

# **Computer Vision System Toolbox™ Release Notes**

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*Computer Vision System Toolbox™ Release Notes*

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## Summary by Version

This table provides quick access to what's new in each version. For clarification, see “Using Release Notes” on page 1.

<b>Version (Release)</b>	<b>New Features and Changes</b>	<b>Version Compatibility Considerations</b>	<b>Fixed Bugs and Known Problems</b>
<b>Latest Version V4.0 (R2011a)</b>	Yes Details	Yes Summary	Bug Reports Includes fixes
V3.1 (R2010b)	Yes Details	Yes Summary	Bug Reports Includes fixe
V3.0 (R2010a)	Yes Details	No	Bug Reports Includes fixes

## Using Release Notes

Use release notes when upgrading to a newer version to learn about:

- New features
- Changes
- Potential impact on your existing files and practices

Review the release notes for other MathWorks® products required for this product (for example, MATLAB® or Simulink®). Determine if enhancements, bugs, or compatibility considerations in other products impact you.

If you are upgrading from a software version other than the most recent one, review the current release notes and all interim versions. For example, when you upgrade from V1.0 to V1.2, review the release notes for V1.1 and V1.2.

## What Is in the Release Notes

### New Features and Changes

- New functionality
- Changes to existing functionality

### Version Compatibility Considerations

When a new feature or change introduces a reported incompatibility between versions, the **Compatibility Considerations** subsection explains the impact.

Compatibility issues reported after the product release appear under Bug Reports at the MathWorks Web site. Bug fixes can sometimes result in incompatibilities, so review the fixed bugs in Bug Reports for any compatibility impact.

### Fixed Bugs and Known Problems

MathWorks offers a user-searchable Bug Reports database so you can view Bug Reports. The development team updates this database at release time and as more information becomes available. Bug Reports include provisions for any known workarounds or file replacements. Information is available for bugs existing in or fixed in Release 14SP2 or later. Information is not available for all bugs in earlier releases.

Access Bug Reports using your MathWorks Account.

### Documentation on the MathWorks Web Site

Related documentation is available on [mathworks.com](http://mathworks.com) for the latest release and for previous releases:

- Latest product documentation
- Archived documentation

## Version 4.0 (R2011a) Computer Vision System Toolbox

This table summarizes what's new in Version 4.0 (R2011a):

New Features and Changes	Version Compatibility Considerations	Fixed Bugs and Known Problems
Yes Details below V4.0 (R2011a)	Yes—Details labeled as <b>Compatibility Considerations</b> , below. See also Summary.	Bug Reports Includes fixes

- “Product Restructuring” on page 4
- “New Computer Vision Functions” on page 5
- “New Foreground Detector System Object” on page 5
- “New Tracking Cars Using Gaussian Mixture Models Demo” on page 6
- “Expanded To Video Display Block with Additional Video Formats” on page 6
- “New Printing Capability for the mplay Function and Video Viewer Block” on page 6
- “Improved Display Updates for mplay Function, Video Viewer Block and vision.VideoPlayer System Object” on page 6
- “Improved Performance of FFT Implementation with FFTW library” on page 6
- “Variable Size Data Support” on page 6
- “Heterogeneous Arrays of System Objects” on page 7
- “System Object Input and Property Warnings Changed to Errors” on page 7
- “System Object Code Generation Support” on page 7
- “MATLAB Compiler Support for System Objects” on page 7
- “R2010a MAT Files with System Objects Load Incorrectly” on page 8
- “Documentation Examples Renamed” on page 8

## Product Restructuring

The Video and Image Processing Blockset has been renamed to Computer Vision System Toolbox™. This product restructuring reflects the broad expansion of computer vision capabilities for the MATLAB and Simulink environments. The Computer Vision System Toolbox software requires the Image Processing Toolbox™ and DSP System Toolbox™ software.

You can access archived documentation for the Video and Image Processing Blockset™ products on the MathWorks website.

## System Object Name Changes

**Package Name Change.** The System object package name has changed from `video` to `vision`. For example, `video.BlobAnalysis` is now `vision.BlobAnalysis`.

**Object Name Changes.** The 2D System object names have changed. They no longer have 2D in the name and now use the new package name.

Old Name	New Name
<code>video.Autocorrelator2D</code>	<code>vision.Autocorrelator</code>
<code>video.Convolver2D</code>	<code>vision.Convolver</code>
<code>video.Crosscorrelator2D</code>	<code>vision.Crosscorrelator</code>
<code>video.DCT2D</code>	<code>vision.DCT</code>
<code>video.FFT2D</code>	<code>vision.FFT</code>
<code>video.Histogram2D</code>	<code>vision.Histogram</code>
<code>video.IDCT2D</code>	<code>vision.IDCT</code>
<code>video.IFFT2D</code>	<code>vision.IFFT</code>
<code>video.MedianFilter2D</code>	<code>vision.MedianFilter</code>



## **New Computer Vision Functions**

### **Extract Features**

The `extractFeatures` function extracts feature vectors, also known as descriptors, from an image.

### **Feature Matching**

The `matchFeatures` function takes a pair of feature vectors, as returned by the `extractFeatures` function, and finds the features which are most likely to correspond.

### **Uncalibrated Stereo Rectification**

The `estimateUncalibratedRectification` function returns projective transformations for rectifying stereo images.

### **Determine if Image Contains Epipole**

The `isEpipoleInImage` function determines whether an image contains an epipole. This function supports the `estimateUncalibratedRectification` function.

### **Epipolar Lines for Stereo Images**

The `epipolarLine` computes epipolar lines for stereo images.

### **Line-to-Border Intersection Points**

The `lineToBorderPoints` function calculates the location of the point of intersection of line in an image with the image border. This function supports the `epipolarLine` function.

### **New Foreground Detector System Object**

The `vision.ForegroundDetector` object computes a foreground mask using Gaussian mixture models (GMM).

## **New Tracking Cars Using Gaussian Mixture Models Demo**

The new Tracking Cars Using Gaussian Mixture Models demo illustrates the use of Gaussian mixture models for detection and tracking of cars. The algorithm detects and tracks the cars in a video by separating them from their background.

## **Expanded To Video Display Block with Additional Video Formats**

The To Video Display block now supports 4:2:2 YCbCr video input format.

## **New Printing Capability for the mplay Function and Video Viewer Block**

You can now print the display information from the GUI interface of the mplay function and the Video Viewer block.

## **Improved Display Updates for mplay Function, Video Viewer Block and vision.VideoPlayer System Object**

R2011a introduces the capability to improve the performance of mplay, the Video Viewer block and the vision.VideoPlayer System object by reducing the frequency with which the display updates. You can now choose between this new enhanced performance mode and the old behavior. By default, all scopes operate in the new enhanced performance mode.

## **Improved Performance of FFT Implementation with FFTW library**

The 2-D FFT, 2-D IFFT blocks and the vision.FFT and vision.IFFT System objects include the use of the FFTW library.

## **Variable Size Data Support**

The Resize block now supports variable size data. See “Working with Variable-Size Signals” for more information about variable size data.

## Heterogeneous Arrays of System Objects

You can now create arrays that contain System objects of different classes. This capability allows you to run a subset of methods on multiple System objects simultaneously. You can run these methods on System object arrays: `clone`, `getNumInputs`, `getNumOutputs`, `isLocked`, `release`, and `reset`. Note that the `step` method is not supported for System object arrays.

## System Object Input and Property Warnings Changed to Errors

When a System object is locked (e.g., after the `step` method has been called), the following situations now produce an error. This change prevents the loss of state information.

- Changing the input data type
- Changing the number of input dimensions
- Changing the input complexity from real to complex
- Changing the data type, dimension, or complexity of tunable property
- Changing the value of a nontunable property

## Compatibility Consideration

Previously, the object issued a warning for these situations. The object then unlocked, reset its state information, relocked, and continued processing. To update existing code so that it does not error, use the `release` method before changing any of the items listed above.

## System Object Code Generation Support

The following System objects now support code generation:

- `vision.GeometricScaler`
- `vision.Foreground.Detector`

## MATLAB Compiler Support for System Objects

The Computer Vision System Toolbox supports the MATLAB® Compiler™ for all objects except `vision.VideoPlayer`. With this capability, you can use the

MATLAB Compiler to take MATLAB files, which can include System objects, as input and generate standalone applications.

## **R2010a MAT Files with System Objects Load Incorrectly**

If you saved a System object to a MAT file in R2010a and load that file in R2011a, MATLAB may display a warning that the constructor must preserve the class of the returned object. This occurs because an aspect of the class definition changed for that object in R2011a. The object's saved property settings may not restore correctly.

### **Compatibility Consideration**

MAT files containing a System object saved in R2010a may not load correctly in R2011a. You should recreate the object with the desired property values and save the MAT file.

## **Documentation Examples Renamed**

In previous releases, the examples used throughout the Video and Image Processing Blockset™ documentation were named with a `doc_` prefix. In R2011a, this changed to a `ex_` prefix. For example, in R2010b, you could launch an example model using the Video Viewer block by typing `doc_thresholding` at the MATLAB command line. To launch the same model in R2011a, you must type `ex_thresholding` at the command line.

### **Compatibility Considerations**

You can no longer launch Video and Image Processing Blockset™ documentation example models using the `doc_` prefix name. To open these models in R2011a, you must replace the `doc_` prefix in the model name with `ex_`.

## Version 3.1 (R2010b) Video and Image Processing Blockset

This table summarizes what's new in Version 3.1 (R2010b):

New Features and Changes	Version Compatibility Considerations	Fixed Bugs and Known Problems
Yes Details below	Yes Summary	Bug Reports Includes fixes

- “New Estimate Fundamental Matrix Function for Describing Epipolar Geometry” on page 9
- “New Histogram System Object Replaces Histogram2D Object” on page 10
- “New System Object release Method Replaces close Method” on page 10
- “Expanded Embedded MATLAB Support” on page 10
- “Data Type Assistant and Ability to Specify Design Minimums and Maximums Added to More Fixed-Point Blocks” on page 11
- “Data Types Pane Replaces the Data Type Attributes and Fixed-Point Panes on Fixed-Point Blocks” on page 12
- “Enhanced Fixed-Point and Integer Data Type Support with System Objects” on page 12
- “Variable Size Data Support” on page 12
- “Limitations Removed from Video and Image Processing Blockset Multimedia Blocks and Objects” on page 12

### **New Estimate Fundamental Matrix Function for Describing Epipolar Geometry**

New Estimate Fundamental Matrix function for describing epipolar geometry. Epipolar geometry applies to the geometry of stereo vision, where you can calculate depth information based on corresponding points in stereo image pairs. The function supports the generation of embeddable C code.

## **New Histogram System Object Replaces Histogram2D Object**

The new `video.Histogram System` object replaces the `video.Histogram2D System` object. The name change was made to align this object with its corresponding block.

### **Compatibility Consideration**

The `video.Histogram2D System` object now issues a warning. Update code that uses the 2D-Histogram object to use the new Histogram object.

## **New System Object release Method Replaces close Method**

The `close` method has been replaced by the new `release` method, which unlocks the object and releases memory and other resources, including files, used by the object. The new `release` method includes the functionality of the old `close` method, which only closed files used by the object.

### **Compatibility Consideration**

The `close` method now issues a warning. Update code that uses the `close` method to use the new `release` method.

## **Expanded Embedded MATLAB Support**

Embedded MATLAB® now supports the generation of embeddable C code for two Image Processing Toolbox functions and additional Video and Image Processing Blockset System objects. The generated C code meets the strict memory and data type requirements of embedded target environments. Video and Image Processing Blockset provides Embedded MATLAB support for these Image Processing Toolbox functions. See for details, including limitations.

### **Supported Image Processing Toolbox Functions**

`label2rgb`  
`fspecial`

## Supported System objects

Video and Image Processing Blockset objects now support code generation:

```
video.CornerDetector  
video.GeometricShearer  
video.Histogram  
video.MorphologicalBottomHat  
video.MorphologicalTopHat  
video.MultimediaFileReader  
video.MultimediaFileWriter
```

## Data Type Assistant and Ability to Specify Design Minimums and Maximums Added to More Fixed-Point Blocks

The following blocks now offer a **Data Type Assistant** to help you specify fixed-point data types on the block mask. Additionally, you can now enable simulation range checking for certain data types on these blocks. To do so, specify appropriate minimum and maximum values on the block dialog box. The blocks that support these features are:

- 2-D DCT
- 2-D FFT
- 2-D IDCT
- 2-D IFFT
- 2-D FIR Filter

For more information on these features, see the following sections in the Simulink documentation:

- “Using the Data Type Assistant”
- “Signal Ranges”

## Data Types Pane Replaces the Data Type Attributes and Fixed-Point Panes on Fixed-Point Blocks

In previous releases, some fixed-point blocks had a **Data type attributes** pane, and others had a **Fixed-point** pane. The functionality of these panes remains the same, but the pane now appears as the **Data Types** pane on all fixed-point Computer Vision System Toolbox blocks.

## Enhanced Fixed-Point and Integer Data Type Support with System Objects

For nonfloating point input, System objects now output the data type you specify. Previously, the output was always a fixed-point, numeric `fi` object.

### Compatibility Consideration

Update any code that takes nonfloating point input, where you expect the object to output a `fi` object.

## Variable Size Data Support

Several Video and Image Processing Blockset blocks now support changes in signal size during simulation. The following blocks support variable size data as of this release:

PSNR	2-D Correlation
Median Filter	2-D Convolution
Block Processing	2-D Autocorrelation
Image Complement	Deinterlacing
Gamma Correction	

See “Working with Variable-Size Signals” for more information about variable size data.

## Limitations Removed from Video and Image Processing Blockset Multimedia Blocks and Objects

Support for reading interleaved AVI data and reading AVI files larger than 2GB on UNIX platforms. Previously, this was only possible on Windows



platforms. The following blocks and System objects have the limitation removed:

From Multimedia File block  
`video.MultimediaFileReader` System object

Support for writing AVI files larger than 2GB on UNIX platforms, which was previously only possible on Windows platforms. The following blocks and System objects have the limitation removed:

To Multimedia File block  
`video.MultimediaFileWriter` System object

## Version 3.0 (R2010a) Video and Image Processing Blockset

This table summarizes what's new in Version 3.0 (R2010a):

New Features and Changes	Version Compatibility Considerations	Fixed Bugs and Known Problems
Yes Details below	No	Bug Reports Includes fixes

- “New System Objects Provide Video and Image Processing Algorithms for use in MATLAB” on page 14
- “Intel Integrated Performance Primitives Library Support Added to 2-D Correlation, 2-D Convolution, and 2-D FIR Filter Blocks” on page 15
- “Variable Size Data Support” on page 15
- “Expanded From and To Multimedia File Blocks with Additional Video Formats” on page 16
- “New Simulink Demos” on page 16
- “New System Object Demos” on page 16
- “SAD Block Obsoleted” on page 17

### New System Objects Provide Video and Image Processing Algorithms for use in MATLAB

System objects are algorithms that provide stream processing, fixed-point modeling, and code generation capabilities for use in MATLAB programs. These new objects allow you to use video and image processing algorithms in MATLAB, providing the same parameters, numerics and performance as corresponding Video and Image Processing Blockset blocks. System objects can also be used in Simulink models via the Embedded MATLAB Function block.

## Intel Integrated Performance Primitives Library Support Added to 2-D Correlation, 2-D Convolution, and 2-D FIR Filter Blocks

The 2-D Correlation, 2-D Convolution, and 2-D FIR Filter blocks are now taking advantage of SSE Intel instruction set and multi-core processor capabilities for double and single data types.

## Variable Size Data Support

Several Video and Image Processing Blockset blocks now support changes in signal size during simulation. The following blocks support variable size data as of this release:

2-D FFT	Hough Transform
2-D FIR Filter	Image Data Type Conversion
Apply Geometric Transformation	Image Pad
Autothreshold	Insert Text
Bottom-hat	Label
Chroma Resampling	Maximum
Closing	Mean
Color Space Conversion	Median
Compositing	Minimum
Contrast Adjustment	Opening
Dilation	Rotate
Edge Detection	Standard Deviation
Erosion	Template Matching
Estimate Geometric Transformation	To Video Display
Find Local Maxima	Top-hat
Frame Rate Display	Variance
Gaussian Pyramid	Video Viewer

See “Working with Variable-Size Signals” for more information about variable size data.

## **Expanded From and To Multimedia File Blocks with Additional Video Formats**

The To Multimedia File and From Multimedia File blocks now support 4:2:2 YCbCr video formats.

The To Multimedia File block now supports WMV, WMA, and WAV file formats on Windows® platforms. This block now supports broadcasting WMV and WMA streams over the network.

## **New Simulink Demos**

The Video and Image Processing Blockset contain new and enhanced demos.

### **New Modeling a Video Processing System for an FPGA Target Demo**

This demo uses the Video and Image Processing Blockset in conjunction with Simulink HDL Coder™ to show a design workflow for generating Hardware Design Language (HDL) code suitable for targeting video processing application on an FPGA. The demo reviews how to design a system that can operate on hardware.

## **New System Object Demos**

### **New Image Rectification Demo**

This demo shows how to rectify two uncalibrated images where the camera intrinsics are unknown. Rectification is a useful procedure in many computer vision applications. For example, in stereo vision, it can be used to reduce a 2-D matching problem to a 1-D search. This demo is a prerequisite for the Stereo Vision demo.

### **New Stereo Vision Demo**

This demo computes the depth map between two rectified stereo images using block matching, which is the standard algorithm for high-speed stereo vision

in hardware systems. It further explores dynamic programming to improve accuracy, and image pyramiding to improve speed.

### **New Video Stabilization Using Point Feature Matching**

This demo uses a point feature matching approach for video stabilization, which does not require knowledge of a feature or region of the image to track. The demo automatically searches for the background plane in a video sequence, and uses its observed distortion to correct for camera motion. This demo presents a more advanced algorithm in comparison to the existing Video Stabilization demo in Simulink.

### **SAD Block Obsoleted**

The new Template Matching block introduced in the previous release, supports Sum of Absolute Differences (SAD) algorithm. Consequently, the SAD Block has been obsoleted.

## Compatibility Summary for Computer Vision System Toolbox

This table summarizes new features and changes that might cause incompatibilities when you upgrade from an earlier version, or when you use files on multiple versions. Details are provided in the description of the new feature or change.

Version (Release)	New Features and Changes with Version Compatibility Impact
<p><b>Latest Version</b> <b>V4.0 (R2011a)</b></p>	<p>See the <b>Compatibility Considerations</b> subheading for each of these new features and changes:</p> <ul style="list-style-type: none"> <li>• “System Object Input and Property Warnings Changed to Errors” on page 7</li> <li>• “R2010a MAT Files with System Objects Load Incorrectly” on page 8</li> <li>• “Documentation Examples Renamed” on page 8</li> </ul>
<p>V3.1 (R2010b)</p>	<p>See the <b>Compatibility Considerations</b> subheading for each of these new features and changes:</p> <ul style="list-style-type: none"> <li>• “New Histogram System Object Replaces Histogram2D Object” on page 10</li> <li>• “New System Object release Method Replaces close Method” on page 10</li> </ul>

<b>Version (Release)</b>	<b>New Features and Changes with Version Compatibility Impact</b>
	<ul style="list-style-type: none"><li>• “Enhanced Fixed-Point and Integer Data Type Support with System Objects” on page 12</li></ul>
V3.0 (R2010a)	None