

MaZda Texture Analysis Software

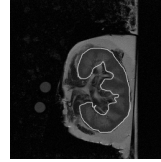
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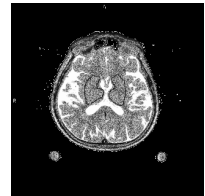
Institute of Electronics
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COST B11 action (1998-2002)

Quantitation of Magnetic Resonance Image Texture



- to develop methods for reliable discrimination of different kinds of tissue in MR images



- contribution to more reliable and repeatable medical diagnosis

COST B11:
"Software and Statistics" Working Group



Goals

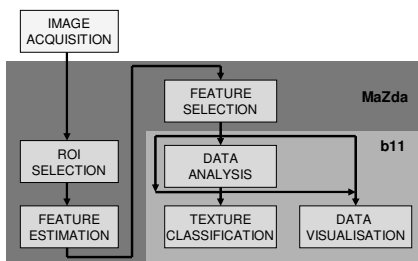
- To develop PC MS Windows computer programs with appropriate GUI and agreed set of functions.
- To develop efficient techniques of image processing and pattern recognition, adequate for MRI quantitative texture analysis.

MaZda texture analysis software

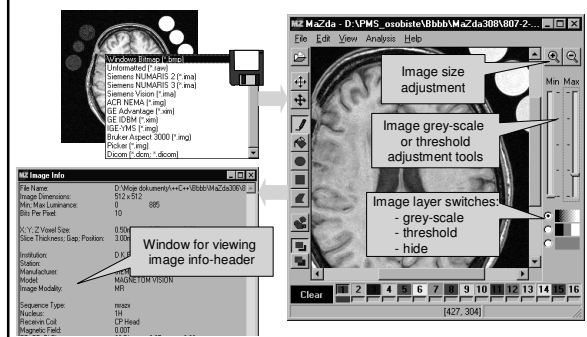


- specialised software tool for calculation of texture features (parameters), feature selection, preprocessing and classification
- written in C++ and compiled for a graphical user interface of Windows 9x/NT system
- MaZda – acronym for co-occurrence matrix
– *Macierz Zdarzeń* in polish
- under develop since 1996 in Institute of Electronics, Technical University of Lodz

MaZda - texture analysis flowchart



Loading and viewing image



Definition of regions of interest (ROIs)

Viewer for image histogram within ROI

Regions of interest (.roi)
Windows bitmap (.bmp)

Saving and loading regions

Window for changing ROI name (class)

Built-in tools for ROI editing

Morphological operation tools for ROI editing

Overlapping and non-overlapping ROI mode

Up to 16 ROI marked with unique colours

3D Editor

loading and visualisation of 3D images

definition of volumes of interest

Analysis options (1)

Haar wavelet analysis options

Wavelet energy within ROI

Wavelet map

Switch for type of image normalisation

Analysis options (2)

Tree-view for maps selection

Mask size adjustment

Step adjustment

Choosing region for normalisation

Saving and loading options

Analysis

Possibility to stop the analysis

More precise information on what have been done

Feature	1	2	3	4	5
Mean	47.97	214	1712	188	45
Stdev	12.81	17.45	17.11	18.71	40.48
Variance	164.28	303.58	292.88	350.52	1639.04
Kurtosis	0.2884	2.0803	2.0861	2.0861	1.0201
Skewness	0.0105	11.207	11.11	11.09	0.6272
Perc 0%	102	50	50	50	36
Perc 10%	120	119	119	119	45
Perc 20%	140	148	148	148	58
Perc 30%	160	176	176	176	71
Perc 40%	180	194	194	194	84
Perc 50%	200	212	212	212	97
Perc 60%	220	220	220	220	110
Perc 70%	240	228	228	228	123
Perc 80%	260	216	216	216	136
Perc 90%	280	204	204	204	149
Perc 100%	300	192	192	192	162

Feature maps window

Saving and loading maps in floating-point format

Feature value in mouse cursor co-ordinates

Report window – feature values

Data header

Tab-page keeps the analysis result

Features table

Saving and loading reports (tab-pages)

Report text file (*.par)

Report window – feature selection

Saving selected features

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
RenameROI roi_name1, ...
/ and ; for remarks
    
```

Run macro

All files

Further feature preprocessing with B11



Input (data)

Output (report)

Visualisation, analysis, classification

Methods

- data analysis: PCA, LDA, NDA
- classification: k-NN, ANN

ANN option window

Neural network parameters

- 1st hidden layer < 1.10 > 3
- 2nd hidden layer < 2.4 > 2
- backprop eta < 0.01-0.99 > 0.15
- backprop iter. limit < 50k-1M > 200000
- optimization iter. limit < 1..1000 > 50

Classification

Selected category 1

Diagram: INPUT LAYER, HIDDEN LAYER, OUTPUT NEURON

The screenshot displays a software interface with two main windows. The top window, titled "b11- Segmentation Module", features a menu bar (Load, Save, Run, Report, Exit) and a toolbar. The central area shows a grayscale image of a circular object with a dark background, segmented into three distinct regions. To the right of the image is a control panel with fields for "Number of clusters" (set to 3), "Number of iterations" (set to 500), and "View" options for "Image", "ROI", and "Segments" (checked). A "Progress" bar is also visible. The bottom window, titled "11/best_seg_seg - Silhouette Plot", shows a plot of silhouette values for three clusters. The x-axis is labeled "Silhouette values" and ranges from 0.0 to 1.0. The plot shows three horizontal bars representing the silhouette values for Cluster #1, Cluster #2, and Cluster #3. A legend on the right identifies the clusters by color: Cluster #1 (light gray), Cluster #2 (medium gray), and Cluster #3 (dark gray). The status bar at the bottom of the main window indicates "Done in (milliseconds) 00:12:46.9".

Unsupervised data analysis

- data clustering: AHC, SCM, k-means
- image segmentation