

10 Things to Consider When Choosing Vision Software



Introduction

National Instruments has been a leader in machine vision and image processing for nearly a decade. NI vision software is available in two packages – the NI Vision Development Module and NI Vision Builder for Automated Inspection (AI). The Vision Development Module contains hundreds of vision functions to use with National Instruments LabVIEW, NI LabWindows/CVI, C/C++, or Visual Basic to program powerful vision inspection, alignment, identification, and measurement applications. Vision Builder AI is an interactive software environment for configuring, benchmarking and deploying machine vision applications without programming. Both software packages work with all NI vision frame grabbers and the NI Compact Vision System. The following 10 topics outline the important points to consider when choosing vision software.

Camera Choice

The first consideration when picking vision software is to determine if it works with the camera that is best suited for your application. It is easy to find low-cost analog cameras, but, often, an application needs more than VGA resolution, frame rates faster than 30 frames/s, and overall greater image quality than a standard analog camera has.



National Instruments hardware and software are compatible with thousands of cameras, from low-cost standard analog to high-speed line scan. Use the Industrial Camera Advisor at ni.com to find the right camera for your application and to guide you to the correct acquisition hardware.

Hardware Scalability

While choosing the right camera is a crucial step in any application, camera scalability is another important consideration. Because camera technologies are advancing rapidly, someday you may want to upgrade your cameras to improve image quality or measure additional features. National Instruments NI-IMAQ driver software supports all NI frame grabbers and interfaces to thousands of cameras with one easy-to-use interface. Your software does not change if you upgrade from an analog camera to a Camera Link camera. The same is true for NI-IMAQ for IEEE 1394 Cameras software, which communicates and acquires images from more than 100 different IEEE1394 (FireWire) cameras without a frame grabber.



Not only does National Instruments driver software support thousands of cameras, but it also works on all NI hardware platforms, from PCs and CompactPCI/PXI to the NI Compact Vision System. Thus, you can prototype your application in a lab on a PC with an inexpensive IEEE 1394 (FireWire) camera and then deploy it to the production floor on a rugged Compact Vision System without changing the acquisition or image-processing code.

Software Ease of Use

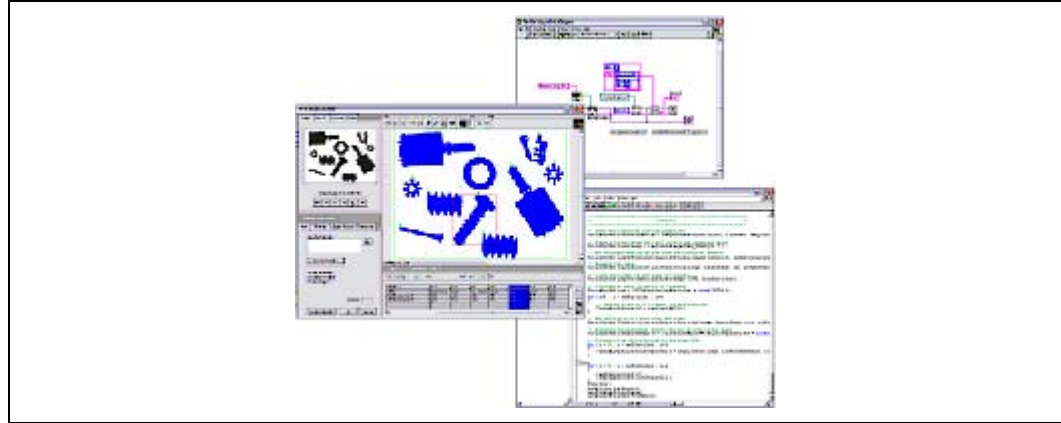
Once you acquire an image, the next step is to process it. With the choices in algorithms today, finding the correct tools through trial and error in a programming language can be tedious and ineffective. With this in mind, you need vision software tools to help you make the most of the algorithms.

For many applications, you do not need a programming language to build a complete machine vision system. Although less flexible than programming in C, Visual Basic, or LabVIEW, configurable software such as NI Vision Builder AI provides an easy-to-navigate, interactive environment to configure, benchmark, and deploy machine vision applications. Vision Builder AI includes almost 50 popular machine vision tools such as pattern matching, OCR, DataMatrix readers, color matching, and many others. Vision Builder AI also can acquire images from any camera NI supports, and communicate inspection results with other devices using common industrial protocols over Ethernet, serial, or digital I/O.



While programming a vision application is more complex than configuring one with Vision Builder AI, National Instruments makes application development in LabVIEW, C, and Visual Basic easy and straightforward with NI Vision Assistant. Included with the NI Vision Development Module, Vision Assistant is a prototyping environment with which you can interactively experiment with different vision functions to see what works for your application and how long each function takes to run.

Once you determine how best to solve your application challenge, simply click a button and Vision Assistant generates ready-to-run LabVIEW, LabWindows/CVI, C/C++, or Visual Basic code. You finish the majority of your vision application before you ever type a line of code. You can run the code generated by Vision Assistant on its own or add it to a larger industrial control, data acquisition, or motion control system.



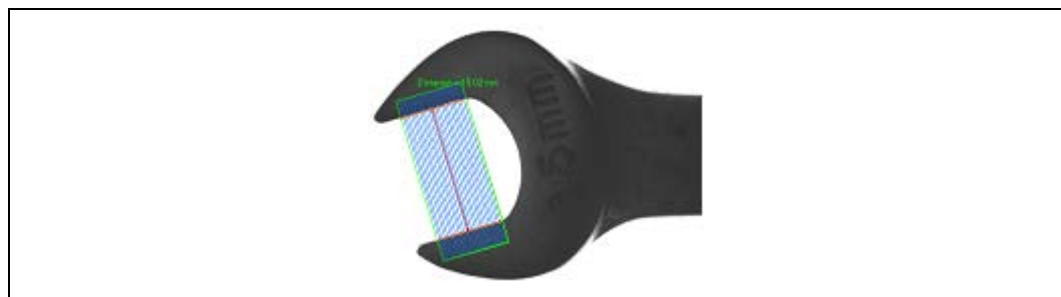
Whether you are a vision novice or an expert vision integrator, NI Vision Assistant helps you create an efficient and reliable vision application in less time.

Algorithm Breadth and Accuracy

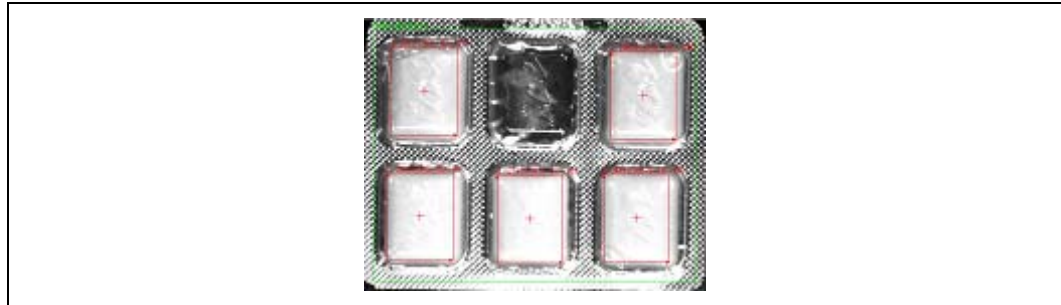
There is much to consider when choosing vision software – most importantly, whether the software tools can correctly and accurately measure important part or object features down to the subpixel. If the software is not accurate and reliable, then it does not matter how fast your computer is or how many pixels your camera has. Keep in mind that it is much easier to make accurate code faster than to make fast code more accurate.

The NI Vision Development Module and Vision Builder AI include hundreds of accurate and reliable vision functions. The five most common machine vision application areas are listed below, along with the most popular algorithms.

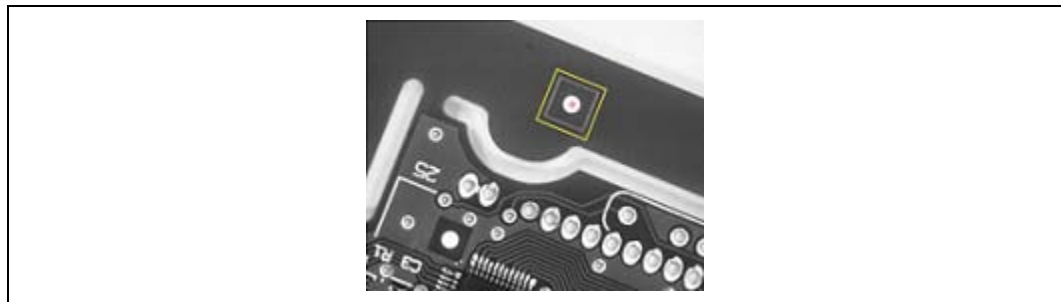
Enhancing an image – Use filtering tools to sharpen edges, remove noise, or extract frequency information. Use image calibration tools to remove nonlinear and perspective errors caused by lens distortion and camera placement. You also can use the image calibration tools to apply real-world units to your measurements, so the tools return values in microns, millimeters, or miles instead of pixels.



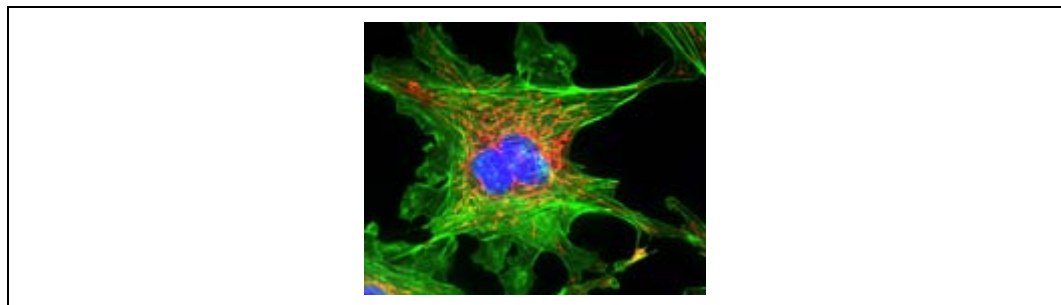
Checking for presence – This is the simplest type of vision inspection. To check for part or feature presence, you can use any of the color, pattern-matching, or histogram tools. A presence check always results in a yes/no or pass/fail.



Locating features – Locating features is important when aligning objects or determining exact object placement, serving as a standard for all subsequent inspections. Edge detection, grey-scale pattern matching, shape matching, geometric matching, and color pattern matching are all tools you can use to locate features. The tools return the object position (X, Y) and rotation angle down to one-tenth of a pixel. Geometric matching is immune to overlapping objects or objects that change in scale.



Measuring features – The most common reason to use a vision system is to take a measurement. Typically, you use edge detection, particle analysis, and geometric function tools to measure distance, diameter, total count, angles, and area. Whether you are calculating the total number of cells under a microscope or the angle between two brake-caliper edges, these tools always return a number instead of a location or pass/fail value.



Identifying parts – Part identification is important for part compliance, tracking, and verification. Straightforward identification methods include reading a barcode or data code such as DataMatrix and PDF 417. Newer methods use trainable OCR or object classification. Part identification often results in text or a string rather than a measurement or a pass/fail determination.



All of the NI Vision Development Module and Vision Builder AI functions take advantage of subpixel accuracy to interpolate locations, distances, and measurements down to one-tenth of a pixel and one-tenth of a degree.

To learn about NI vision algorithm capabilities, how they work, and how best to use them, refer to the *NI Vision Concepts Manual*.

Algorithm Performance

While accuracy and ease of use often are the two most important factors in choosing a vision system, execution speed is a third consideration. No matter how many hundreds of algorithms you have to choose from or how quickly you can build an application with them, if the inspection tools are inefficient and take too long to run, then much of your work goes to waste.

NI vision software is highly optimized to squeeze performance from every possible source, resulting in software that rivals the fastest vision software package speed in the world. In fact, when compared to a leading vision software provider, NI vision software is consistently faster in many categories, as shown in the chart below:

	NI Vision Software Speed (ms)	Leading Vision Software Speed (ms)	NI Speed Increase
Histogram	0.91	2.03	2.2X
Geometric Transform	3.1	10.3	3.3X
Morphology	1.8	5.9	3.3X
OCR	3.3	5.9	1.8X
Geometric Matching	93.0	149.8	1.6X
Object Classification	7.5	—	—

To repeat the NI vision benchmarks, simply request an NI Vision Development Module or Vision Builder AI evaluation copy and run the tools on a few of the images included.

Integration with Other Devices

If you have ever completed a vision application, then you know that vision is often part of a much larger control system. In industrial automation, your vision application may need to control actuators to sort products; communicate inspection results to a robot controller, PLC, or programmable automation controller; save images and data to network servers; or communicate inspection parameters and results to a local or remote user interface.

Often, for scientific imaging applications, you must integrate vision with motion stages, data acquisition systems, microscopes, specialized optics, and advanced triggering.

Because National Instruments is a leading industrial control, data acquisition, and motion control product supplier, NI vision products are designed to work with these and other common components. Whether you need to communicate with a PLC over DeviceNet or a microscope over a serial bus, you can do it with NI vision products.

To learn more about how to integrate vision with data acquisition and motion, read the *Integrating Measurements with Vision and Motion* white paper.

To learn more about communicating with other common industrial devices, visit the industrial communications page at ni.com.

Price

Vision software packages come in many variations. Many cater to OEM customers by splitting up their development libraries and selling algorithms a la carte. While each individual algorithm bundle seems lower in cost, the total vision development package cost is often quite high. Add to that the cost of a license for each component, and application deployment becomes complicated as well as costly.

The NI Vision Development Module comes with all the algorithms you need to solve the toughest vision challenges so you can avoid researching, buying, and maintaining multiple software bundles. Plus, deploying applications is quite inexpensive – with a single vision deployment license, you can deploy an executable that uses any number of vision algorithms. Also, the NI Compact Vision System includes all the licenses you need to deploy applications. So no matter how many Compact Vision Systems you use, you only need to purchase one copy of the NI Vision Development Module, or Vision Builder AI.

Partners and Integrators

National Instruments makes image processing and machine vision hardware and software. Because NI does not make lighting, cameras, and optics, the company works closely with other experts who do. To find a reseller or component provider to help complete your vision system, visit the NI vision product partner page.

Over the last decade, National Instruments vision products have helped solve thousands of diverse and challenging application challenges, from inspecting automotive components to assisting in cancer research. While NI vision tools are designed for end users, larger applications may require expert vision help. To assist in your application development, National Instruments works with more than 600 National Instruments Alliance Partners that can help you select the right components or build you a complete turnkey solution. To find a vision consultant or integrator in your area, refer to the NI vision system integration page.

Technical Support

While NI vision software is designed to be easy to use, it is important to get help when you need it. National Instruments sells vision software directly to its customers, and offers direct product support. A distributor or third party never comes between you and a qualified NI engineer. When you need an expert, you can contact one of hundreds of degreeed applications engineers via phone or e-mail.

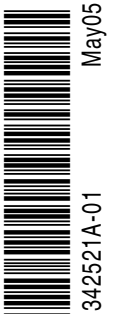
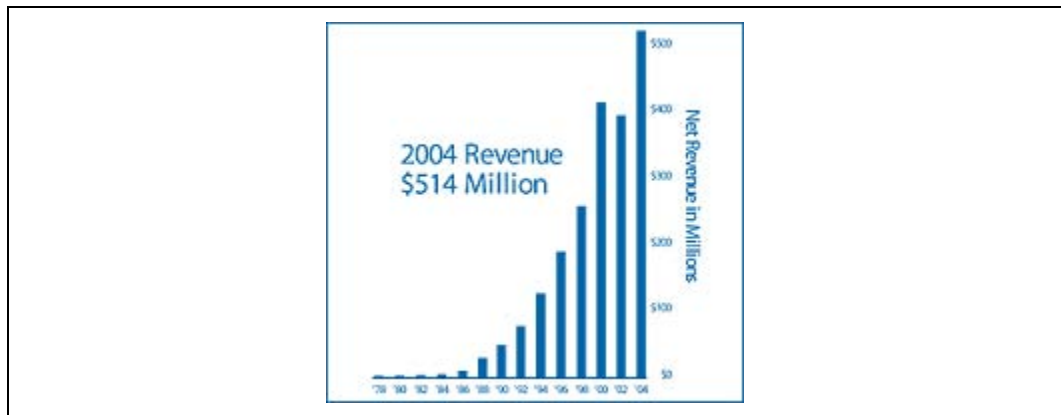
For 24-hour support, visit the award-winning NI technical support Web site or submit your question to the large NI vision discussion forum user community. Chances are, an active member has already tackled your problem or application challenge.



Company Growth and Stability

When you invest in machine vision software, knowing that you can use your software in the future is just as important as getting it running today. There are many small, specialized machine vision companies and, while their tools may work for a current application, when you need to update an inspection station in five years, you want to know that the company and the software is still around and still improving.

For nearly 30 years, National Instruments has maintained growth and profitability. Through heavy R&D investment, NI has established itself as a technical vision software and hardware pioneer. You can rest assured that, in the years to come, NI continues to expand and enhance its commitment to machine vision and image processing.



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