Open eVision 1.2

IMAGE ANALYSIS SOFTWARE TOOLS

- **64-bit libraries**
- Open eVision **Dongle-Based Licenses**
- Seamless compatibility with
  eVision and Open eVision C++ and ActiveX APIs

EURESYS™
Excellence in vision

Contents

- General Features
- Open eVision Accessories
- General Purpose Libraries
- Mark Inspection Libraries
- Licensing
- Conclusion

General Features

Image Analysis Tools

- **Open eVision is a rich suite of software tools dedicated for image processing and analysis**
- **Successor of our popular eVision tools with 150 thousands licenses deployed worldwide over the past ten years**
- **Designed to be integrated into your application**
  - Libraries (DLLs), ActiveX controls, .NET classes
  - Extensive support of development environments

New

- **Open eVision contains a set of**
  - **64-bit libraries** for C++ and .NET development
  - 32-bit libraries for C++, .NET or ActiveX development
- **Compatible with**
  - Windows® x86 processor architecture
  - A wide variety of programming languages and development environments

    Open eVision requires a processor compatible with the x86 instruction set, with MMX extensions. If the SSE or SSE2 extensions are present, they are used, but they are not required.

New

- **For existing users,**
  Open eVision 1.2 supports the previous Open eVision and eVision APIs
  - Open eVision 1.2 comes with an alternate set of C++ headers and an ActiveX component that allows developing or porting code against the older API that was supplied with eVision 6.7.1 (and lower) and Open eVision 1.0.
  - See the “Migration to Open eVision 1.2” guide on www.euresys.com for detailed information.

Sub-pixel Accuracy

- **Ability of a measurement function to return a result with a precision smaller than the size of one pixel**
- **Functions returning results with sub-pixel accuracy:**
  - Metrology - EasyGauge™ -
  - Blob analysis - EasyObject™ -
  - Pattern matching - EasyMatch™ -
  - Geometric pattern matching - EasyFind™ -

CALIBRATION

- **Compensate all measurements for**
  - ✓ Lens distortion: Correction of pin cushioning
    Barreling
  - ✓ Non-square pixels: Correction of the pixel aspect ratio
  - ✓ Rotation and perspective distortions
- **Calibration performed from**
  - ✓ A precise dot grid
  - ✓ A list of point coordinates
- **Measurement in real-word units**
  - ✓ Support of the conversion of coordinates
    - From pixel coordinates to real-world coordinates and vice-versa
    - Mils, microns or millimeters

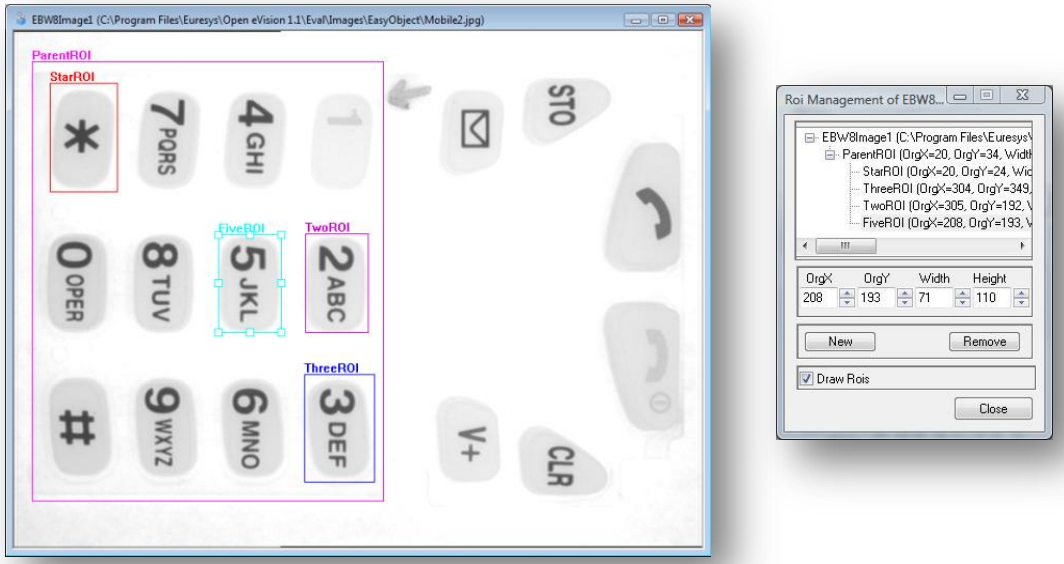
Saving and Loading Images

- **BMP**
- **JPEG and JPEG-2000**
  - ✓ JPEG compression and decompression functions
  - ✓ Selectable compression quality
- **PNG**
  - ✓ Lossless data compression
- **TIFF**
- **Serialized**
  - ✓ Euresys proprietary image file format obtained from the serialization of the Open eVision image objects

Regions of Interest

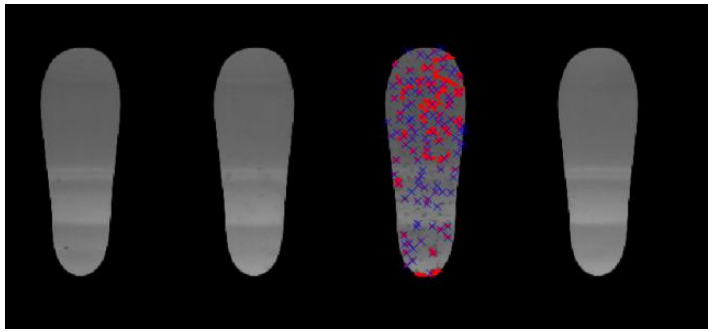
- The **processing** of all Open eVision functions can be **restricted to a Region of Interest** (ROI)
- Support of **nested rectangular** ROIs

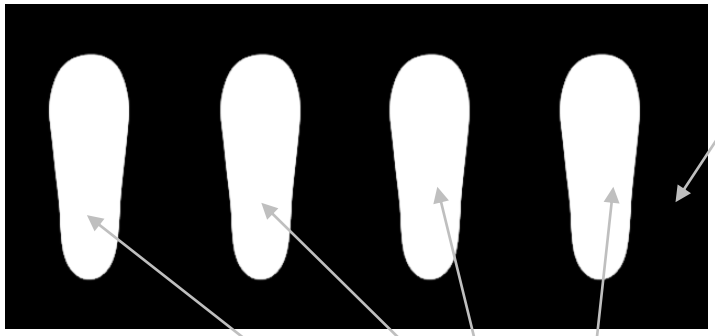
  Organized in a hierarchical way
- ROIs have the **same behavior** as an image object



Flexible Masks

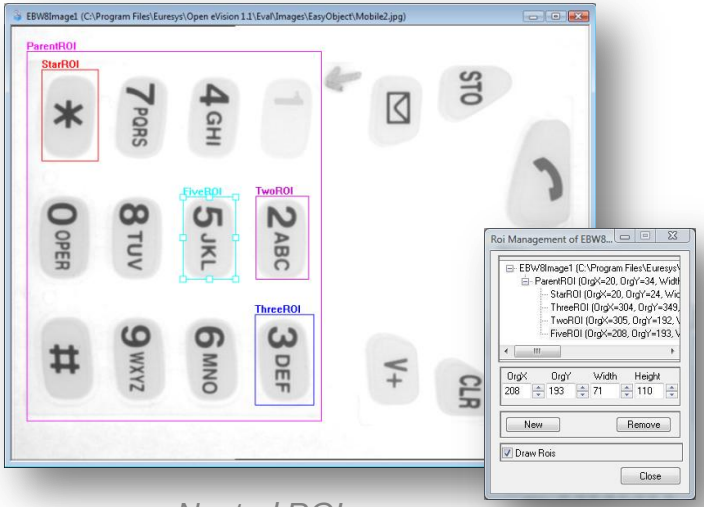
- **Masking a region**
  - **It is a powerful** way to **restrict the processing** to a part of the image
  - It identifies two types of freely definable areas in the image
    - The **Don't-care areas** that should not be considered for the processing, are defined by a mask value of **0**
    - **Do-care areas** that should not be considered for the processing are defined by any other pixel value than 0



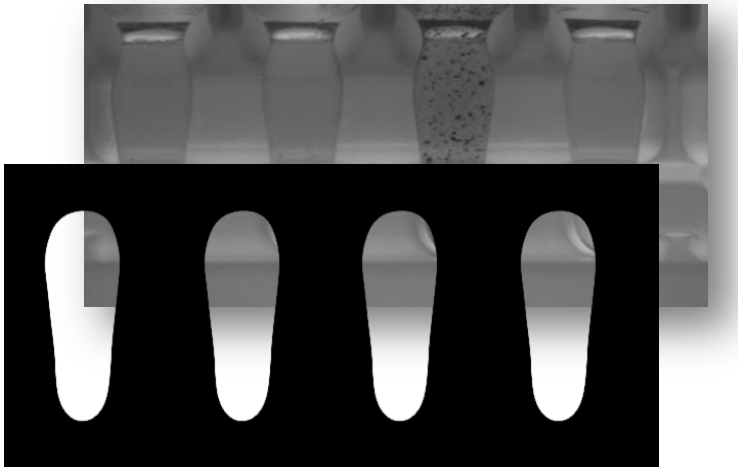


Flexible Masks

- **The Open eVision masks are flexible**
  - ✓ They support **complex** and **disconnected shapes**, while ROIs support nested rectangular regions
  - ✓ Masks are applied **on** the image, while ROIs are a part of the image and are considered as an image



Nested ROIs



Flexible Masks

Flexible Masks

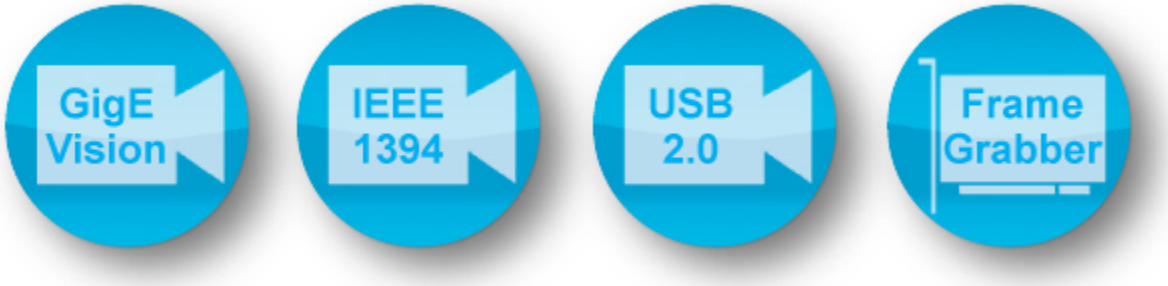
- **A mask is a BW8 image**
  - With the same height and the same width as the source image
- **They can be generated by**
  - Any application outputting BW8 images
  - Open eVision that includes processing functions generating Masks
- **The Flexible Masks are supported for selected functions of the EasyObject and EasyImage libraries.**

Other Features

- **Improved Execution Time Thanks to SSE2 Technology**
- **Thread-Safety**
- **Image and Graphic Display**
  - Functions to help display the result of the image analysis, and provide interactivity with the user
- **Modern error reporting** functions through **exceptions**
- **Precise execution time measurement functions for application profiling**

Open to All Image Sources

- **Open eVision supports any 3rd party device for image acquisition.**



- **Process generic bitmap images in the host memory, independent of the origin.**

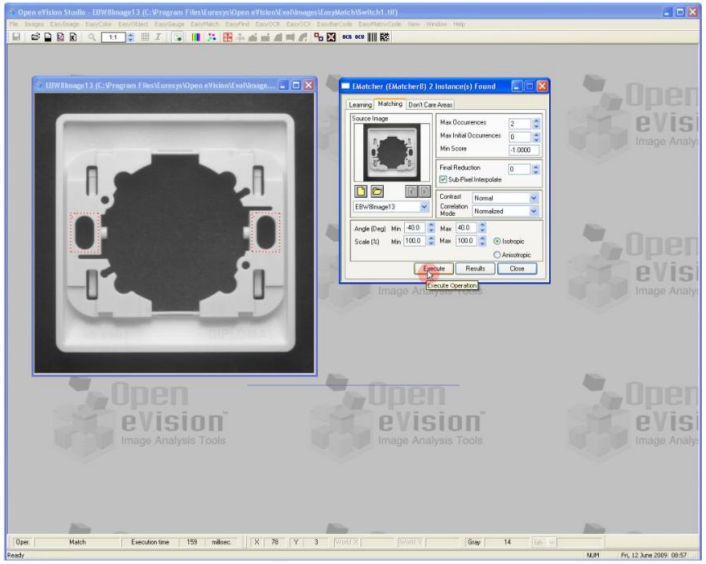
Open eVision Accessories

EVALUATION

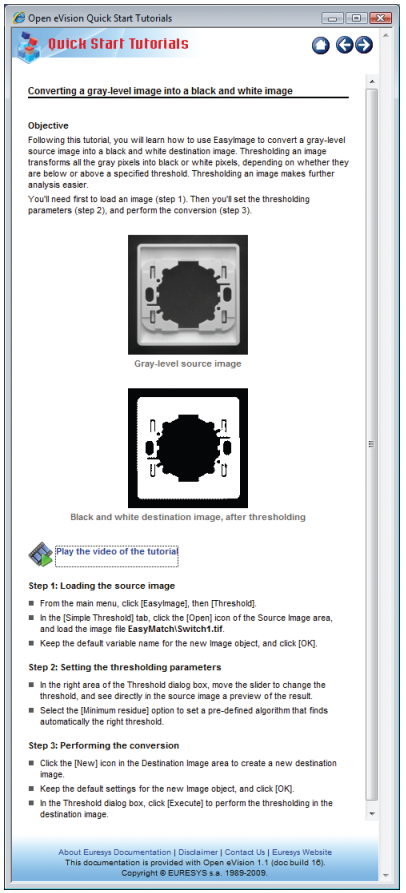
- **Freely downloadable application**
- **Evaluate the Open eVision functionalities and their performance**
  - for your specific application
  - using your images
- **Includes a Getting Started Guide**

EVALUATION

- **Quick Start Tutorials** to take your first steps in Open eVision
  - ✓ They point up the main functionalities of Open eVision in a didactic way
  - ✓ They include a large set of images is included to practice the lessons by yourself.

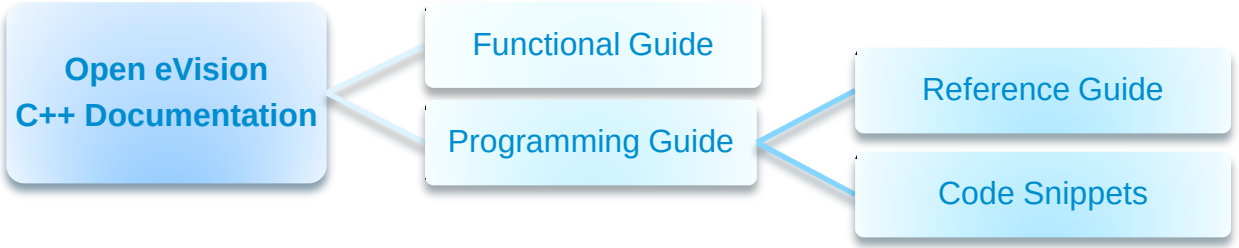


On top of a step by step script, the Quick Start Tutorials contain video animations.



LEARNING

- **Comprehensive and structured documentation**
  - ✓ One documentation per programming interface:
    - Open eVision C++ Documentation
    - Open eVision .NET Documentation
    - Open eVision ActiveX Documentation
  - ✓ Each documentation is split into a **Functional Guide** and a **Programming Guide**



  - ✓ The documentation is available **in two formats**:
    - Compiled HTML files, which are convenient to search
    - PDF files, which are suitable to be printed

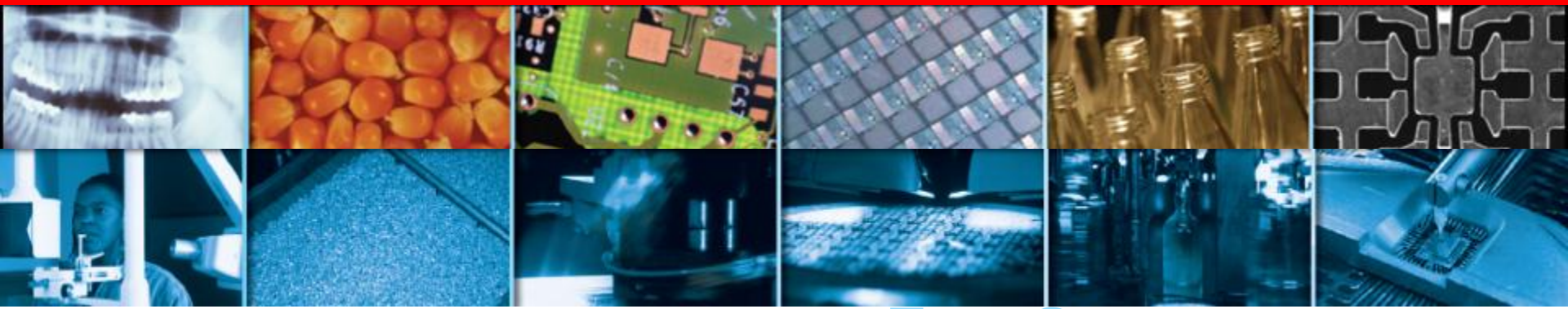
LEARNING

- **Project Samples**
  - ✓ They illustrate concisely how to use the Open eVision libraries with a particular IDE
  - ✓ They are downloadable from the Download area
- **Application Samples**
  - ✓ They illustrate the combined use of different libraries in a specific application
  - ✓ A variety of combination and applications are represented
  - ✓ They are downloadable from the Download area

DEVELOPMENT

- **Getting Started with Open eVision Studio** to take your first step in Open eVision Studio
- The **Quick Start Tutorials** for each library

General Purpose Libraries



EasyGauge

EasyImage

EasyColor

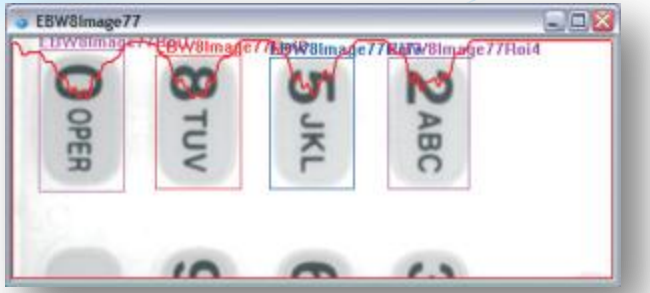
EasyMatch

EasyObject

EasyFind

EasyImage™

Image Processing



Main Features

- Convolution and morphology
- Geometric transformations
- Image statistics
- 16-bit accuracy processing

EasyImage™

Image Processing

Typical Applications

- **Image enhancement**
- **Image restoration**
- **Presence / Absence check**

EasyImage™

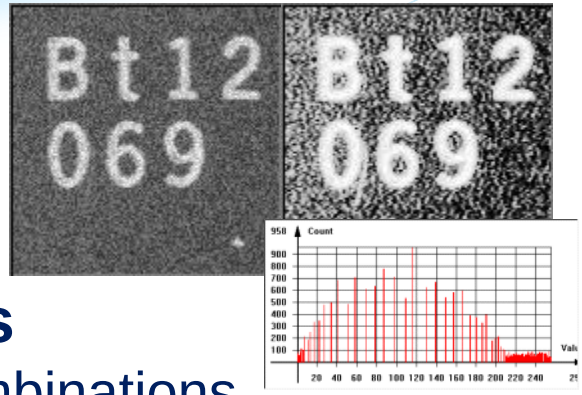
Image Processing

FUNCTIONS

- **Thresholding**
  - Automatic thresholding:
    - ✓ Min residue
    - ✓ Max entropy
    - ✓ Isodata
  - Manual thresholding
    - ✓ Single threshold (absolute and relative)
    - ✓ Double threshold
  - Histogram-based threshold

EasyImage™

Image Processing

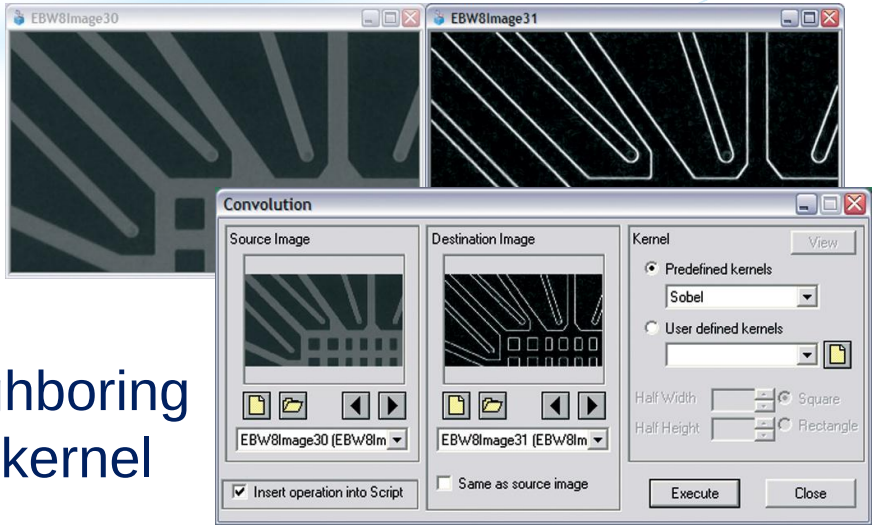


Histogram equalization

- **Arithmetic and logic operations**
  Pixel-wise arithmetical and logical combinations between two images or between an image and a constant.
  - Arithmetic operations: Add, subtract
    Multiply, divide
    Copy
    Invert, module, shift
  - Logical and bitwise operations: AND, OR, XOR, NOT
  - Minimum, maximum
  - Pixel compare
  - Histogram equalization

EasyImage™

Image Processing

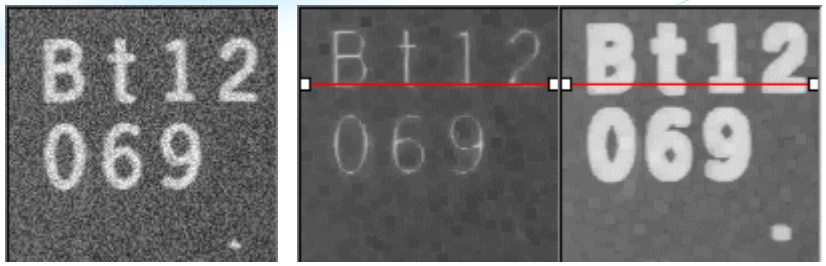


Convolution

- **Convolution**
  Linear combination of neighboring pixels using a convolution kernel
  - Pre-defined filters for
    - ✓ Edge detection
      Laplacian, Gradient, Prewitt, Sobel, Roberts
    - ✓ Sharpening with several high-pass filters
    - ✓ Smoothing
      Several low-pass including Gaussian filter and uniform filters
  - Custom kernel filtering
    Kernel creation and management functions

EasyImage™

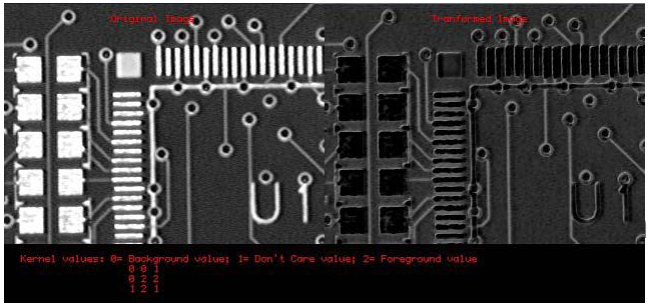
Image Processing



Erosion and dilatation

- **Non-linear filtering**
  Non-linear combinations of neighboring pixels
  - Median filter
  - Morphological operators
    - ✓ Erosion, dilation
    - ✓ Opening, closing
    - ✓ Morphological distance
    - ✓ **Hit-and-miss transform:**
      It detects a particular pattern of background pixels in an image.
      The EasyImage implementation of this filter operates on **color images** top of **gray-scale images**
    - ✓ Thinning, thickening
    - ✓ Top-hat filters

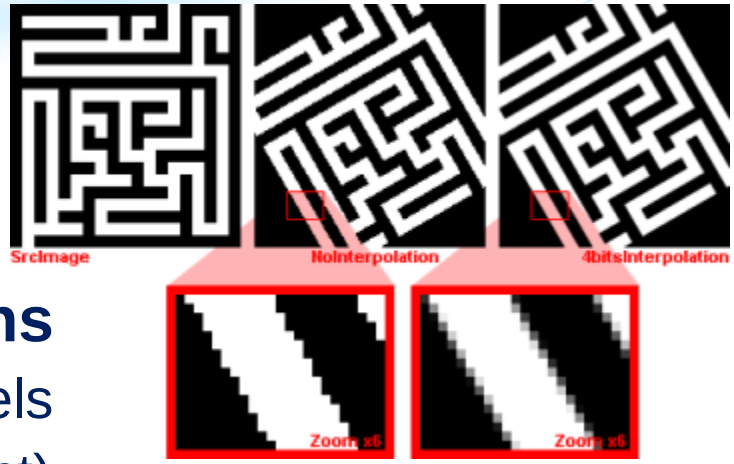
New



Hit-and-miss transformation

EasyImage™

Image Processing



Rotation without or with interpolation

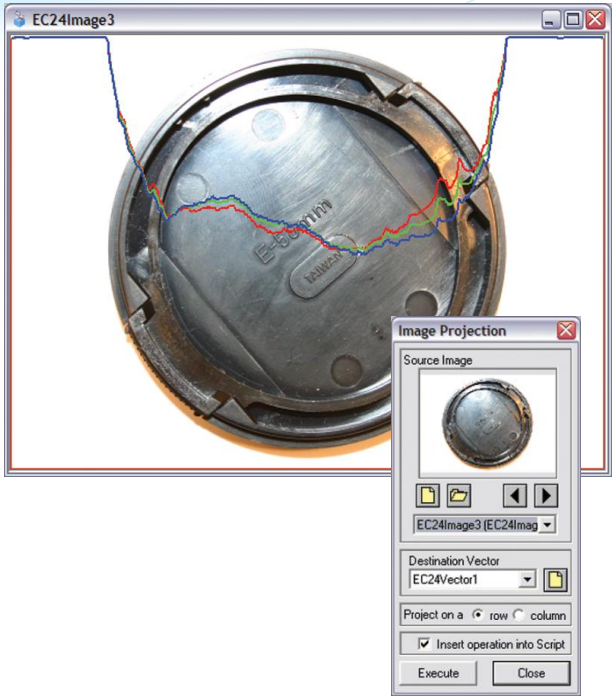
- **Geometric transformations**

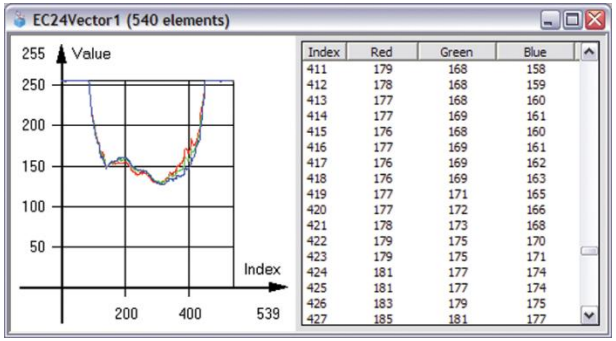
  Displacement of the image pixels
  - Image registration (alignment)
  - Horizontal and vertical mirroring
  - Translation, scaling and rotation with optional interpolation
  - LUT-based (un)warping

EasyImage™

Image Processing

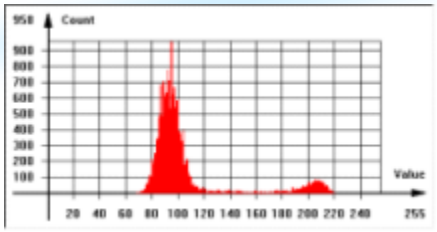
- **Vector operations**
  Extraction of 1-dimensional data from an image
  - Projection
    - ✓ Sum of all gray-level values in a given direction vector
  - Profile
    - ✓ Sampling (line segment, path, contour)
    - ✓ Analysis





EasyImage™

Image Processing

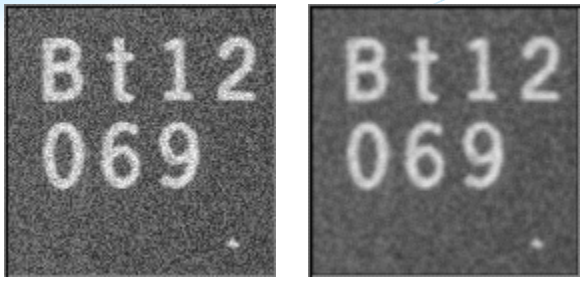


Histogram

- **Statistics**
  Measurement of
  - Area, binary moments
  - Weighted moments
  - Gravity center
  - Pixel count and pixel statistics
  - Minimum and maximum gray-level value
  - Average, variance and standard deviation
  - Histogram computation and analysis
  - Image focus

EasyImage™

Image Processing



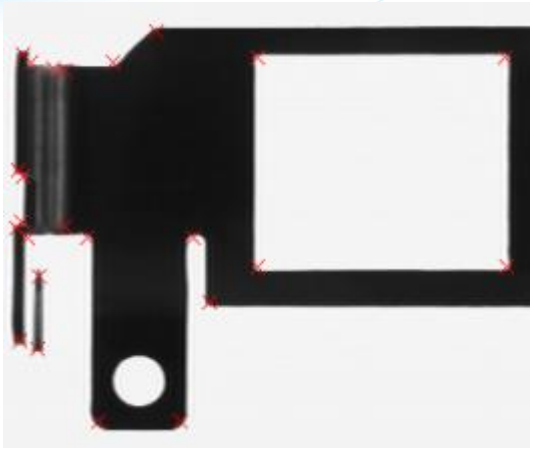
Uniform noise reduction by low-pass filtering

- **Noise reduction and estimation**
  - Spatial noise reduction
    - ✓ Convolution
    - ✓ Median filters
  - Temporal noise reduction
    - ✓ Recursive average
    - ✓ Moving average
    - ✓ Average
  - Noise estimation
    - ✓ Root-mean-square noise
    - ✓ Signal-to-noise ratio

EasyImage™

Image Processing

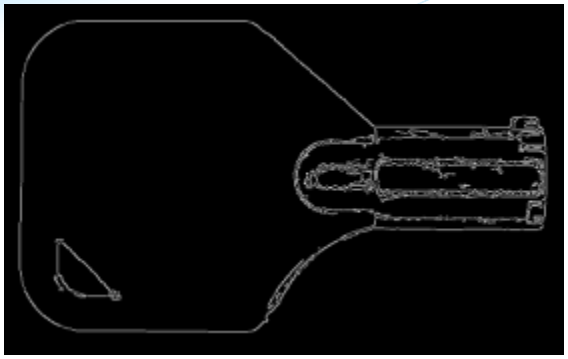
- **Feature points detectors**
  - Harris corner detector
    - ✓ Popular due to its strong invariance to rotation, illumination variation and image noise.



Harris corner detector

EasyImage™

Image Processing



Canny edge detector

- **Feature points detectors**
  - **Canny edge detector**
    - ✓ Known as the optimal edge detector
    - ✓ Offers three excellent characteristics for the image processing applications
      - A good detection

        It finds as many edges in the image as possible
      - A good localization

        The found edges are as close as possible to the “real” edges in the image
      - A minimal response

        A single edge response is accepted for each position, i.e. avoiding multiple close or intersecting edge responses

EasyImage™

Image Processing

- **Operation on interlaced video frames**
  - Elimination of the interlaced images artifacts by rebuilding or re-aligning fields
- **Overlay**
- **Scalar Gradient**

EasyImage™

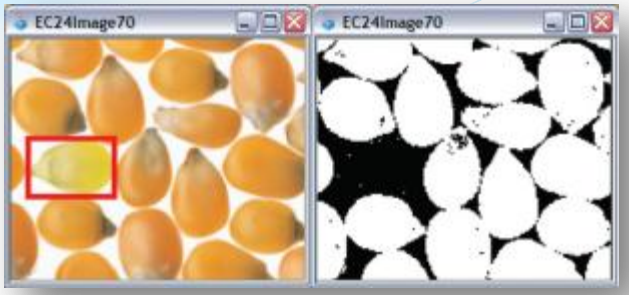
Image Processing

Flexible Masks in EasyImage

- **EasyImage supports flexible masks as an argument for selected functions:**
  - ✓ Automatic Thresholding
  - ✓ Histograms
  - ✓ Vector Operations: Projection and Profile
  - ✓ Statistics Operations
  - ✓ Noise Reduction by Integration
  - ✓ Overlays

EasyColor™

Color Image Analysis

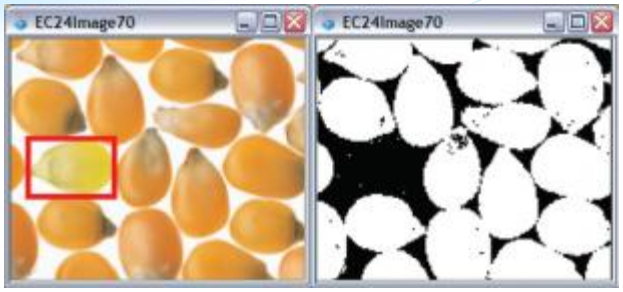


Main Features

- **Fast conversion to 11 color spaces**
- **Color segmentation**
- **Color verification**

EasyColor™

Color Image Analysis

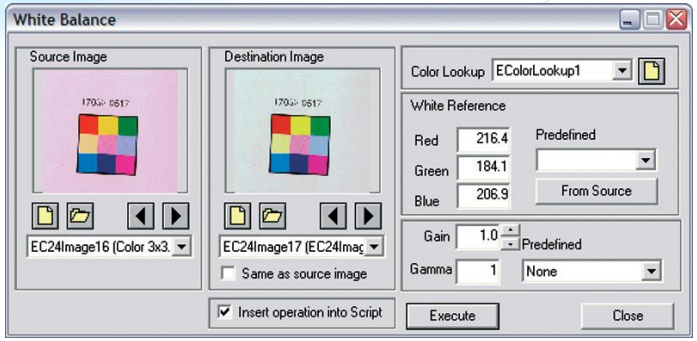


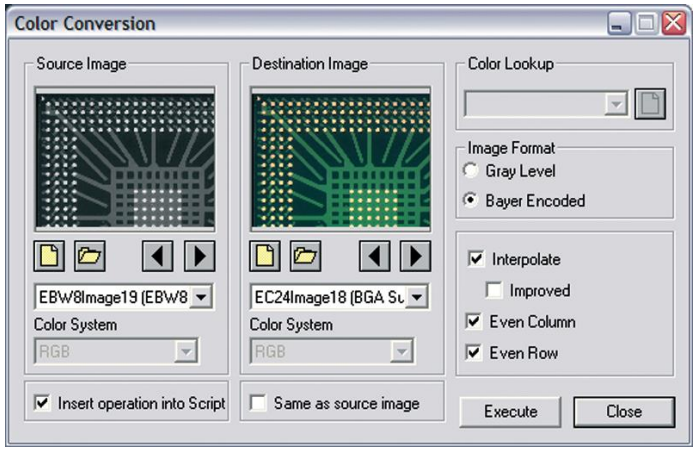
Typical Applications

- **Food inspection**
- **Printing**
- **PCB inspection**

EasyColor™

Color Image Analysis



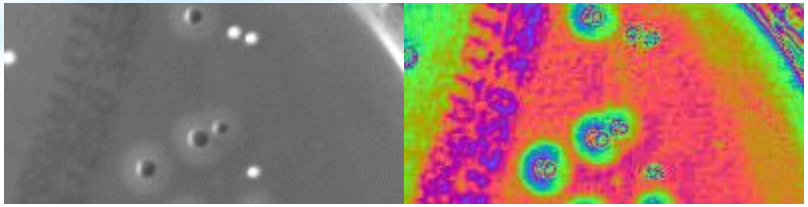


FUNCTIONS

- **Color transformations**
- **Lookup Tables (LUTs)**
- **LUT for specific usage**
  - Colorimetric systems conversion
  - LUT for Gain / Offset (Color)
  - LUT for Color calibration
  - LUT for Color balance
  - Gamma pre-compensation, white balance

EasyColor™

Color Image Analysis



Gray-level and pseudo-colored image

- **Color image components**
  - Image components merging and extracting
  - Pseudo-coloring
- **Color classification for segmentation**
- **Special color formats**
  - YUV 422 decompression
  - Bayer patterns to RGB

EasyGauge™

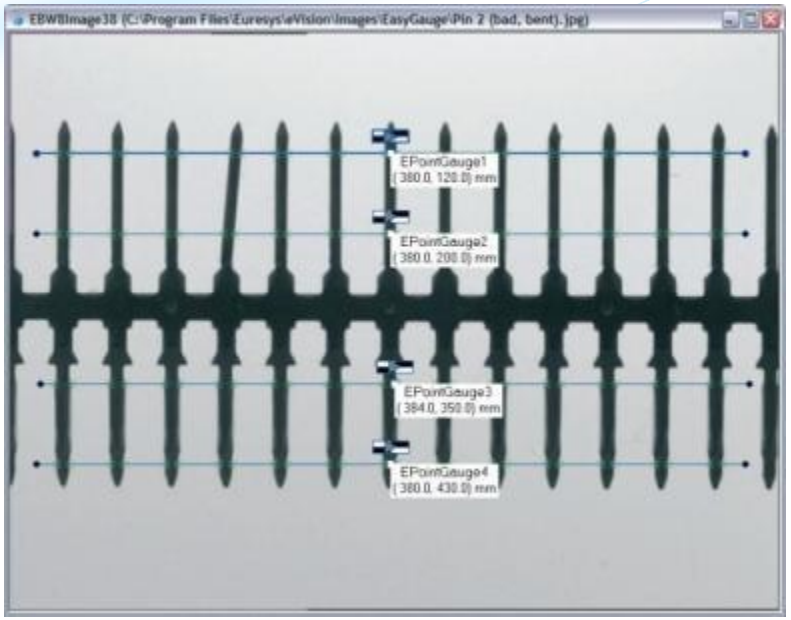
Sub-pixel Measurement and Dimension Control

Main Features

- **Sub-pixel point location and edge fitting**
- **Highly accurate and robust**
- **Position, orientation, size, curvature, distances**
- **Advanced and automatic calibration**
- **Multiple gauge models**
- **Graphical model edition**

EasyGauge™

Sub-pixel Measurement and Dimension Control

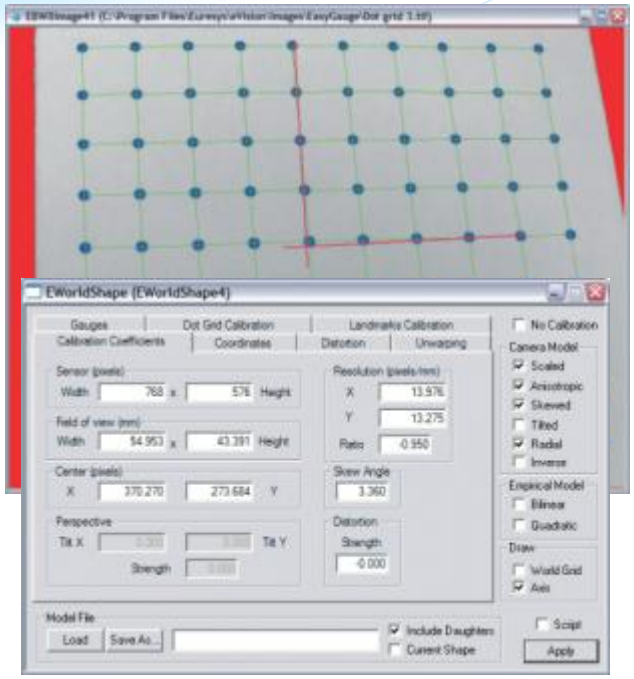


Typical Applications

- **Gauging**
  - Calibration metrology
  - Assembly inspection

EasyGauge™

Sub-pixel Measurement and Dimension Control

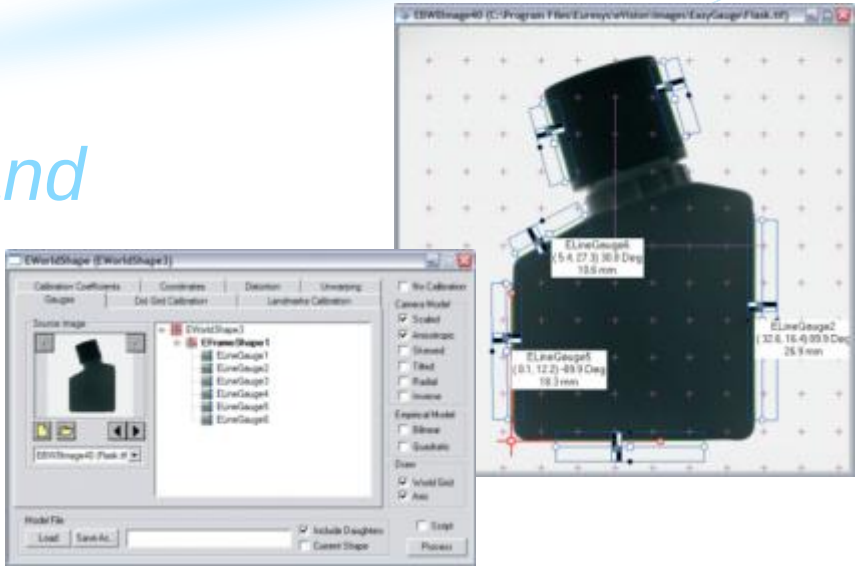


FUNCTIONS

- **Advanced and automatic calibration**
  - Built-in calibration capabilities
  - Support of : Non-square pixels
    Non-square pixels
    Rotated coordinate axis
  - Determine and correct with no performance loss
    - Perspective
    - Optical distortion

EasyGauge™

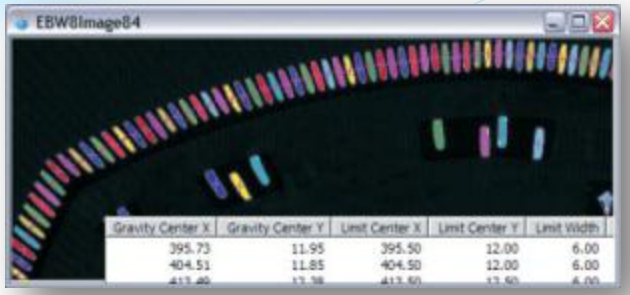
Sub-pixel Measurement and Dimension Control



- **Gauge grouping**
  - Translation and/or rotation of the grouped gauges
- **Computation of the derived measurements**
  - Distances between feature points

EasyObject™

Image Segmentation

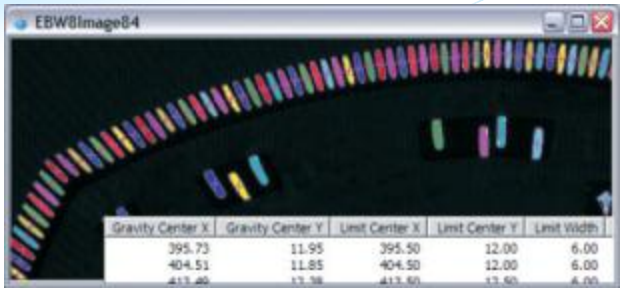


Main Features

- **Blob analysis**
- **Object labeling**
- **Geometric feature extraction**

EasyObject™

Image Segmentation

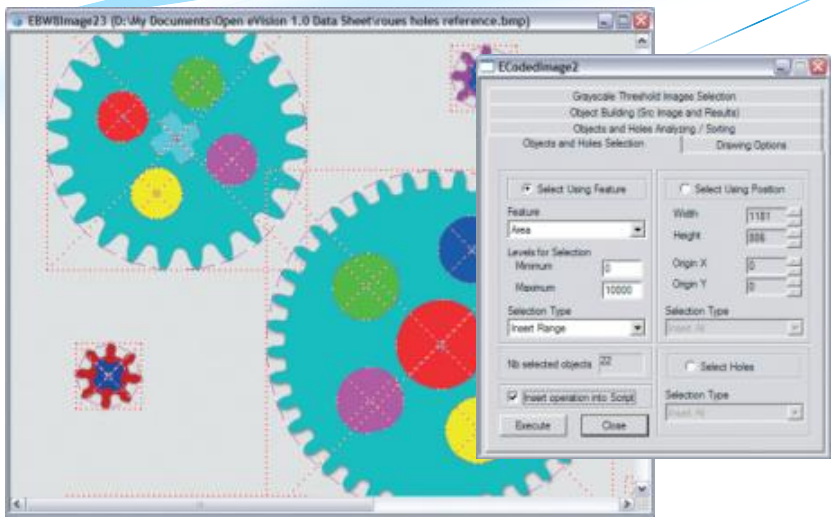


TYPICAL APPLICATIONS

- **Surface inspection**
- **Packaging inspection**
- **Object location**

EasyObject™

Image Segmentation



FUNCTIONS

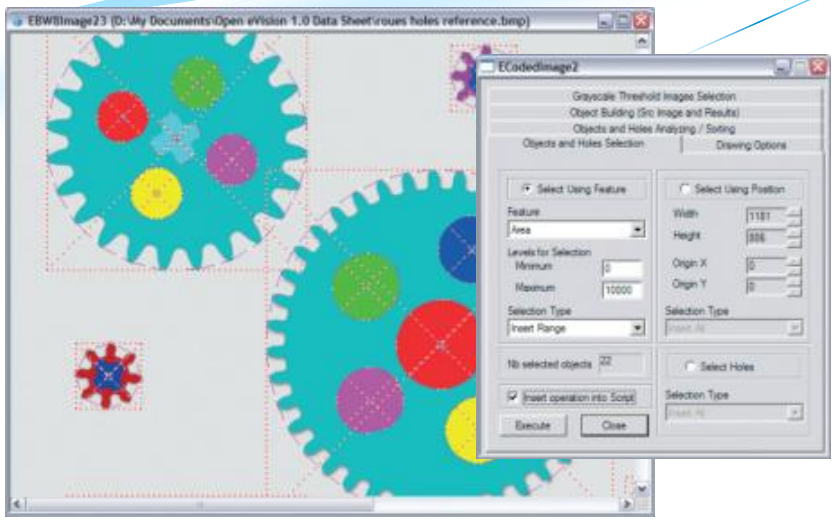
- **Image Encoding**

  Support of BW1, BW8, BW16 and C24 source images.

  - Run construction
    - ✓ Image Segmentation:
      - Grayscale Single Threshold
      - Grayscale Double Threshold
      - Color Single Threshold
      - Color Range Threshold
      - Reference Image
      - Image Range
      - Labeled Image
      - Binary Image
    - ✓ Pixel aggregation into runs

EasyObject™

Image Segmentation

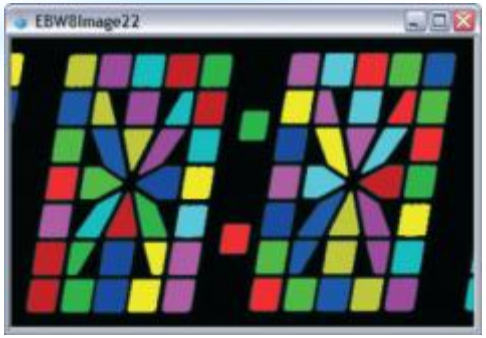


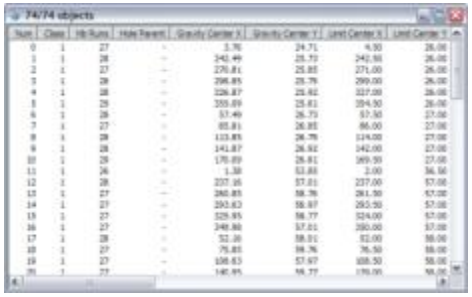
FUNCTIONS

- **Image encoding**
  Support of BW1, BW8, BW16 and C24 source images.
  - Object construction: run aggregation into objects
  - Hole construction: run aggregation into holes
  - Possible continuous mode for images whose height is a priori unknown or infinite (e.g. coming from a line-scan camera)

EasyObject™

Image Segmentation





- **Object or hole**
  - Feature extraction
    - ✓ Geometric parameter computation
  - Selection and sorting
    - ✓ According to any feature value

EasyObject™

Image Segmentation

Calculable Features

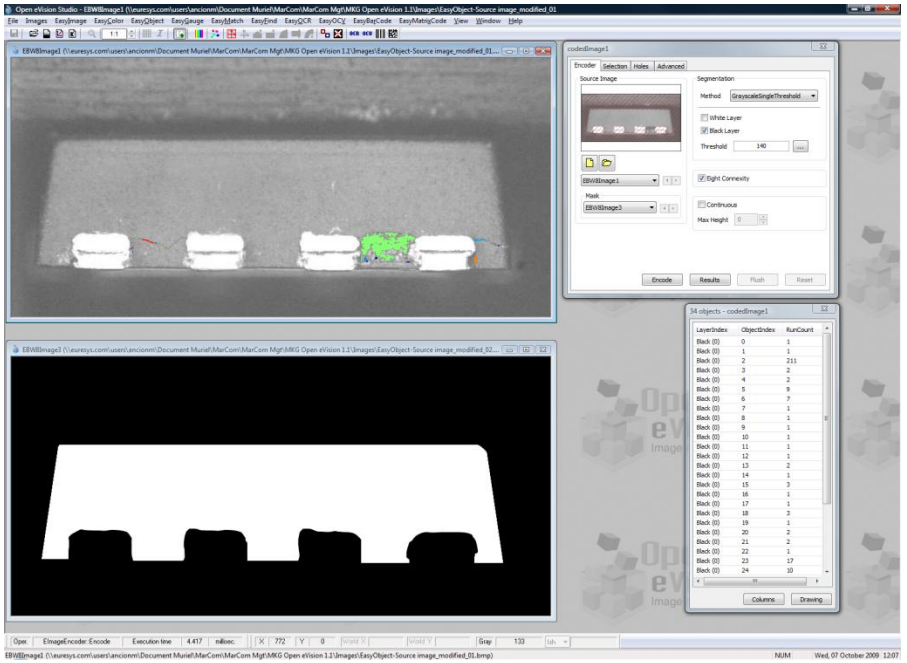
- Position
- Extents
- Ellipse of Inertia
- Convex Hull
- Statistics
- Miscellaneous:
  - Object number
  - Starting point of the object contour
  - Run count
  - Largest run

EasyObject™

Image Segmentation

Flexible Masks Support

- **To restrict the areas that will be encoded by EasyObject**
- **To generate Flexible Masks from an encoded image**



EasyObject™

Image Segmentation

Improved Execution Time

- **EasyObject has been re-factored to globally improve the execution time, especially for large images and images with numerous objects.**

EasyObject™

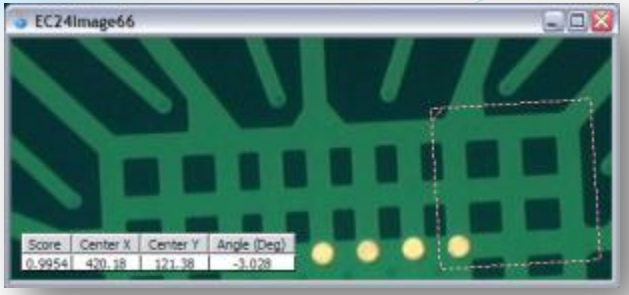
Image Segmentation

OBJECT-ORIENTED API

- **From Open eVision 1.1, EasyObject is accessible through a new object-oriented API centered on the `ECodedImage2` class**
  - Earlier versions of EasyObject are not compatible with this new EasyObject API.
  - For maintenance purpose, the legacy API is still available and documented in a dedicated section.

EasyMatch™

Pattern Matching

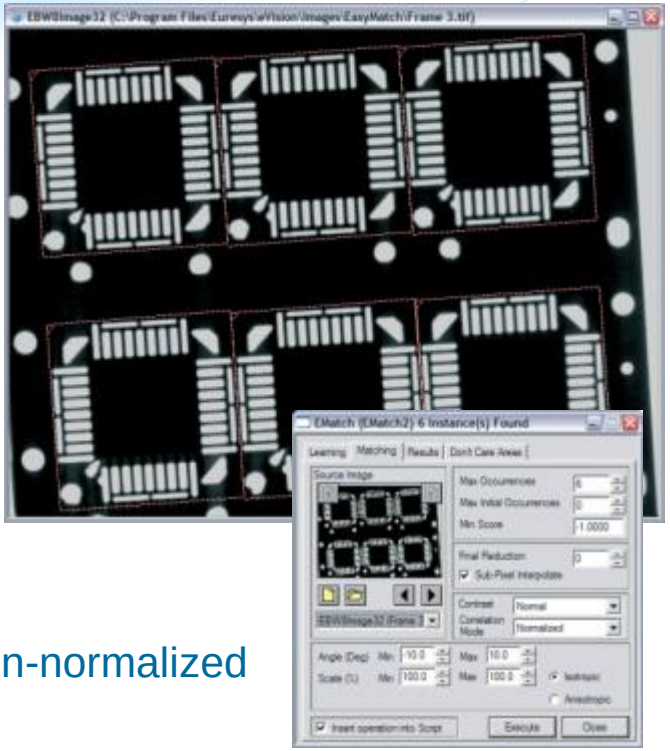


TYPICAL APPLICATIONS

- **Presence, absence**
- **Alignment**
- **Pick and place**

EasyMatch™

Pattern Matching

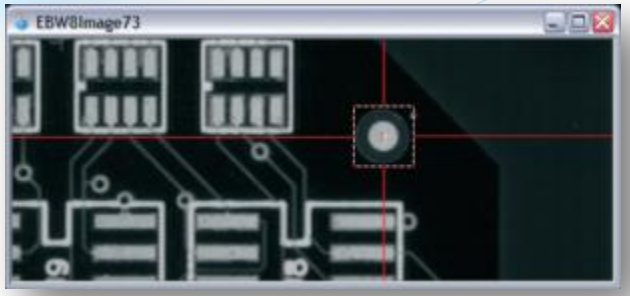


FEATURES

- Gray-level and color images
- Multiple pattern occurrences
- Correlation:
  - Standard
  - Offset-normalized, gain-normalized
  - Fully normalized
- Normal, inverse or mixed contrast
- Translation, rotation and isotropic/anisotropic scaling
- Variable accuracy, up to sub-pixel level
- Don’t care pixels and non-square pixels compensation

EasyFind™

Geometric Pattern Matching

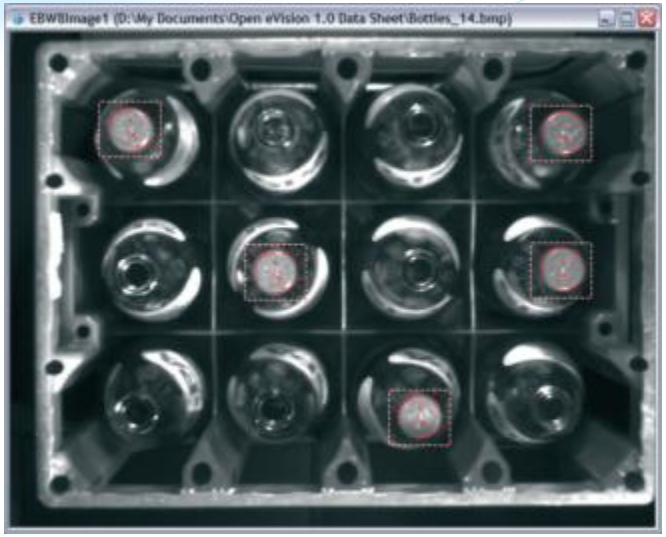


Main Features

- **Feature point technology**
- **Fully automatic, fast and robust**
- **Rotation and scaling invariant**
- **High tolerance to pattern degradation**
- **Don’t care areas**
- **User-defined pivot point**

EasyFind™

Geometric Pattern Matching



TYPICAL APPLICATIONS

- **Presence, absence**
- **Alignment**
- **Pick and place**
- **Printing industry**

EasyFind™

Geometric Pattern Matching

- **Fast processing and improved robustness thanks to three different operational modes**
  - **Consistent edges** mode
  - **Thin structure mode**
  - **Contrasting regions mode**

EasyFind™

Geometric Pattern Matching

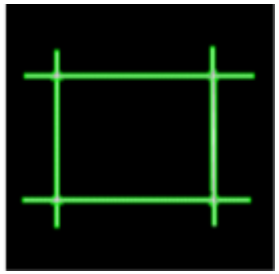
Fast Processing and Improved Robustness

- **Consistent edges mode**
  - ✓ For patterns with well defined edges
  - ✓ To find non deformed instances
  - ✓ Robust against blur, noise, occlusion or illumination variation
  - ✓ A **new point by point scoring method** makes this operating mode more resilient to large occlusions and/or large variations of contrast. It also globally reduces the **computation time** of the finding phase.

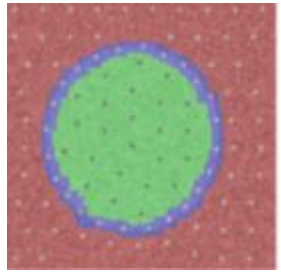
EasyFind™

Geometric Pattern Matching

- **Fast processing and improved robustness**
  - **Thin structure mode**
    - ✓ To locate patterns with particularly thin structures
    - ✓ Robust against blur, noise, occlusion and illumination variation



  - **Contrasting regions mode**
    - ✓ For patterns with poorly defined edges
    - ✓ For patterns exhibiting noise, blur, and random texture
    - ✓ Robust against blur, noise, illumination variation



Mark Inspection Libraries

EasyBarCode

EasyOCV

EasyOCR

EasyMatrixCode

EasyOCV™

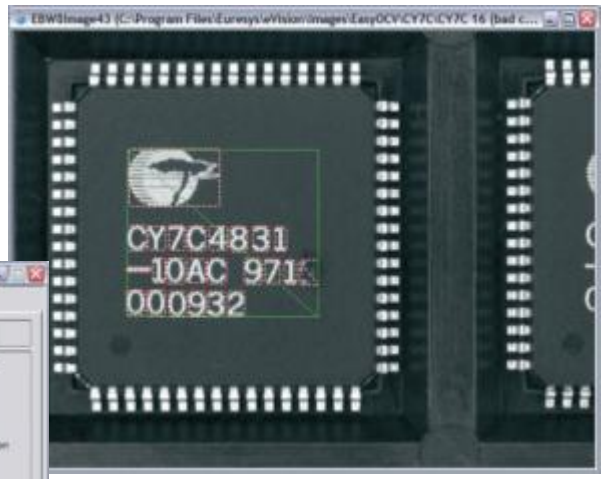
Optical Character Verification

Main Features

- **Comprehensive automatic training**
- **Grayscale analysis**
- **Text and Character-level inspection**
  - Contrast, position, shape defect detection
  - Allowed text translation, rotation, character translation …
  - Statistical Training
  - …

EasyOCV™

Optical Character Verification

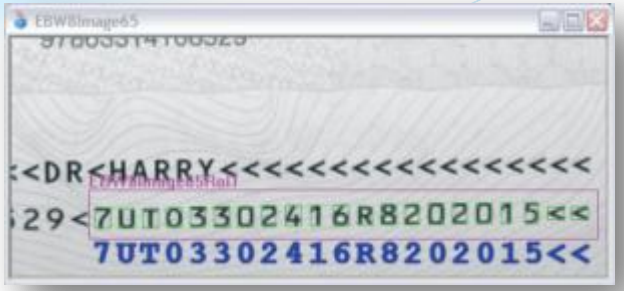


TYPICAL APPLICATIONS

- **Mark inspection**
- **Label inspection**
- **Lot mixing verification**

EasyOCR™

Optical Character Recognition



Main Features

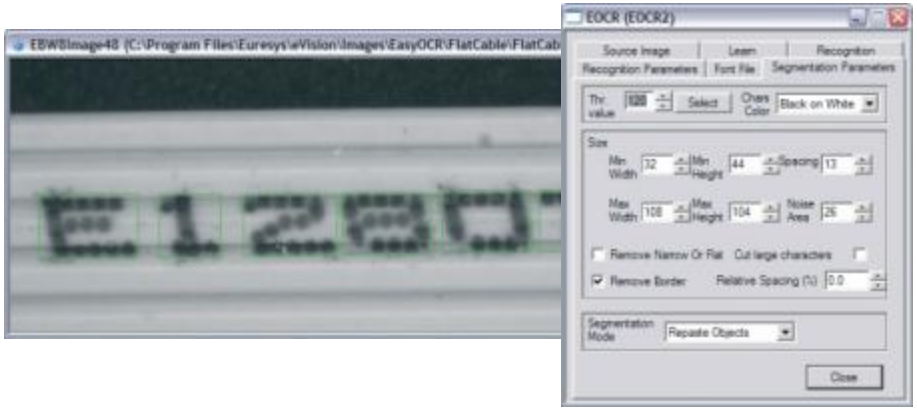
- Teachable system
- Reliable and robust recognition
- Size invariance
- Trained character fonts
- Broken character reconstruction
- Touching character separation
- Pre-defined fonts

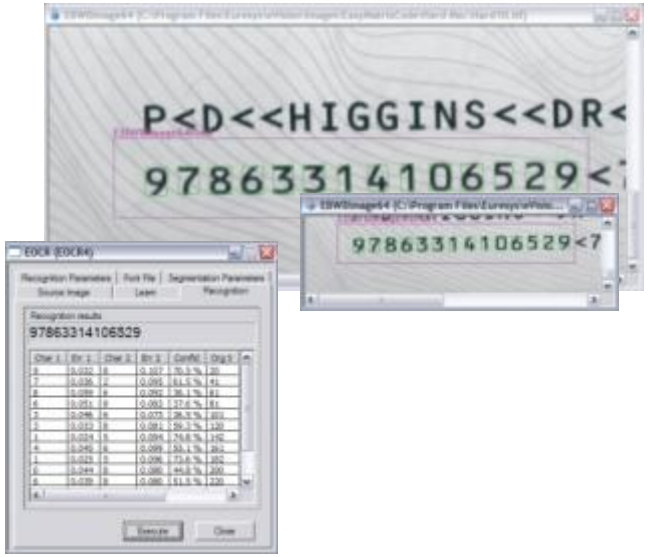
EasyOCR™

Optical Character Recognition

TYPICAL APPLICATIONS

- **Part identification**
- **Part traceability**
- **Serial number verification**





EasyBarCode™

Bar Code Reading

Main Features

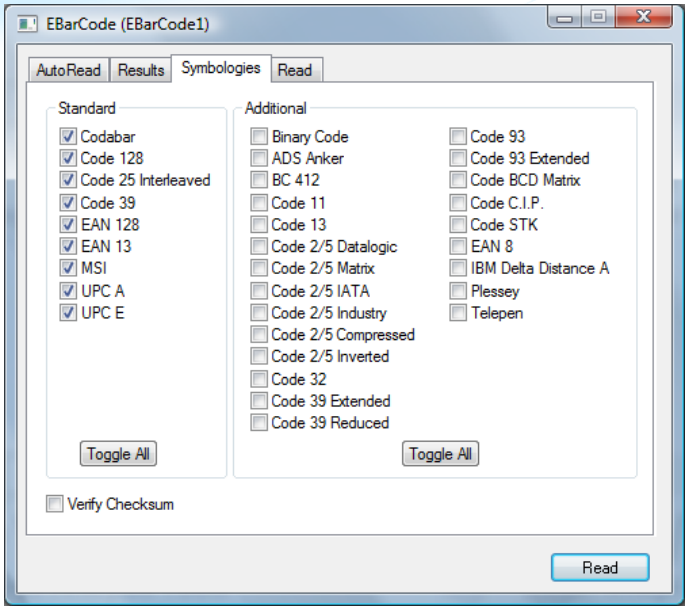
- **Automatic symbology detection**
- **Very fast and robust**
- **Full support of numerous symbologies**

Typical Applications

- **Product identification**
- **Bar code verification**
- **Symbologies identification**

EasyBarCode™

Bar Code Reading



SUPPORTED SYMBOLOGIES

- Standard Symbologies

Codabar	Code 39	MSI
Code 128	EAN 128	UPC A
Code 25 Interleaved	EAN 13	UPC E

- Additional Symbologies

Binary Code	Code 32	EAN 8
Code ABC Anker	Code 39 Extended, Reduced	IBM Delta Distance A
Code BC 412	Code 93	Plessey
Code 11	Code 93 Extended	Telepen
Code 25 *DataLogic, Matrix, IATA, Industry, Compressed, Inverted*	Code BCD Matrix	
	Code CIP	
	Code STK	

EasyMatrixCode

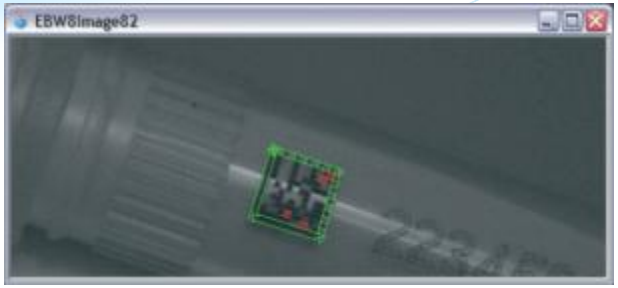
Data Matrix 2D Code Reading

Main Features

- **Impressive robustness to noise, blur and distortion**
  - Automatic code detection
  - Very fast operation
  - Error detection and correction

EasyMatrixCode

Data Matrix 2D Code Reading



Main Features

- **Rotation and flipping invariant**
- **Scaling up to a minimum size** - Minimum cell 3X3 pixels -
- **Contrast invariant**
- **Automatic compensation for illumination changes**
- **Supported codes:**

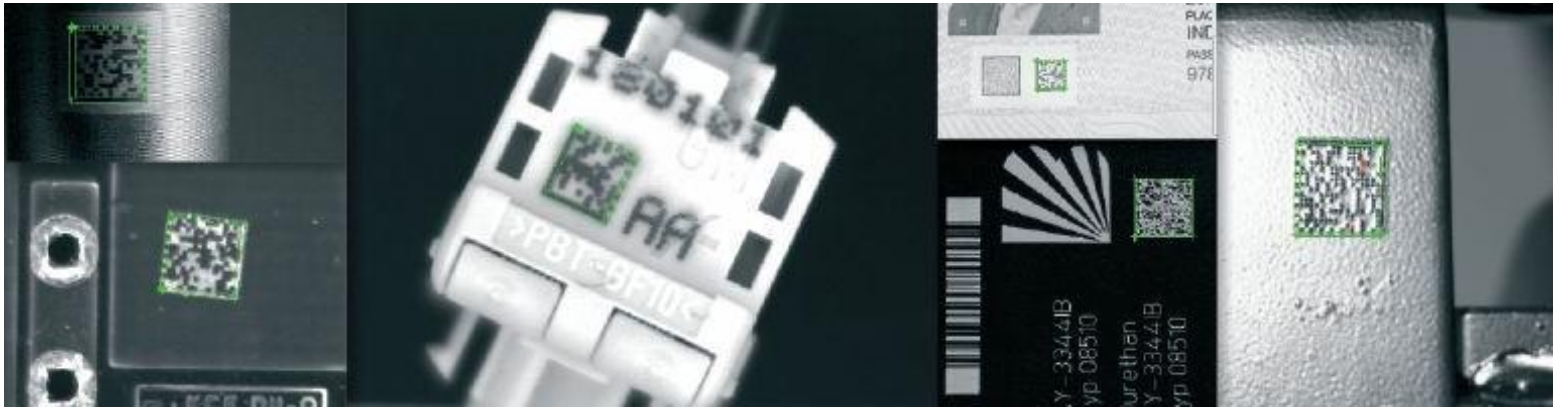
  Data Matrix codes, including ECC200, ECC000, ECC050, ECC080, ECC100 and ECC140 encoding types

EasyMatrixCode

Data Matrix 2D Code Reading

Typical Applications

- **Part identification**
- **Product traceability**



EasyMatrixCode™

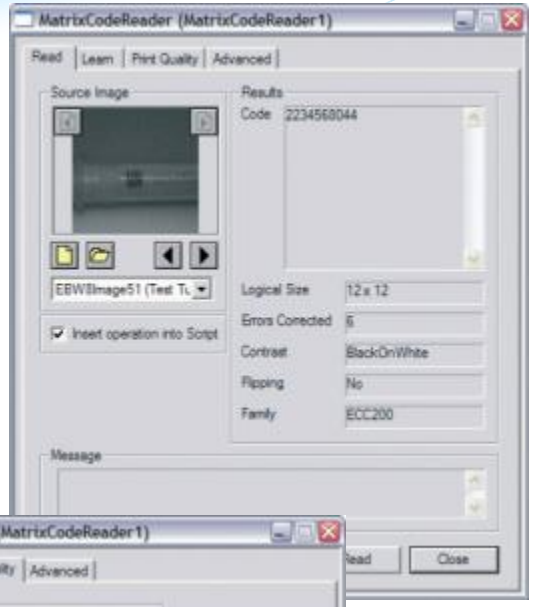
Data Matrix 2D code reading

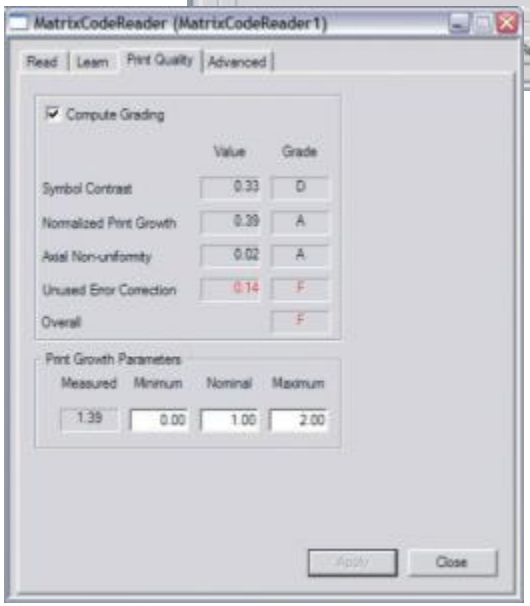
- **Impressive robustness to noise, blur and distortion**
  - Bad illumination conditions
    - ✓ Non uniform contrast
    - ✓ Under or over exposures
  - Bad images resulting from printing or optical defects
    - ✓ Blurred Data Matrix codes
    - ✓ Anisotropic and non uniform scaling
    - ✓ Noisy images
    - ✓ Skewed images

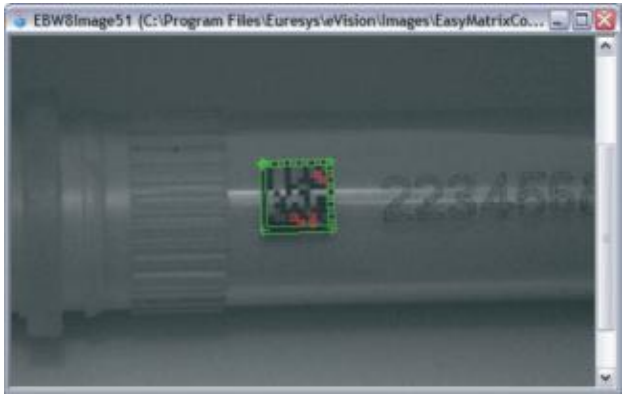
EasyMatrixCode™

Data Matrix 2D code reading

- Codes hard to detect
  - ✓ Small size matrix codes
  - ✓ Textured background
  - ✓ Laser marked
  - ✓ Nailed
  - ✓ Rectangular matrix codes







Licensing

Dongle-Based Licensing

Bundles

Software-based Licensi

SDK

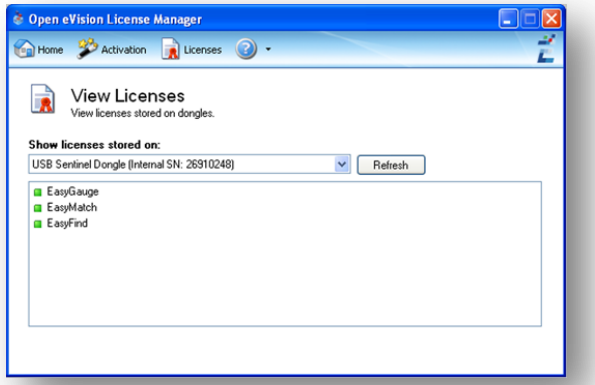
Individual licenses

Dongle or Software-Based

New

- **Open eVision features two types of licensing systems:**
  - **Dongle-Based licensing system**
    - ➔ linked to a Euresys dongle
  - **Software-Based licensing**
    - ➔ linked to a platform

- Both licensing systems use the **License Manager**
  - To activate the licenses
  - To view the licenses activated



New

Dongle-Based Licensing

- **Two types of Euresys dongles are available:**
  - USB dongle
  - Parallel port dongle

SOFTWARE-BASED LICENSING

- Licenses are **linked to a platform.**
- **Easy-to-use with** mobile platforms, embedded systems, compact vision systems, smart cameras

Various Licenses Options

An Open eVision customer is free to choose among a large choice of products the most suitable and attractive offer for his application.

- **Individual licenses**
  - All libraries can be purchased individually.
- **SDK**
  - Group the following Open eVision products:
    - ✓ Open eVision Studio,
    - ✓ EasyImage, EasyColor, EasyObject,EasyMatch, EasyFind, EasyGauge, EasyOCR, EasyOCV, EasyBarCode and EasyMatrixCode.

- **Bundles**

  Open eVision Bundles group several libraries:

  - The **Open eVision Inspection** bundle includes

    EasyImage, EasyColor, EasyObject, EasyMatch and EasyGauge.

  - The **Open eVision Mark Inspection bundle** include

    EasyOCR, EasyOCV, EasyBarCode and EasyMatrixCode.

Conclusion

Open eVision 1.2 New Features

- **64-bit libraries** for C++ and .NET development
- **Open eVision Dongle-Based Licenses** on Euresys parallel or USB dongles
- **Seamless compatibility** with eVision 6.7.1 and Open eVision 1.0 C++ and ActiveX APIs

Evaluate Open eVision 1.2 Functionalities

Download it for free

from www.euresys.com

Thank you for your attention!