



# Software design of MaZda 3.08

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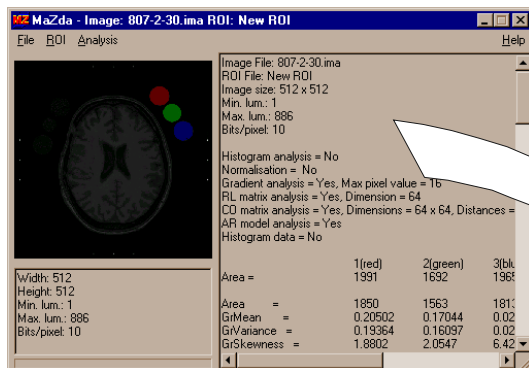
# What is MaZda?



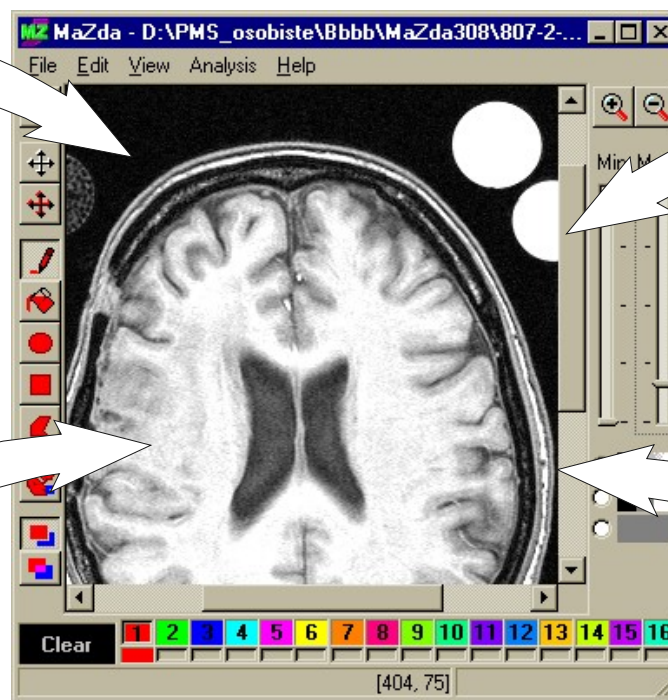
- specialised software tool for calculation of texture features (parameters) in MR images
  - within defined regions of interest
  - as feature maps (image filtration)
- written in C++ and compiled for a graphical user interface of Windows 9x/NT/2k system
- MaZda – acronym for co-occurrence matrix
  - **M**acierz **Z**darzeń in polish
- under develop since 1996 in Institute of Electronics, Technical University of Lodz

# Integration of MaZda, RoiEdit, BMPView and Convert

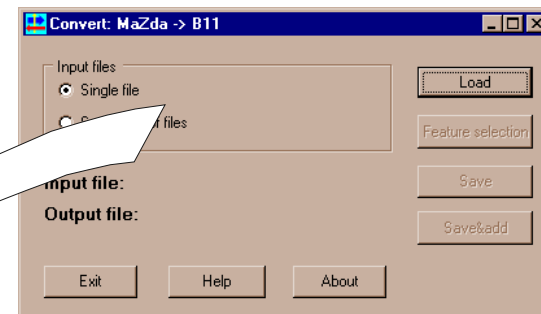
MaZda.exe



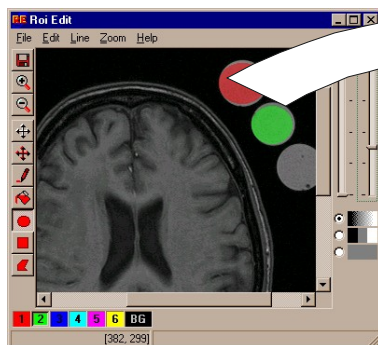
MaZda.exe version 3.08



Convert.exe



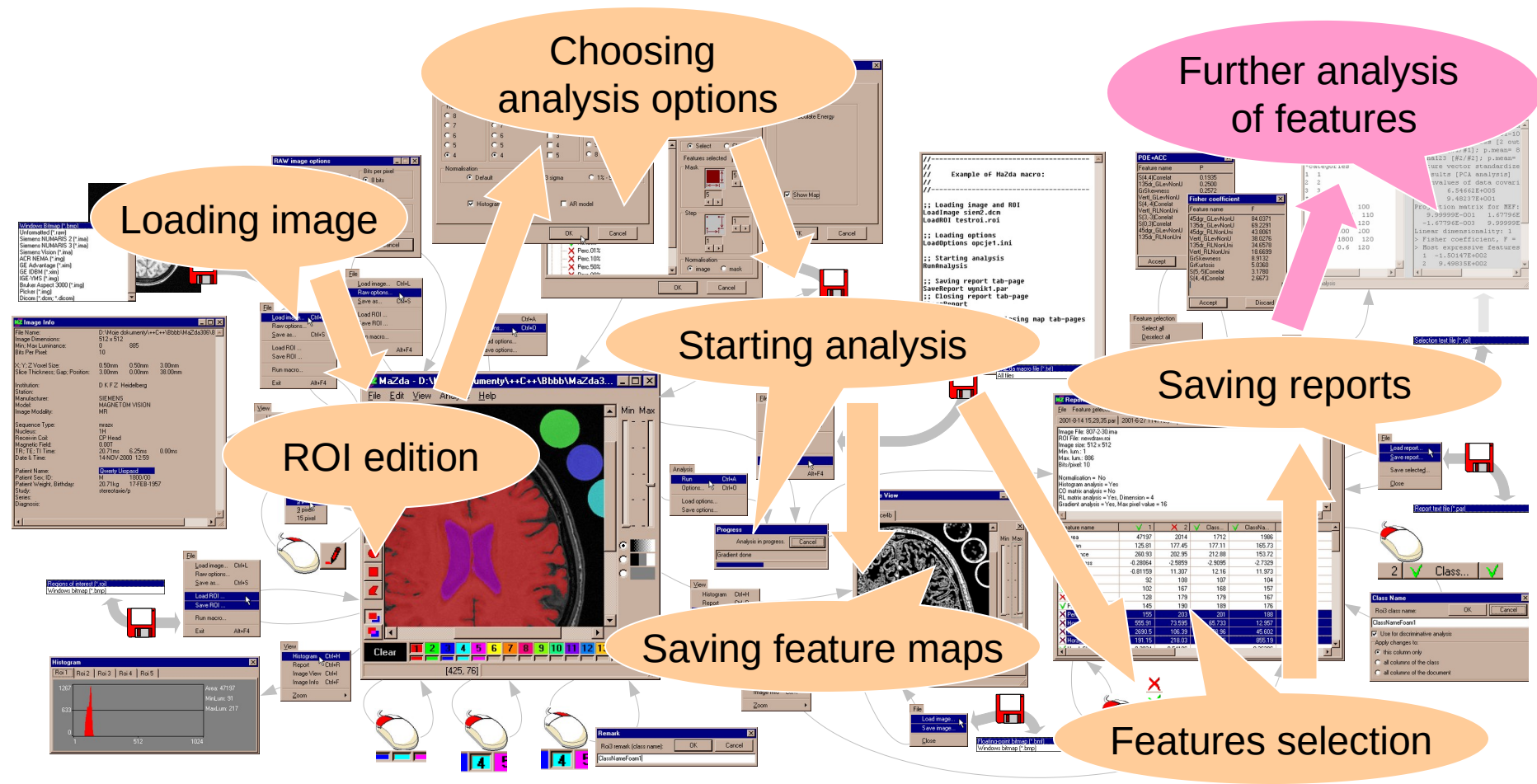
RoiEdit.exe



BMPView.exe



# Image analysis with MaZda



Loading image

Choosing analysis options

Starting analysis

ROI edition

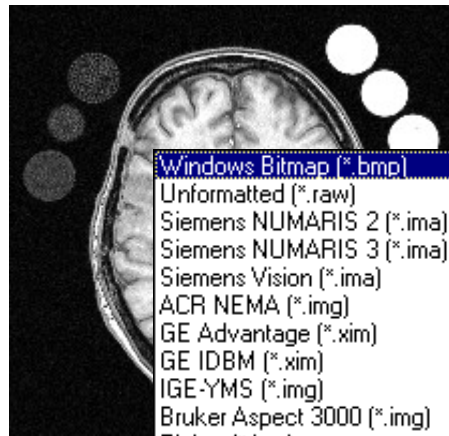
Saving feature maps

Further analysis of features

Saving reports

Features selection

# Loading and viewing image



- 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)
- Bruker Aspect 3000 (\*.img)
- Picker (\*.img)
- Dicom (\*.dcm; \*.dicom)

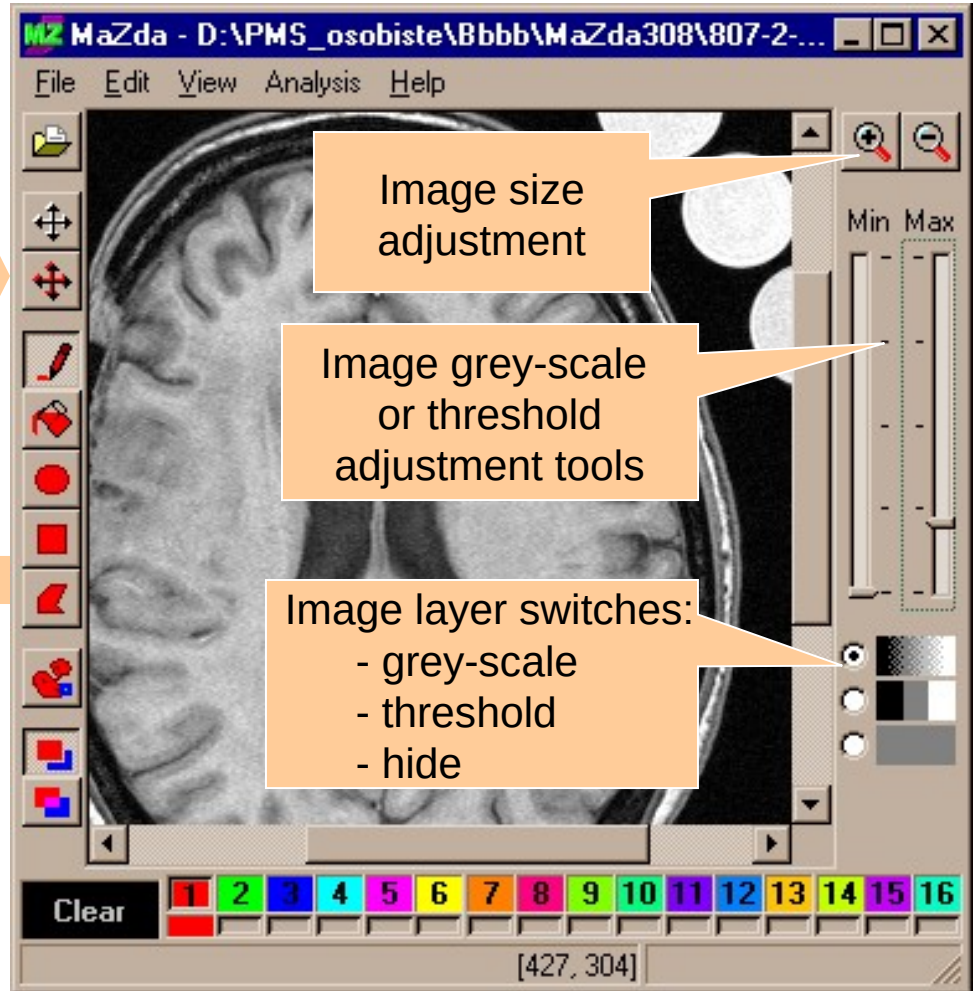
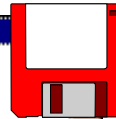
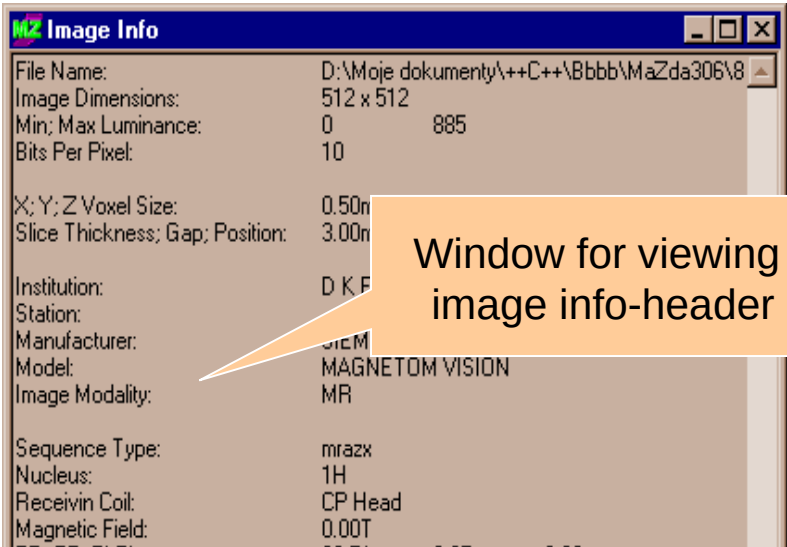


Image size adjustment

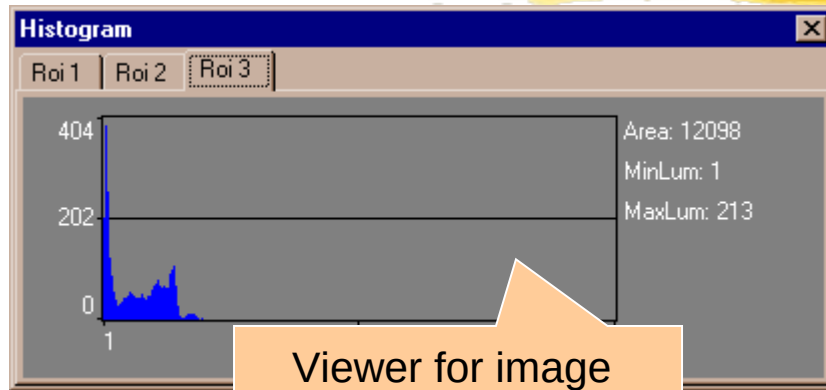
Image grey-scale or threshold adjustment tools

Image layer switches:  
- grey-scale  
- threshold  
- hide

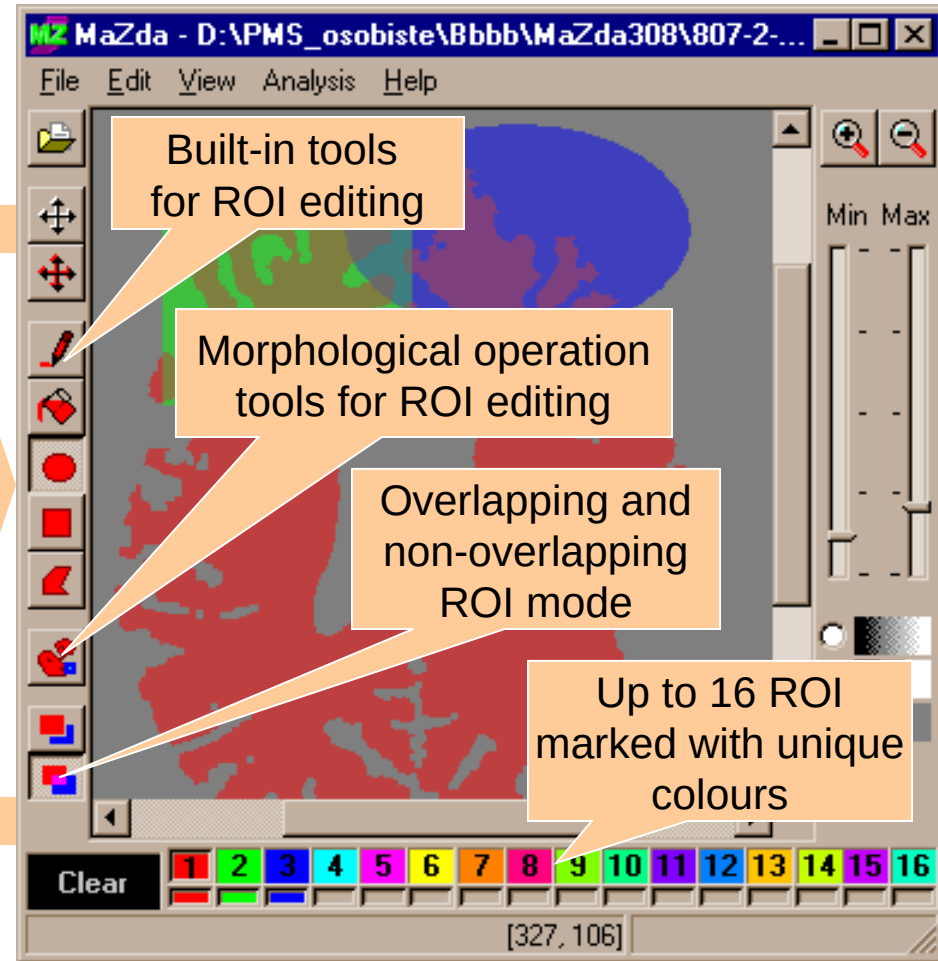
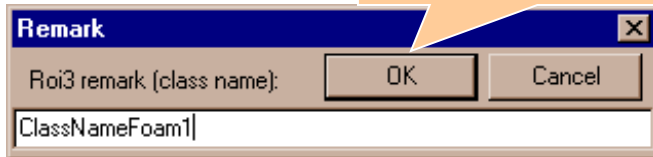


Window for viewing image info-header

# Defining regions of interest

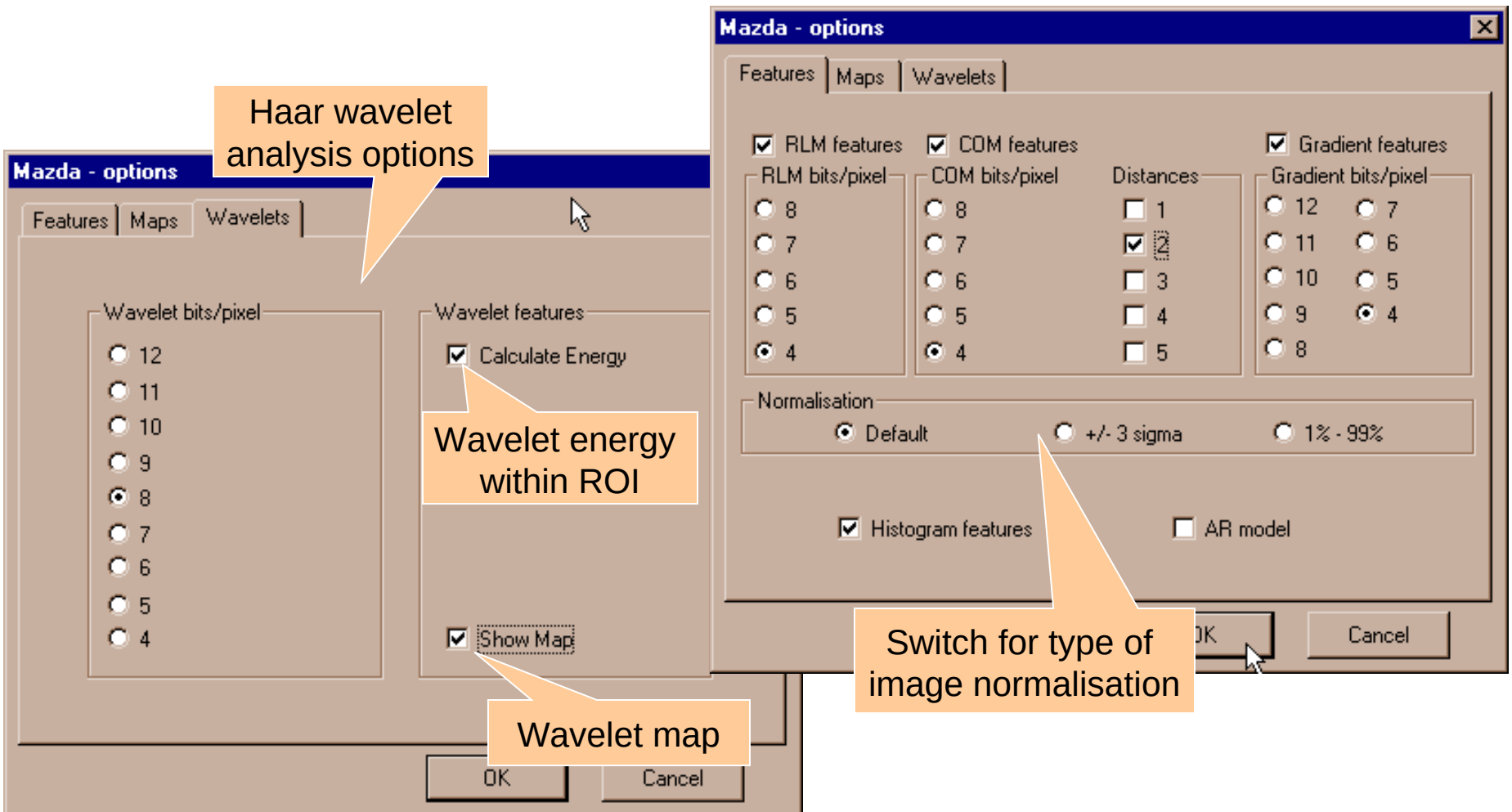


Window for changing ROI name (class)

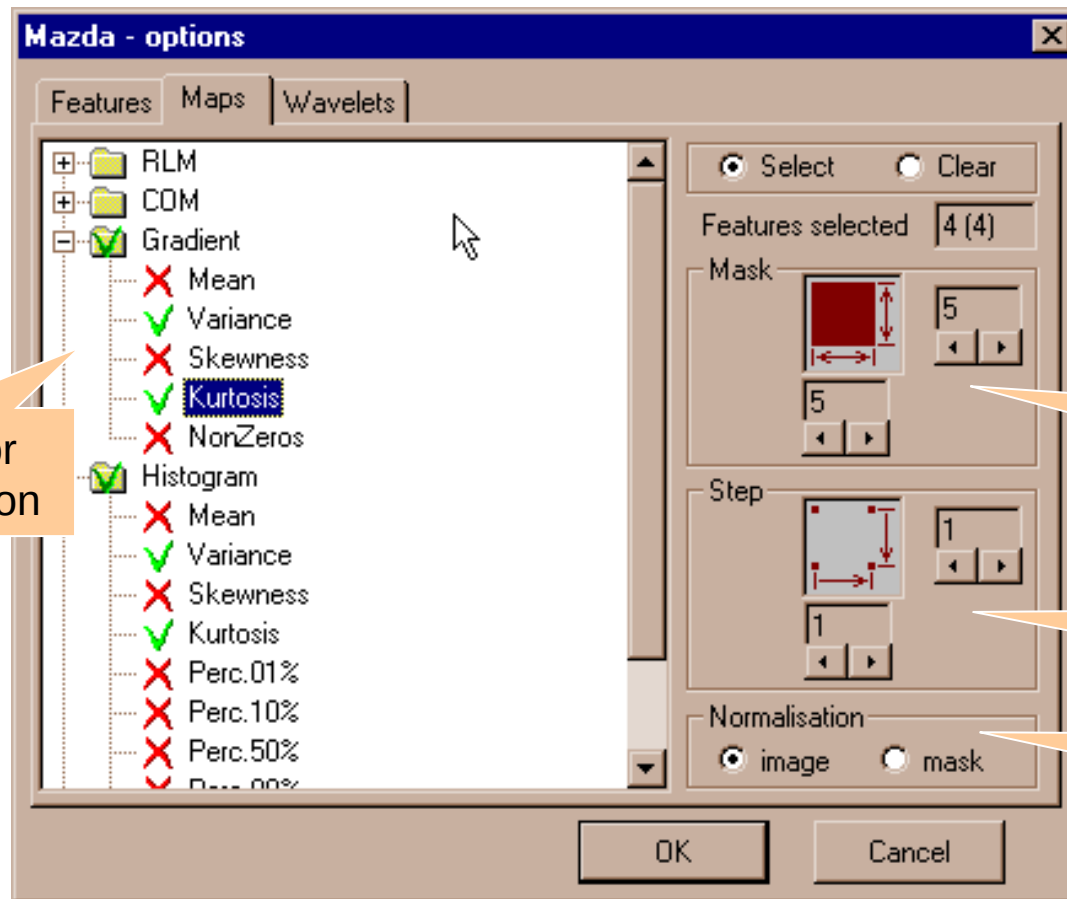


ROI editing example

# Choosing analysis options (1)



# Choosing analysis options (2)



Tree-view for maps selection

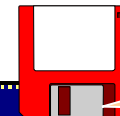
Mask size adjustment

Step adjustment

Choosing region for normalisation

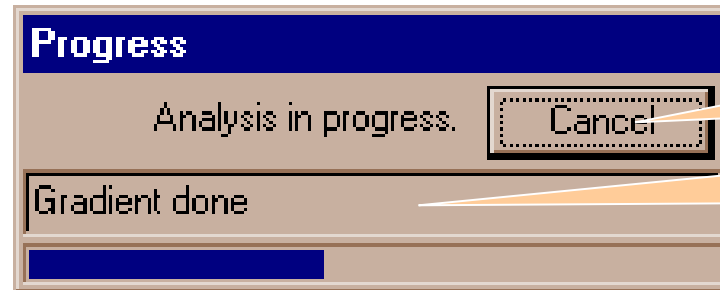
Saving and loading options

Options (\*.ini)



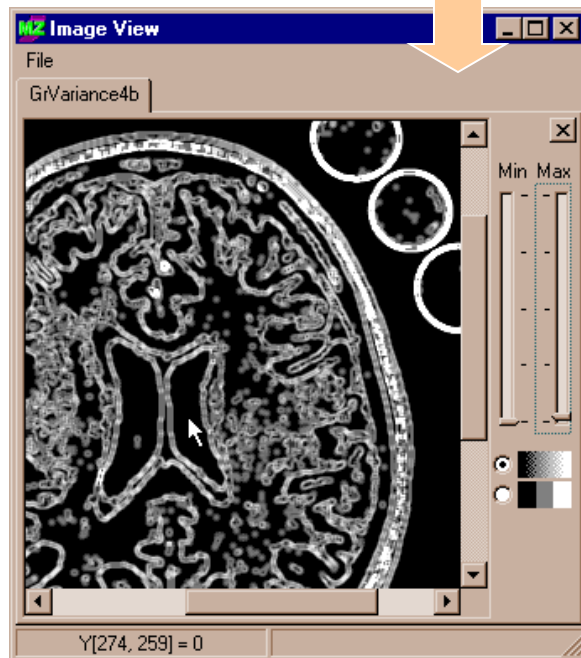


# Analysis



Possibility to stop the analysis

More precise information on what have been done



Report

File Feature selection

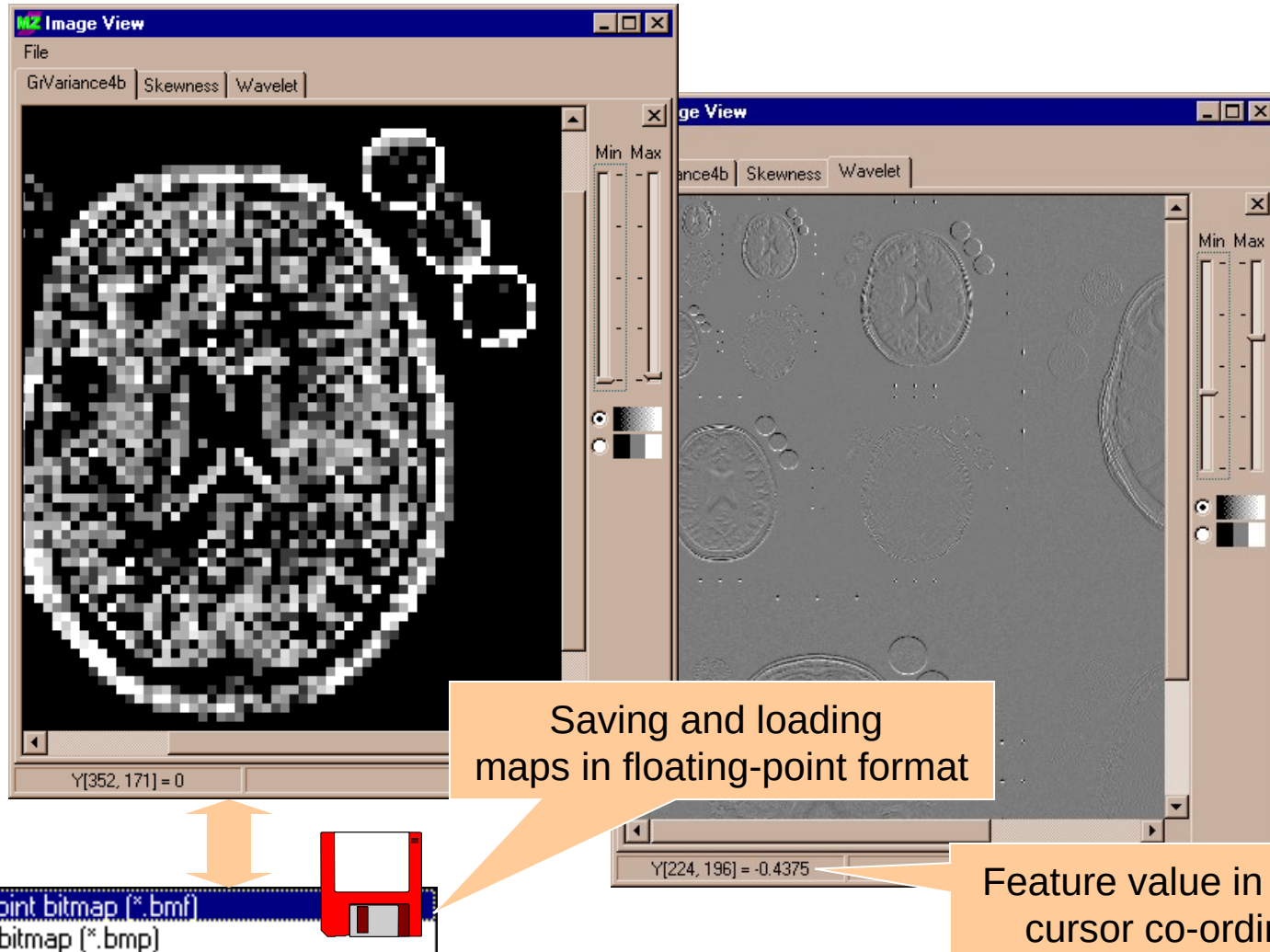
2001-8-14 15,29,35.par 2001-6-27 114710.par 2001-11-29 16,00,19.par 2002-2-12 13,24,00

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  
Gradient analysis = Yes, Max pixel value = 16

Feature name	✓ 1	✗ 2	✓ Class...	✓ ClassNa...	✓ 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	176	73
✗ Perc.99%	155	203	201	188	89
✗ Horiz_RLNonUri	555.91	73.595	65.733	12.957	29.037
✗ Horiz_GLevNonU	2690.5	106.39	78.96	45.602	188.05
✗ Horiz_LngREmph	191.15	218.03	231.5	855.19	252.54
✗ Horiz_LngRSE	8.2934	8.5486	8.5995	8.2996	8.2956

# Feature maps window



# Report window (1)

The screenshot shows the MZ Report window with a menu bar (File, Feature selection, Tools) and a tab-page interface. The active tab is labeled '2002-2-19 22,25,02'. The window displays the following information:

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

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	0.28357	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

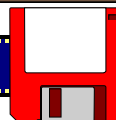
Data header

Tab-page keeps the analysis result

Features table

Saving and loading reports (tab-pages)

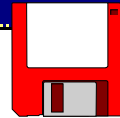
Report text file (\*.par)



# Report window (2)

Selection text file (\*.sel)

Saving selected features



**Class Name**

Roi3 class name:  OK Cancel

ClassNameFoam1

Use for discriminative analysis

Apply changes to:

this column only

all columns of the class

all columns of the document

**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  
Vertl\_RLNonUni  
GrSkewness  
GrKurtosis  
S(5,-5)Correlat  
S(4,-4)Correlat

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

**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  
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Max. lum.: 886  
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Normalisation = No  
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RL matrix analysis = Yes, Dimension = 4  
RL matrix 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	-2.3005	-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
✗ Horz_RLNonUni	555.91	73.595	65.733	12.957	29.037
✗ Horz_GLevNonU	2690.5	106.39	78.96	45.602	188.05
✗ Horz_LngREmph	191.15	218.03	231.5	855.19	252.54
✓ U...	0.20004	-2.3005	-2.9095	-2.7329	1.0991

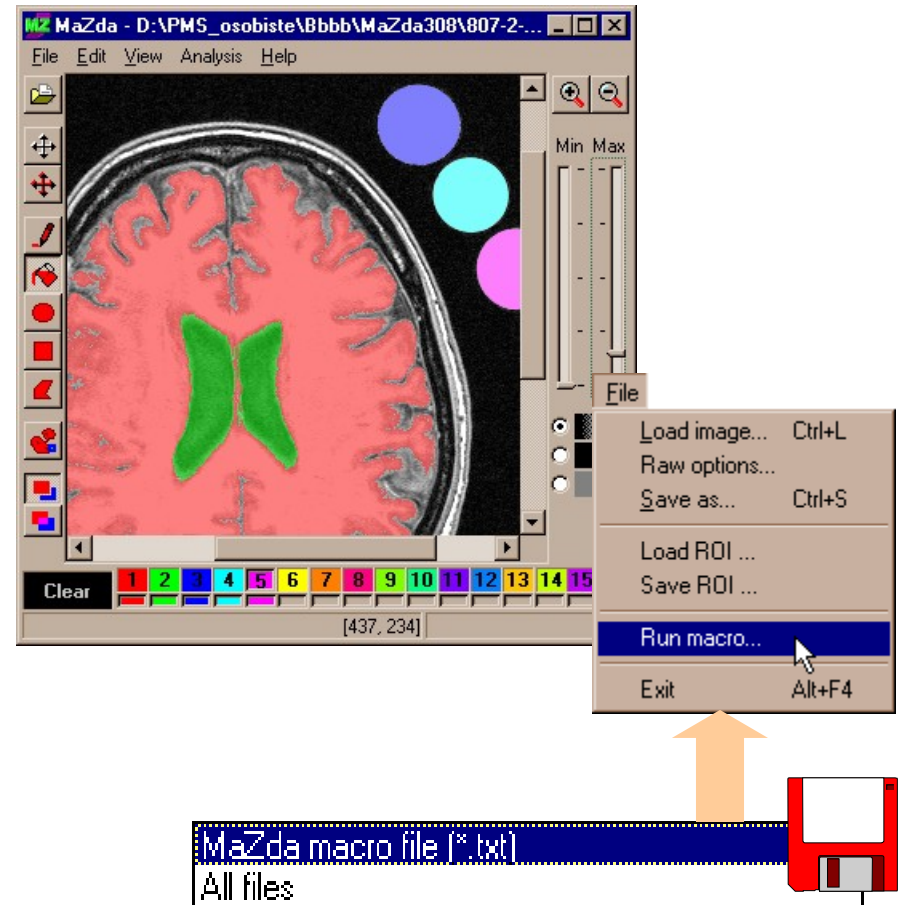
Region (class) selection icons

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**

Tools

B11 analysis

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

**MZ Report**

File Feature selection Tools

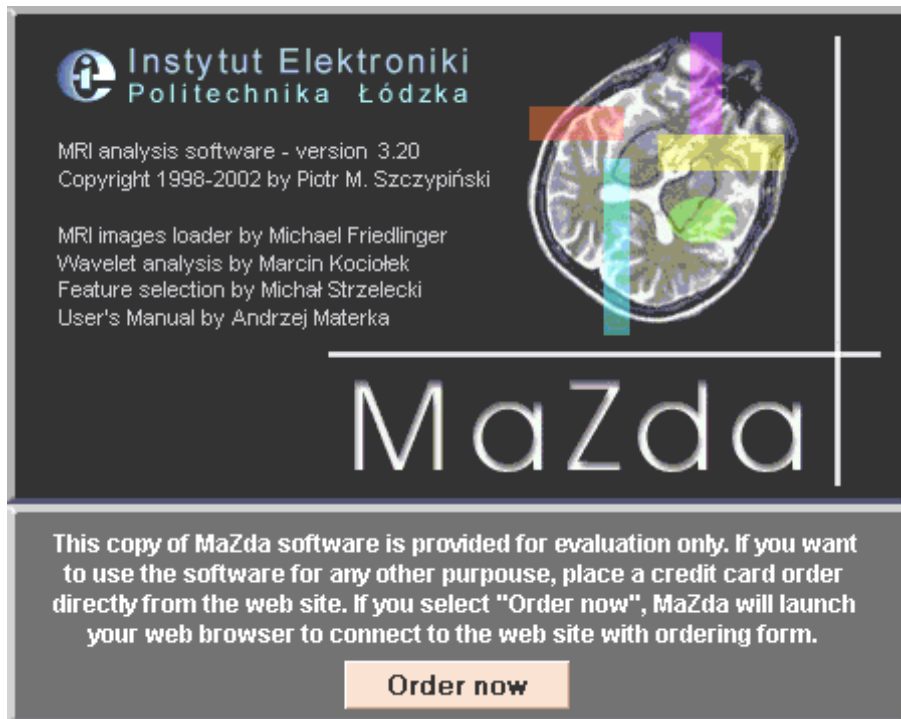
2001-8-14 15,29,35.par | 2001-6-27 114710.par | 2001-1

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
✗ Horz_LRLNonUni	555.91	73.595
✗ Horz_GLLevNonU	2690.5	106.39
✗ Horz_LngREmph	191.15	218.03

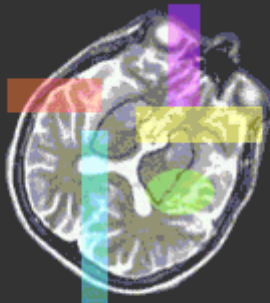
# Shareware version



**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**

This copy of MaZda software is provided for evaluation only. If you want to use the software for any other purpose, place a credit card order directly from the web site. If you select "Order now", MaZda will launch your web browser to connect to the web site with ordering form.

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All programs have been carefully tested, however, the authors cannot formally guarantee their correct operation.

Name and surname  
e-mail  
Affiliation

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- MaZda (ver 2.20, 820k)
- Convert (ver 1.8, 276k)
- B11 (ver 2.7, 508k)

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