Technical University of Lodz
Institute of Electronics

# QMaZda – software tools
# for image analysis and pattern recognition

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# Problem

Shape

Color

Texture

# Solution

Extraction

Discrimination
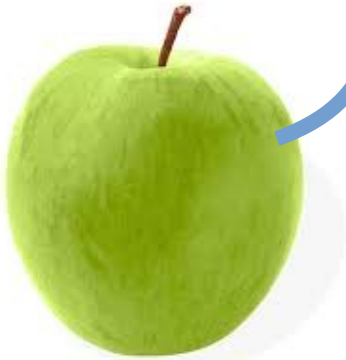
| | |
|---|---|
| YD8HistMean | 127.052 |
| YD8HistVariance | 1115.47 |
| YD8HistSkewness | -0.679759 |
| YD8HistKurtosis | -0.0272242 |
| YD8HistPerc01 | 43 |
| YD8HistPerc10 | 72 |
| YD8HistPerc50 | 134 |
| YD8HistPerc90 | 161 |
| YD8HistPerc99 | 190 |
| YD8HistMaxm01 | 0.0176044 |
| YD8HistDomn01 | 151 |
| YD8HistMaxm10 | 0.248148 |
| YD8HistDomn10 | 143 |
| YS8GradMean | 10.2128 |
| YS8GradVariance | 82.7702 |
| YS8GradSkewness | 2.98139 |
| YS8GradKurtosis | 15.1706 |
| YS8GradNonZeros | 0.994988 |
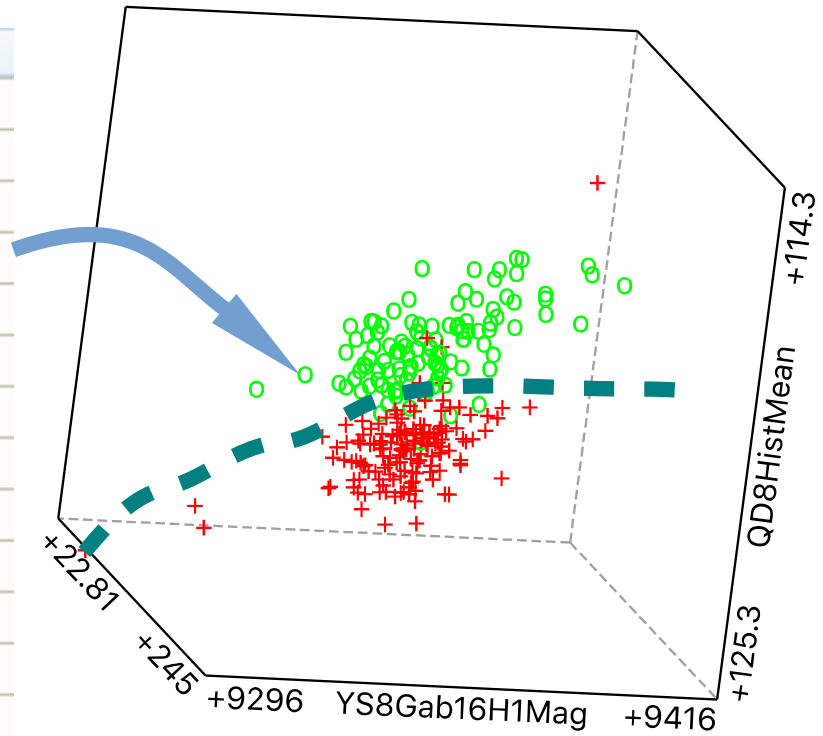


Learning
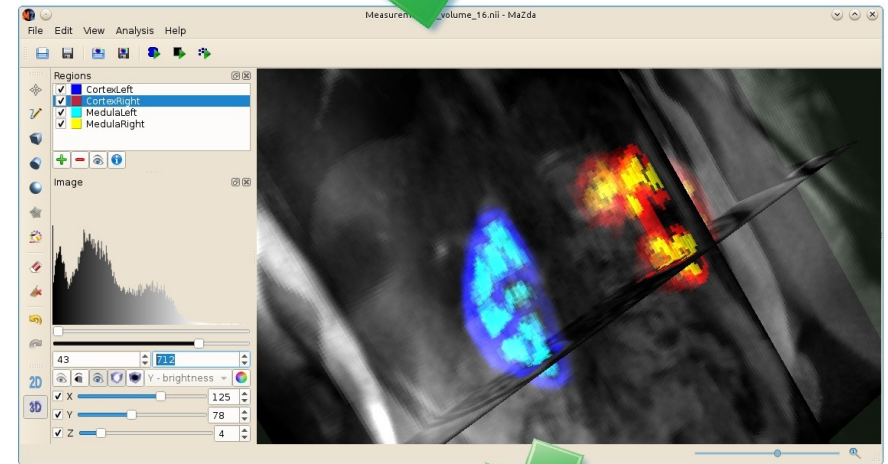
# Integration

*2D or 3D Image*

MaZda



Local extraction

2D and 3D

Texture, color & shape

Feature selection

Machine learning
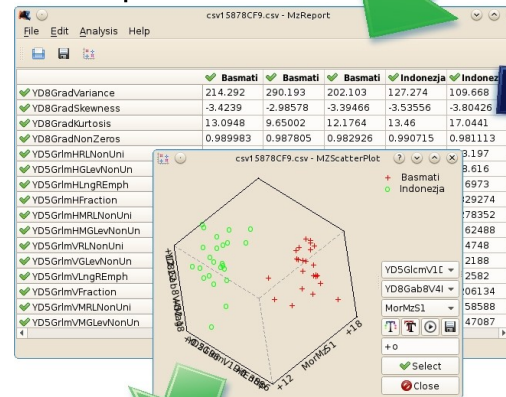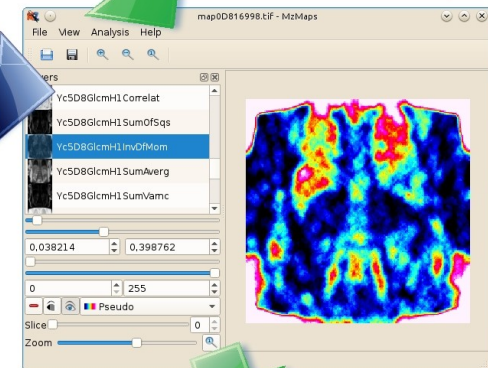
MzGenerator
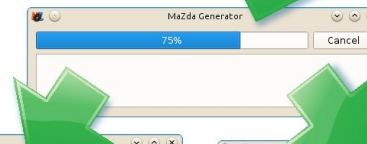
MzReport

MzMaps

*Image attributes*
*Classifiers*

*Maps*
*Segmented images*
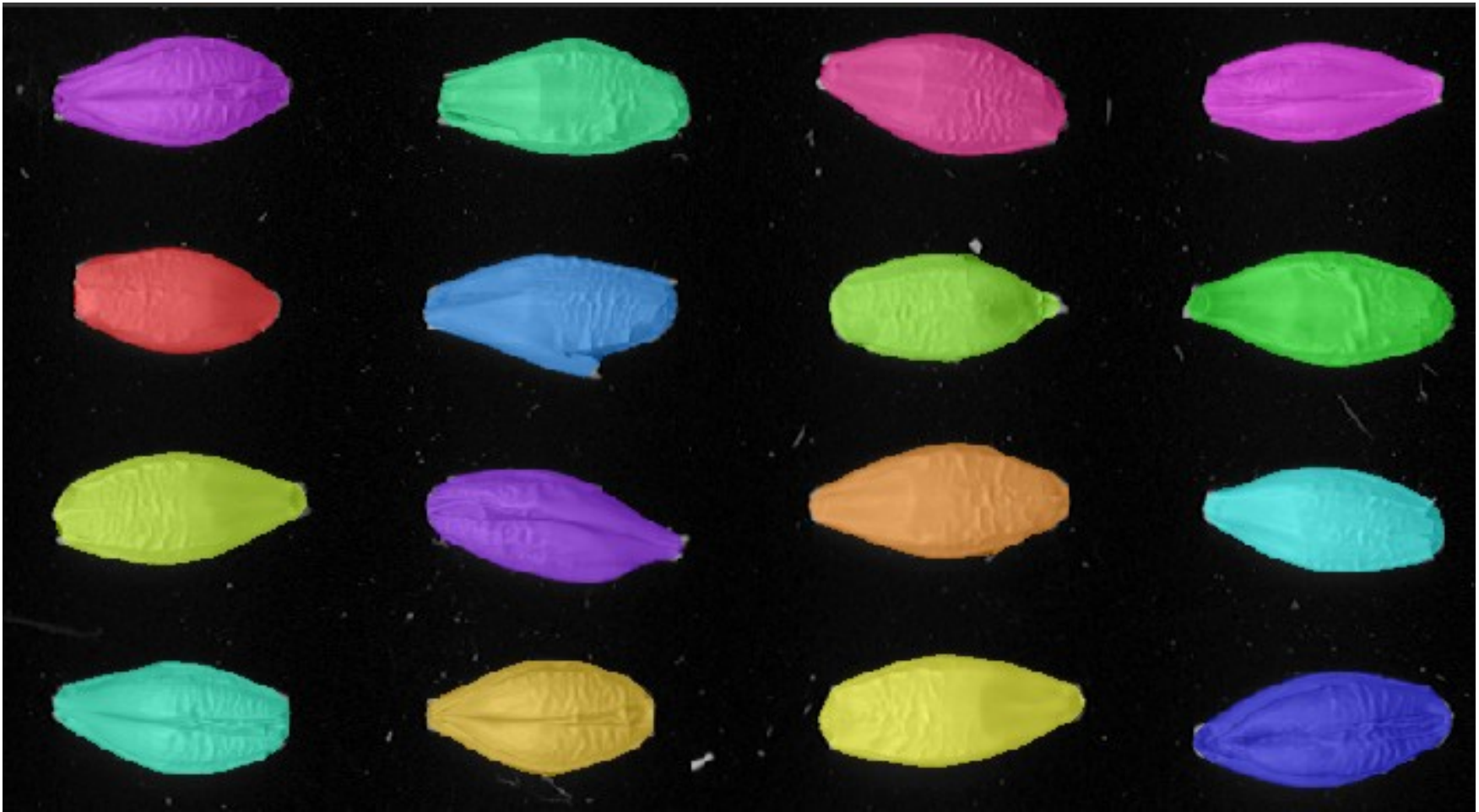
# MaZda and qMaZada

**MaZda** has been developed since 1998, to provide image analysis tools for participants of COST B11 European project *Quantitative Analysis of Magnetic Resonance Image Texture* (1998-2002) and COST B21 European project *Physiological modelling of MR Image formation*.

**qMaZda** project is to further develop MaZda program, make it an open source and port the implemented algorithms to Linux and OS X platforms. Developed under support of NCBR PBS3 *Development of industrial methods of automatic evaluation of technological parameters and* ***classification of grain*** *using image analysis*.

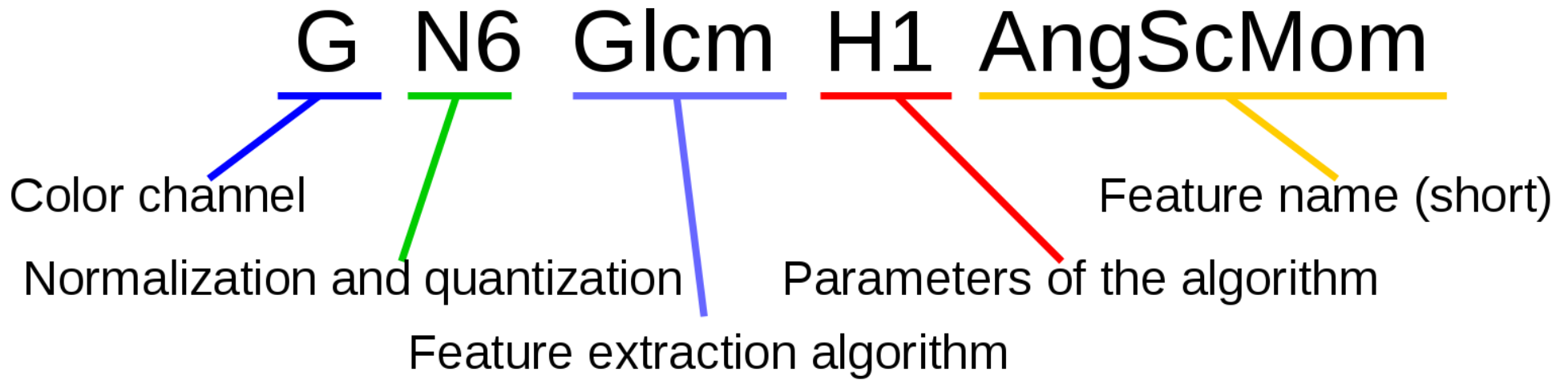# Application

# Grain areas identification

# Feature extraction

G  N6  Glcm  H1  AngScMom

Color channel

Normalization and quantization

Feature extraction algorithm

Parameters of the algorithm

Feature name (short)

# Discrimination & learning
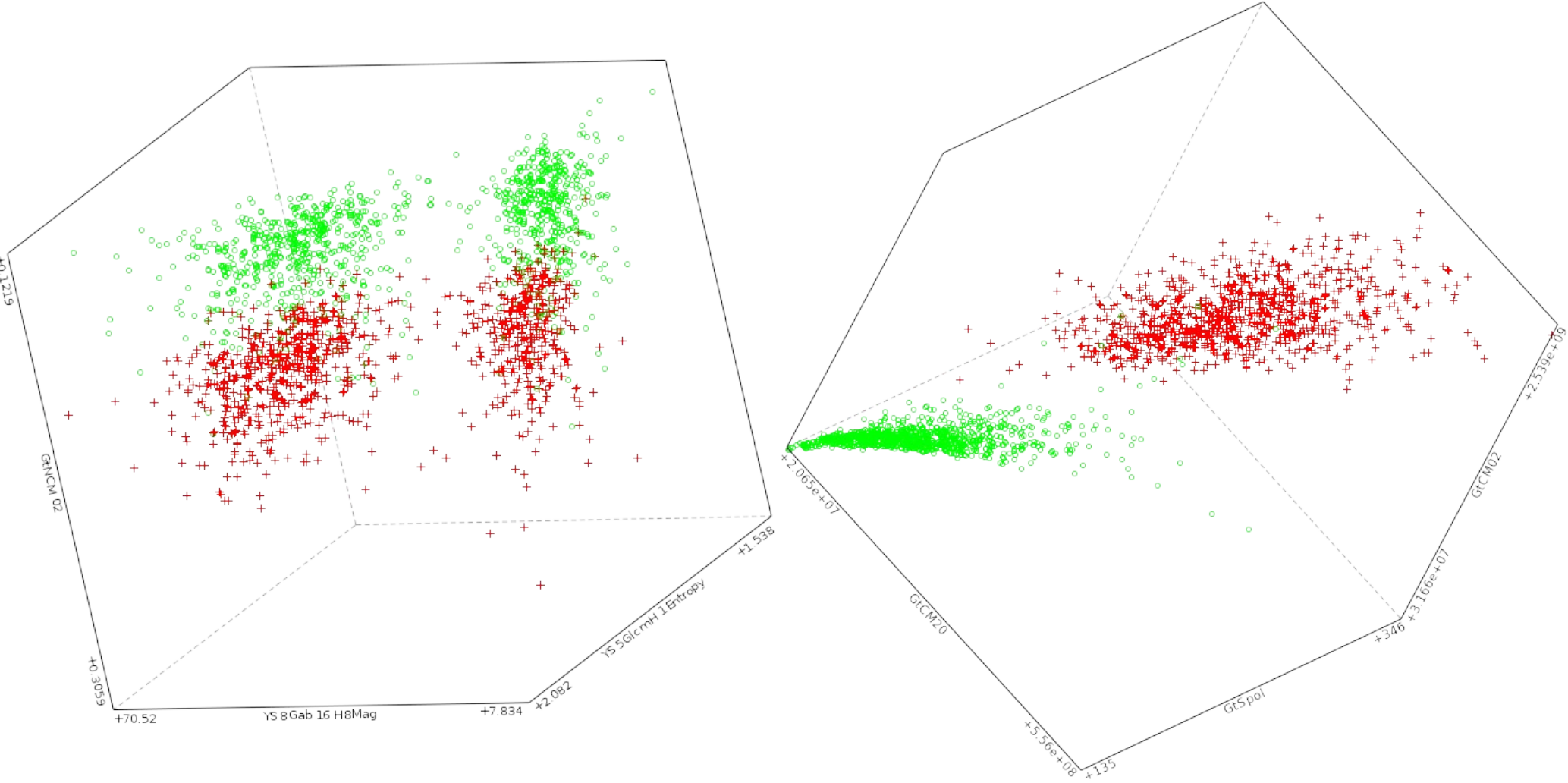
# Classification (methods)

| | Classifier | | |
|---|---|---|---|
| | *Ensembles* | *SVM (linear)* | *SVM (polynomial)* |
| Accuracy [%] | 92.8 | 96.1 | 97.2 |
| Sensitivity [%] | 92.2 | 95.5 | 96.4 |
| Specificity [%] | 98.9 | 99.2 | 99.2 |

# Classification (categories)

| | Predictions | | | | | | Sens. [%] | Spec. [%] |
|---|---|---|---|---|---|---|---|---|
| | *1)* | *2)* | *3)* | *4)* | *5)* | *6)* | | |
| 1) infected | **629** | 5 | 2 | 3 | 0 | 1 | 98.3 | 99.2 |
| 2) green | 7 | **468** | 3 | 0 | 0 | 8 | 96.3 | 99.3 |
| 3) missing germ | 1 | 2 | **430** | 2 | 0 | 9 | 96.8 | 99.2 |
| 4) broken | 1 | 1 | 6 | **387** | 0 | 0 | 98.0 | 99.7 |
| 5) foreign matter | 0 | 1 | 0 | 1 | **24** | 0 | 92.3 | 100.0 |
| 6) normal | 6 | 3 | 4 | 1 | 0 | **409** | 96.7 | 99.1 |

# Conclusions

SVM with the polynomial kernel function determined
defects with accuracy of 97%

Required thorough adjustment and calibration
of the two-camera system

Classification of barley grain defects by means
of qmazda software is feasible

QMaZda proved its utility in food quality assessment

# Contributors

**MaZda**
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Andrzej Materka
Marcin Kociołek
Artur Klepaczko
Sławomir Rażniewski

**qMaZda**
Piotr M. Szczypiński
Artur Klepaczko
Marcin Kociołek

# Available

http://www.eletel.p.lodz.pl/pms/SoftwareQmazda.html
https://gitlab.com/qmazda/qmazda
http://www.eletel.p.lodz.pl/programy/mazda