

Image Acquisition Toolbox 3

Acquire images and video from industry-standard hardware

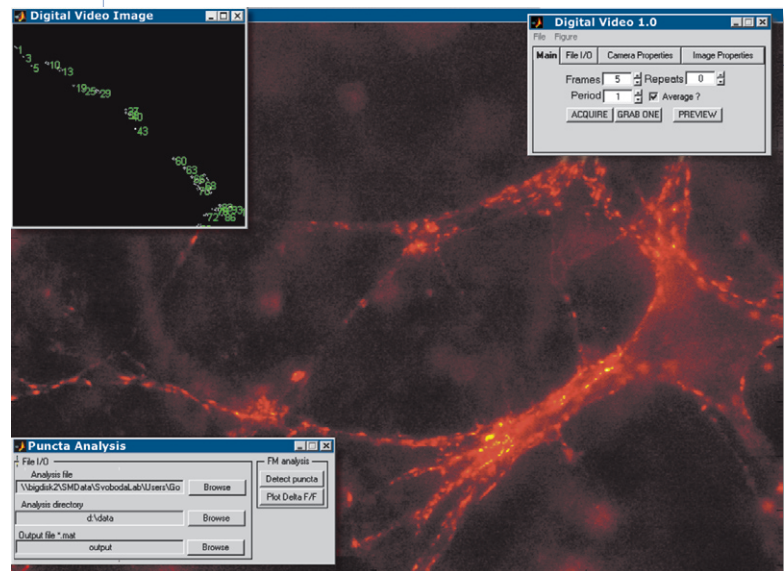
Image Acquisition Toolbox lets you acquire images and video directly into MATLAB® and Simulink® from PC-compatible imaging hardware. You can detect hardware automatically, configure hardware properties, preview an acquisition, and acquire images and video. With support for multiple hardware vendors, you can use a range of imaging devices from inexpensive Web cameras or industrial frame grabbers to high-end scientific cameras that meet low-light, high-speed, and other challenging requirements.

Together, MATLAB, Image Acquisition Toolbox, and Image Processing Toolbox (available separately) provide a complete environment for developing customized imaging applications. You can acquire images and video, visualize data, develop processing algorithms and analysis techniques, and create graphical user interfaces.

You can use Image Acquisition Toolbox with Simulink and Video and Image Processing Blockset (both available separately) to simulate and model real-time embedded imaging systems.

KEY FEATURES

- Automatically detects image and video acquisition devices
- Manages device configurations
- Provides live video previewing
- Acquires static images and continuous video
- Enables in-the-loop image processing and analysis
- Provides graphical user interface for working with devices
- Supports devices for use with MATLAB and Simulink
- Supports multiple hardware vendors



An Image Acquisition Toolbox application that acquires and analyzes images of central synapses to monitor synaptic transmission over time. Graphical user interfaces (upper right and lower left) enable researchers to tune acquisition and processing parameters. *Image courtesy of Polugruto, T.A., Tervo, D.G., and Svoboda, K., Howard Hughes Medical Institute/Cold Spring Harbor Labs.*

Working with Image Acquisition Toolbox

Image Acquisition Toolbox helps you connect to and configure your hardware, preview the acquisition, and acquire and visualize image data. You can use the toolbox from the Image Acquisition Tool, the MATLAB command line, or the From Video Device block within Simulink. This lets you control your image acquisition parameters and incorporate them into M-scripts, applications built within MATLAB, or Simulink models.

Within the toolbox, the Image Acquisition Tool is a graphical user interface for working with image and video acquisition devices in MATLAB. With this tool, you can see all hardware available on your PC, change device settings, preview an acquisition, control acquisition parameters, and acquire image or video data. You can also record data directly to an AVI file or export hardware configuration settings to an M-file so that you can incorporate them into other MATLAB scripts.

A typical session with the Image Acquisition Tool. You can use this tool instead of the MATLAB command line to set up and acquire images and video.

Connecting to Hardware

Image Acquisition Toolbox automatically detects compatible image and video acquisition devices. The connection to your devices is encapsulated as an object, providing an interface for configuration and acquisition. You can create multiple connection objects for simultaneous acquisition from as many devices as your PC and imaging hardware support.

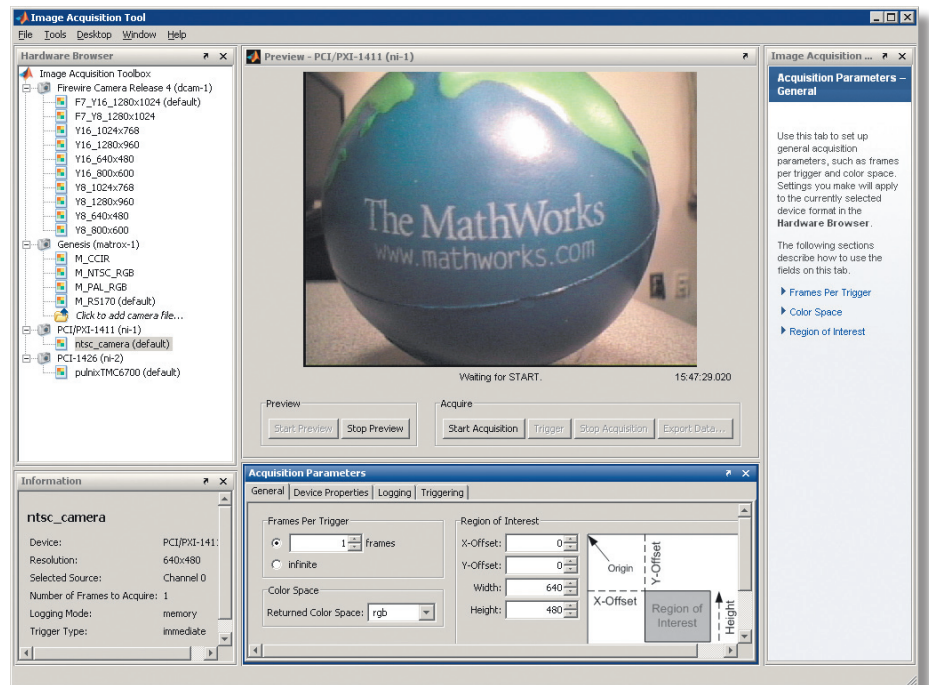
Configuring Hardware

The toolbox provides a consistent interface across multiple hardware devices and vendors, simplifying the configuration process. You configure your hardware by using the Image Acquisition Tool or by modifying the properties of the object associated with the hardware on the MATLAB command line. The toolbox also supports camera files from hardware vendors.

You can set base properties that are common to all supported hardware. These can include video format, resolution, region of interest (ROI), and returned color space. You can also set device-specific properties, such as hue, saturation, brightness, frame rate, contrast, and video sync if your device supports these properties.

Previewing the Acquisition

Image Acquisition Toolbox video preview window helps you verify and optimize your acquisition parameters. It instantly reflects any adjustments that you make to acquisition properties. The Image Acquisition Tool has a built-in preview window, and you can add one to any application built with MATLAB.





A scientific camera connected to a laptop using a FireWire connection. MATLAB interfaces with the camera using Image Acquisition Toolbox.

Acquiring Image Data

Image Acquisition Toolbox can continuously acquire image data while you are processing the acquired data in MATLAB or Simulink. The toolbox automatically buffers acquired data into memory, handles memory and buffer management, and enables acquisition from an ROI. Data can be acquired in a wide range of data types, including signed or unsigned 8-, 16-, and 32-bit integers and single- or double-precision floating point. The toolbox supports any color space provided by the image acquisition device, such as RGB, YUV, or grayscale. Raw sensor data in a Bayer pattern can be automatically converted into RGB data. The toolbox supports any frame rate and video resolution supported by your PC and imaging hardware.

Performing Image Acquisition in Simulink

Image Acquisition Toolbox provides a Simulink block that captures image or video data directly from any device supported by the toolbox. Along with the Video and Image Processing Blockset you can perform simulation and verification of image or video processing system designs with live image or video data.

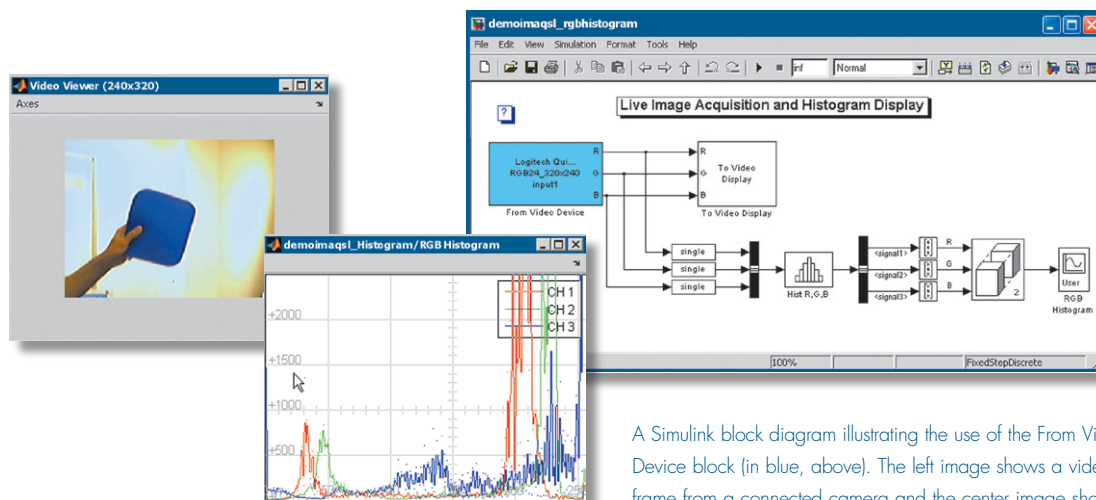
Advanced Acquisition Features

Image Acquisition Toolbox supports three trigger types: immediate, manual, and hardware. Hardware triggers, which are device-specific, let you synchronize your acquisition to an external signal.

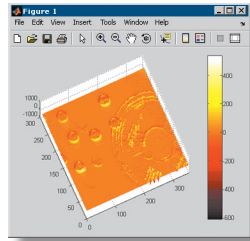
You can log data to disk, memory, or both simultaneously. Image Acquisition Toolbox lets you:

- Log each image frame or log frames at specified intervals
- Log data to disk as compressed or uncompressed AVI streams
- Extract single images from a video stream and store them in standard formats, including BMP, JPEG, and TIFF

For advanced sequencing of your acquisition application, you can create callback functions that are automatically executed whenever events occur, such as acquisition started or stopped, trigger occurred, and a set number of frames acquired.



A Simulink block diagram illustrating the use of the From Video Device block (in blue, above). The left image shows a video frame from a connected camera and the center image shows a histogram of the red, green, and blue channels of this input.



```

% Create a video input object to interface
% with the Windows video camera with ID 1.
vid = videoinput('winvideo', 1);

% Configure the object to acquire 100
% video frames and open a preview window.
preview(vid);
vid.FramesPerTrigger = 100;

% Acquire the video frames.
start(vid);
data = getdata(vid, 100, 'double');

% Average the frames and apply a Sobel edge
% enhancement filter to the red color band.
ave = mean(data, 4);
filtered = filter2(fspecial('sobel'), ave(:, :, 1));
surf(filtered);
shading('interp'); colormap('hot'); colorbar;

```

A script illustrating the three steps of a typical MATLAB image acquisition session: creation, configuration, and acquisition. A few lines of code let you acquire 100 video frames from a camera, process the averaged frames with an edge-enhancement filter, and visualize the results as a 3-D surface.

Required Products

MATLAB

Related Products

Simulink. Simulation and Model-Based Design

Image Processing Toolbox. Perform image processing, analysis, and algorithm development

MATLAB® Compiler. Build stand-alone executables and software components from MATLAB code

Video and Image Processing Blockset. Design and simulate video and image processing systems

For more information on related products, visit www.mathworks.com/products/imaq

Supported Hardware

Image Acquisition Toolbox supports imaging hardware from:

- DALSA Coreco
- Data Translation
- Hamamatsu
- Matrox Imaging
- National Instruments
- QImaging

The toolbox also supports the following interfaces:

- FireWire imaging devices that adhere to DCAM (IIDC 1394-based Digital Camera Specification)
- DirectX-compatible devices that include a Windows Driver Model (WDM) or Video for Windows (VFW) driver
- Camera Link devices from the supported hardware list

In addition, the toolbox includes a C++ framework for adding support for other imaging hardware to the toolbox. For a complete list of supported hardware and driver requirements, visit www.mathworks.com/products/imaq

Platform and System Requirements

For platform and system requirements, visit www.mathworks.com/products/imaq ■

Resources

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