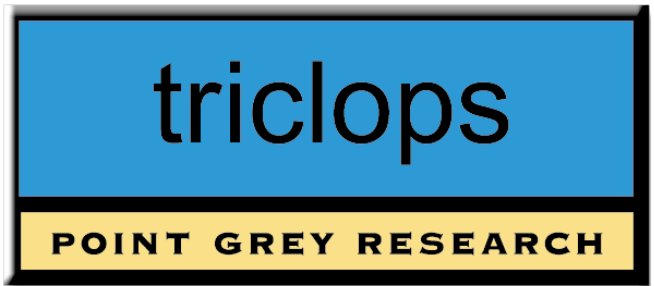


stereo vision software

- ✓ Easy to use
- ✓ Provides continuous sensing
- ✓ Provides a full field-of-view of measurements
- ✓ Fast Intel Pentium MMX-enabled processing
- ✓ Uses sub-pixel stereo for excellent accuracy
- ✓ Designed for use with Digiclops
- ✓ Eliminates lens distortion and misalignment



A key to Point Grey Research stereo vision systems is the high quality of the camera calibration. The calibration achieves an RMS error of about a twentieth of a pixel. This calibration allows the Triclops SDK to correct for lens distortion and camera misalignment to produce three stereo images that fit a perfectly aligned pinhole camera stereo model. This precision makes many 3D computer vision solutions possible.

The Triclops SDK implements subpixel stereo vision matching to increase the accuracy and reliability of range estimates. Triclops subpixel stereo vision obtains stereo matches within 1/200th of a pixel. This subpixel matching improves range accuracy by orders of magnitude.

The Triclops SDK gives users complete control to customize the various parameters of stereo vision to their application. In addition, users can access data at every stage of the stereo vision pipeline. This enables feature-based stereo vision as well as customized correlation stereo vision. The advantage of a color image registered with the range image allows seamless integration of image data for modelling or analysis. These abilities, combined with the powerful correlation stereo engine and the flexible and customizable SDK enable Triclops to form the backbone of any complete 3D computer vision solution.

Triclops has been successfully integrated into a variety of industrial projects including people tracking, gesture recognition, mobile robotics, mining, aerospace, object modeling and object recognition.

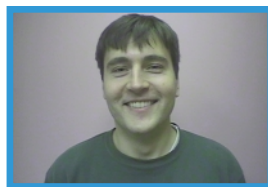
Triclops is a full-featured software development kit (SDK) for 3D computer vision software development. The SDK works with Digiclops™, Point Grey Research's family of digital stereo vision cameras. Using advanced computer vision algorithms, the Triclops SDK extracts range values for every pixel in the image. Triclops delivers full field-of-view range images at speeds up to 30 Hz without sacrificing accuracy through the use of subpixel stereo matching. The result is fast, accurate range images registered pixel-by-pixel with the appearance images suitable for applications such as tracking, gesture recognition, object modeling and object recognition.

The Triclops SDK stereo kernel is designed for high-speed, accurate, 3D processing. The kernel has been optimized for efficient use of high-speed processor cache, as well as the MMX instruction set. This enables exceptional performance speed without compromising on the stereo vision algorithms. The Triclops SDK uses Sum-of-Absolute-Differences Correlation trinocular stereo to compute dense depth images. By using three cameras in an "L" configuration (as in the Digiclops™), stereo processing uses both horizontal and vertical texture information, resulting in a more robust and reliable depth image.

Optimized for 3D Stereo Processing

Triclops Software Development Kit (SDK), provides real-time range images using stereo vision technology. It allows users to accurately measure the distance to every valid pixel in an image. The SDK implements an MMX optimized version of the Sum of Absolute Difference Correlation algorithm providing the user with accurate and fast depth map generation.

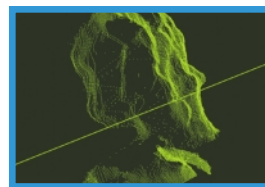
When combined with the Digiclops Stereo Vision Camera System, the Triclops SDK is a complete stereo vision ranging solution.



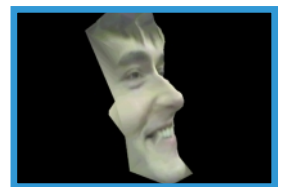
raw image



depth image



3D point cloud visualization



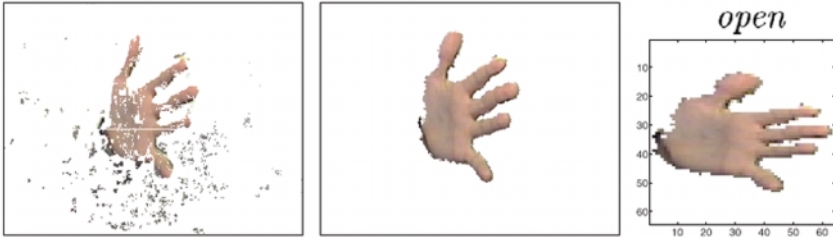
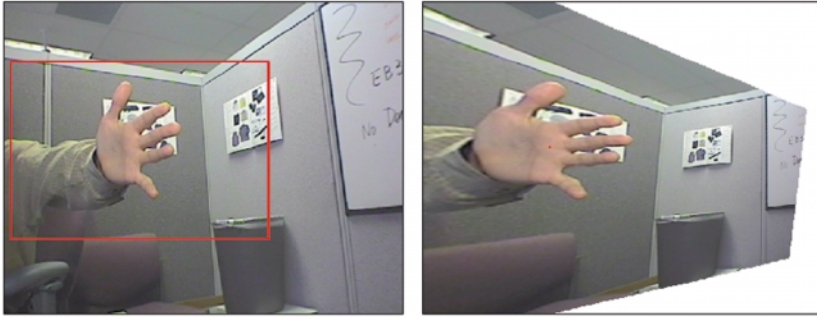
3D surface reconstruction

www.ptgrey.com



Point Grey Research is a product engineering and technology company founded in January 1997. The company designs and develops computer vision technologies for commercial applications worldwide. Point Grey Research technology has been successfully used in people tracking, object tracking, modeling and dimensioning, mobile robotics, mining and many other computer vision applications.

stereo vision software



Property of Intel Corporation

An example of a gesture recognition application: starting at the top left corner, the figure shows an image captured by the stereo camera, perspective unwarping of the hand plane into the frontal view, pixels inside the bounding box classified as foreground by the stereo algorithm, the result of hand segmentation, and the unwarped gesture template together with the recognition result.

triclops

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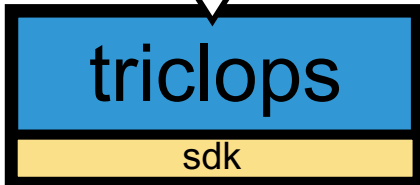
"ideal for research in mobile robotics and computer vision"

Requirements:

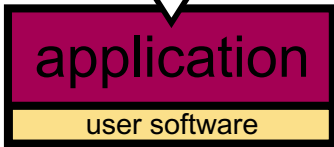
- ✓ **Camera System:**
A Digiclops or Color Digiclops Stereo Vision System.
- ✓ **Processor:**
An Intel Pentium MMX, Pentium II or Pentium III Processor
- ✓ **Operating System:**
Windows98 SE/Windows2000



Images via IEEE1394



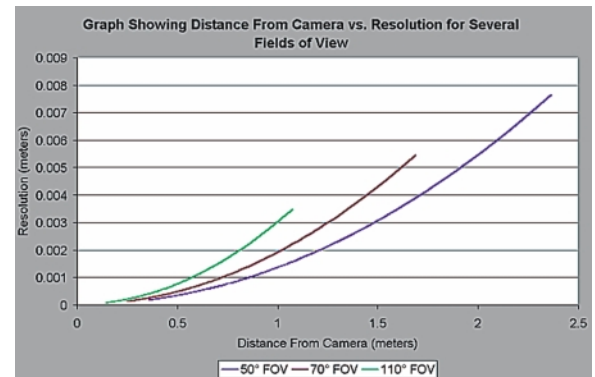
3D information



The table below illustrates the performance of Triclops using a B&W and Color Digiclops on a PIII 450MHz. The disparity range was selected to cover distances from 0.5m to infinity. Timing numbers were obtained using the standard Triclops demo. The number of disparities is directly proportional to speed; if the number of disparities is reduced by 50 per cent, the system will run roughly twice as fast. The speed of processing is independent of the mask size.

resolution	# of disparity	sub-pixel	B & W (Hz)	COLOUR (Hz)
160x120	32	no	16	11.60
	32	yes	14	9.55
320x240	48	no	4.33	3.86
	48	yes	3.10	2.79
640x480	96	no	.62	.54
	96	yes	.47	.46

Resolution: The following graph shows the depth resolution over a variety of operating distances and fields of view given an image resolution of 640x480.



Product relationship diagram:

Point Grey Research products fit into one of 3 categories with specific relationships between them. The Digiclops family of stereo vision cameras provides the fundamental vision sensing. Stereo vision softwaresuch as the Triclops SDK process camera images to obtain 3D information. End-user software for specific applications, such as the Censys3D peopletracking system, are the top level in the Point Grey Research product line.

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