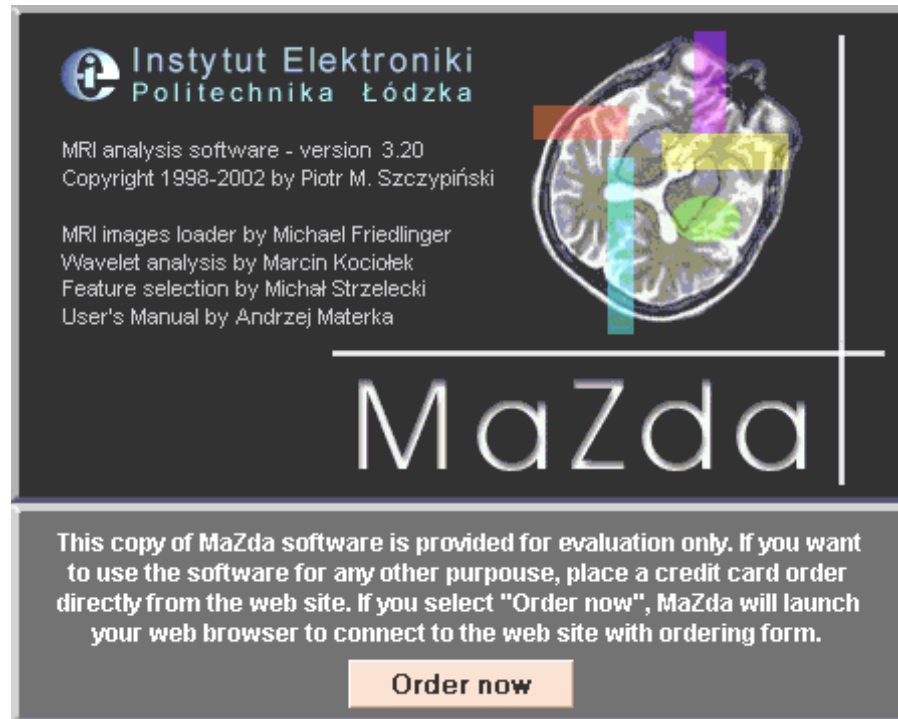
2001-8-14 15,29,35.par | 2001-6-27 114710.par | 2001-1

Image File: 807-2-30.ima
 ROI File: newdraw.roi
 Image size: 512 x 512
 Min. lum.: 1
 Max. lum.: 886
 Bits/pixel: 10

Normalisation = No
 Histogram analysis = Yes
 CO matrix analysis = No
 RL matrix analysis = Yes, Dimension = 4
 Gradient analysis = Yes, Max pixel value = 16

Feature name	✓ 1	✗ 2	✓
Area	47197	2014	
✗ Mean	125.81	177.45	
✓ Variance	260.93	202.95	
✓ Skewness	-0.28064	-2.5859	
✗ Kurtosis	-0.81159	11.307	
✗ Perc.01%	92	108	
✓ Perc.10%	102	167	
✗ Perc.50%	128	179	
✓ Perc.90%	145	190	
✗ Perc.99%	155	203	
✗ Horzl_RLNonUni	555.91	73.595	
✗ Horzl_GLvNonU	2690.5	106.39	
✗ Horzl_LngREmph	191.15	218.03	
✗ Horzl_LngREMP	8.2834	8.54108	

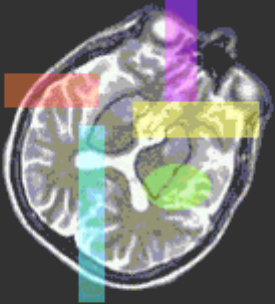
Shareware version



**Instytut Elektroniki
Politechnika Łódzka**

MRI analysis software - version 3.20
Copyright 1998-2002 by Piotr M. Szczypiński

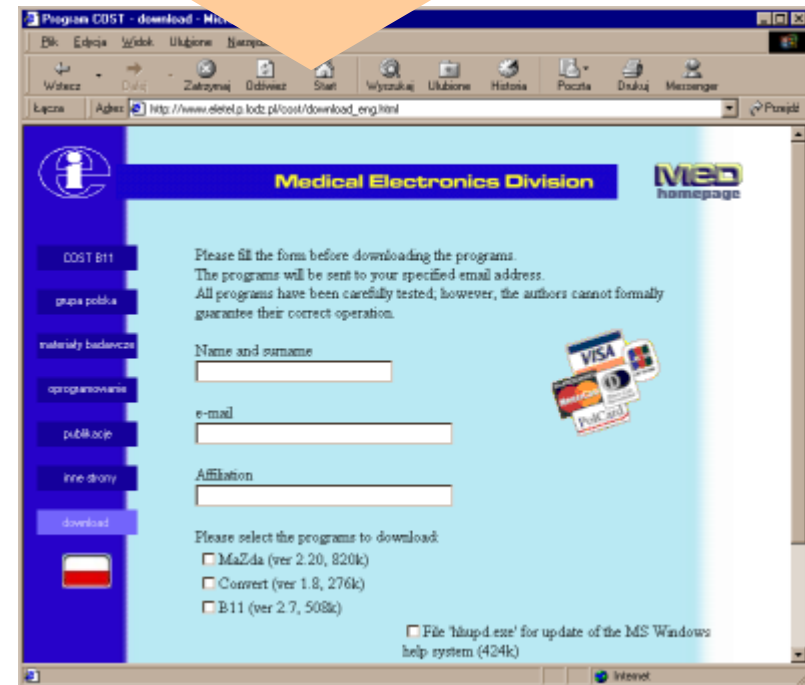
MRI images loader by Michael Friedlinger
Wavelet analysis by Marcin Kociotek
Feature selection by Michał Strzelecki
User's Manual by Andrzej Materka



MaZda

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☐ Convert (ver 1.8, 276k)
☐ B11 (ver 2.7, 508k)

☐ File 'help.d.exe' for update of the MS Windows help system (424k)

