imageWarp Feature Comparison Chart

ACQUISITION FEATURES	ImageWarp	ImageWarp LE
> Capture Devices:		
GigE Vision compliant cameras	✓	✓
USB3 Vision compliant cameras	✓	✓
IIDC 1394 (DCAM) compliant FireWire cameras	✓	✓
CoaXPress cameras and framegrabbers	✓	✓
GenICam (GenTL) compliant cameras and framegrabbers	✓	✓
BitFlow framegrabbers	✓	✓
WDM/DirectShow, VFW, TWAIN devices	✓	✓
> Perform frame averaging and integration while capturing	✓	✓
> Acquire, create, and playback image sequences with user-specified time lapse	✓	✓
> Capture video into AVI files with adjustable compression	✓	✓
> Support for 10-16 bit input devices	✓	✓
> Video format, frame rate and size selection	✓	✓
> Hardware-controlled exposure, gain, brightness, contrast, gamma, saturation, hue, white balance	✓	✓
> Real-time Bayer demosaicing for raw color devices	✓	✓
> Mapping of image memory to DMA buffer for performance boost	✓	
> Acquire images from multiple cameras and boards	✓	
> Trigger and encoder synchronization, exposure, clock and line rate adjustment for digital line scan cameras	✓	✓
> Simulation video-driver for prototyping real-time algorithms prior to buying hardware	✓	✓
> Simulate video input from AVI and TIFF sequences, generate standard patterns, apply several types of noise to a static image, add non-uniform background	✓	✓
> Read and store:		
BMP, GIF, TIFF, JPEG, IWD	✓	✓
PCX, TGA, FITS, STK, DICOM, User-Defined	✓	
> ImageTypes:		
1-bit binary, 8-bit gray, 16-bit gray	✓	✓
32-bit gray, 32-bit floating point, 64-bit complex	✓	
4 and 8-bit palletized	✓	✓
8-bit multiphase	✓	✓
24 and 48-bit color	✓	✓
> Save sequences and animations in GIF, TIFF, AVI and IWD files	✓	✓
> Extended TIFF format for storing high depth images, look-up tables and sequences	✓	✓
> NASA-endorsed FITS format for astronomical and thermal imaging	✓	
> Metamorph STK format for 3D encoding with time and Z-position stamps	✓	
> Proprietary universal IWD format with lossless compression	✓	✓
> Preservation of geometrical and optical scales for:		
IWD	✓	✓
JPEG and TIFF	✓	
> Adjustable compression settings for:		
AVI, JPEG and TIFF	✓	✓

imageWarp Feature Comparison Chart

USER INTERFACE FEATURES	ImageWarp	ImageWarp LE
> Multiple document environment for viewing and manipulating images, data table and charts	✓	✓
> Open Image dialog with thumbnail preview and multiple image selections	✓	✓
> Real-time video window for live acquisition display		
> Up to 100 image frames with superimposed self-adjustable rulers	✓	✓
> Display-range selectors for high-depth images, sequences and live video	✓	✓
> Rendering of a high-depth luminance scale (1024 levels) using proprietary technique	✓	✓
> Correct rendering of images in 256-color display mode	✓	✓
> Built-in set of popular palettes for displaying monochrome images and video in pseudo-color	✓	✓
> Best-fit option to maximize image contrast without modifying pixel values	✓	✓
> Play/stop controls and frame counter for image sequences	✓	✓
> Intermittent and numerical zoom controls	✓	✓
> Context zoom that magnifies the area of interest pointed by the cursor	✓	✓
> Comprehensive functional dialogs with sliding previews	✓	✓
> Palette bar with foreground and background color selection	✓	✓
> Undo/redo stack of user-selected size	✓	✓
> Interactive multi-channel histogram associated with an active image	✓	✓
> Undo/redo stack of user-selected size	✓	✓
> Interactive multi-channel line profile with an extensive selection of shapes (vertical, horizontal, line, rectangle, ellipse, freehand)	✓	✓
> Digital Editor for viewing and editing the numeric content of an active image	✓	✓
> Script Editor for automatic and manual scripting, debugging, storing, and executing imaging algorithms	✓	✓
> Live update of interface elements (images, tables, charts and previews) while running real-time scripts	✓	✓
> Information box for viewing and changing general image parameters	✓	✓
> Print dialog with image position and size adjustment and integrated preview	✓	✓
> Context-sensitive help: position the cursor over any interface element and press F1	✓	✓

GRAPHICAL EDITING FEATURES	ImageWarp	ImageWarp LE
> Rectangular, elliptical and freehand selections (ROI)	✓	✓
> Running marquee for outlining current selection	✓	✓
> Multiple selections automatically combined into one irregular ROI	✓	
> Add negative selections to set up an ROI with holes	✓	
> Use Magic Wand to select a connected area of similar pixels	✓	✓
> Create and manipulate animated selections on animated images	✓	✓
> Copy image or selection into Windows clipboard	✓	✓
> Paste image from clipboard as a new image or as a selection into an existing image (supports all image formats including the high-depth ones)	✓	✓
> Move selection over a current image or from one image onto another	✓	✓
> Move images from or into another program by using a drag-and-drop operation	✓	✓
> Extensive set of drawing tools for direct application to all* supported types of images:		
Color picker, Pencil, Brush, Flood, Clone, Eraser, Stamp, Line, Rectangle, Ellipse, Text and Warp	✓	✓
> Adjustable pen width	✓	✓
> Adjustable size, transparency, hardness, and spacing for brush family tools	✓	✓
> Constrain and straight line options for drawing tools	✓	✓
> Automatic image scrolling when a drawing tool touches the edge of the frame	✓	✓
> RGB/HLS interactive color editor for foreground and background color selection	✓	✓
> Comprehensive palette editor that allows the modification of indexed color palettes and changes to the appearance of 8-bit and 16-bit monochrome images by assigning colors to luminance values	✓	
> Automatic and interactive palette rotation	✓	
> Gray scale maps (look-up tables) for 8-bit and 16-bit monochrome images	✓	✓
> Edit image sequences by cutting off or inserting series of frames	✓	✓

Feature Comparison Chart

PROCESSING FEATURES	ImageWarp	ImageWarp LE
> Intel SSE2/SIMD technology utilized for performance boost	✓	✓
> Multithreading engine allows for performing up to16 parallel operations simultaneously	✓	✓
> Automatic parallelization distributes imaging functions among several cores on multiprocessor systems	✓	
> Distributed processing on several computers through Gigabit Ethernet	✓	✓
> Progress meters on the status bar (up to four in multiprocessing mode) for following the execution progress of each function, execution time of the last called function displayed for benchmarking and prototyping	✓	✓
> Hidden images for buffering intermediate results in scripts	✓	✓
> All operations performed on the current image selection	✓	✓
> Selectable coordinate system for processing color images (RGB, HLS, HSV, L-vector)	✓	
> Selectable overscan (invisible borders around the images) for speed-boost	✓	✓
> High-depth image support in all processing functions	✓	✓
> Processing applied to an entire sequence or current frame only	✓	✓

CONVERSION FEATURES	ImageWarp	ImageWarp LE
> Conversions between all types of supported image formats	✓	✓
> Select the output luminance range when converting into high-depth types	✓	✓
> Three modes of color reduction when converting into palletized types	✓	✓
> Extract or merge color channels:		
RGB and HLS	✓	✓
HIS, RCH, YIQ and Lab	✓	
> Convert a color filter array image into an RGB image (Bayer)	✓	
> Extract or merge component images from or to a complex image (Re, Im, Amp, Phase)	✓	

GEOMETRIC, ARITHMETIC AND LOGIC FEATURES	ImageWarp	ImageWarp LE
> Interactive or automatic resizing with selectable bilinear smoothing	✓	✓
> Translate, Rotate, Flip, Reflect and Warp spatial operations	✓	✓
> Affine and projective image transformation	✓	
> Conversion between Cartesian and Polar coordinate planes	✓	
> Arithmetic operations: Invert, Offset, Factor, Average, Add, Subtract, Multiply, Divide	✓	✓
> Automatic application of component operations to complex images	✓	
> Logical operations:		
Not, And, Or, Xor and Mask	✓	✓
Nor, Nand, Xnor, Swap, L-Shift and R-Shift	✓	
> And function that identifies overlapping features on two images	✓	
> Image Stitching	✓	

INTERACTIVE ADJUSTMENT AND SEGMENTATION FEATURES	ImageWarp	ImageWarp LE
> Real-time full screen preview during the adjustments	✓	✓
> Brightness/Contrast/Gamma adjustment in RGB and HLS space	✓	✓
> Hue/Saturation, Levels, Color balance correction	✓	✓
> Interactive binary and multiphase thresholding with sampling feature	✓	✓
> Color multiphase thresholding in RGB and HLS space	✓	✓
> Several methods of automatic thresholding based on histogram analysis	✓	
> Adaptive segmentation based on local distribution analysis	✓	

Feature Comparison Chart

FILTER FEATURES	ImageWarp	ImageWarp LE
> Emphasize contours with adjustable boost	✓	✓
> Sharpen and unsharpen masks	✓	✓
> Uniform, logarithmic, exponent, and bell equalization	✓	✓
> Brightness normalization with selectable strength	✓	✓
> Dark and white field background correction	✓	✓
> Several methods of background elimination	✓	
> Noise Suppression operators with adjustable window and strength:		
Lowpass, Median, Gauss and Sigma	✓	✓
Salt & Pepper	✓	
> Remove motion artifacts with Deinterlace function	✓	
> Edge detection operators:		
Sobel, Prewitt and Laplace	✓	✓
Roberts, Range and Variance	✓	
HighPass	✓	✓
Gradient	✓	
> Find direction of edges using the Phase mode	✓	✓
> Create graphic effects using Emboss, Pixelate, Floyd, and other miscellaneous filters	✓	✓
> Customized convolution with user-defined kernel images	✓	

FOURIER TRANSFORM FEATURES	ImageWarp	ImageWarp LE
> Perform discrete and fast transform in both directions	✓	
> Create a complex image as a spectral result of direct transform	✓	
> Switch between real, imaginary, amplitude and phase components of the spectrum	✓	
> Use graphical editing to modify the spectrum in a complex image	✓	
> Perform Fourier-based convolution and de-convolution with a user-defined kernel image	✓	

MORPHOLOGY FEATURES	ImageWarp	ImageWarp LE
> Basic set operators:		
Erosion, Dilation, Opening, Closing	✓	✓
Tophat and Contours	✓	
> Interation-independent high-speed algorithms for binary morphology	✓	✓
> Multiphase-aware algorithms keep objects of different class from merging	✓	✓
> Proprietary high-speed thinning, thickening and pruning	✓	
> Fast convex hall in the multiphase space	✓	
> Grayscale morphology with full support of 16-bit, 32-bit and floating point images	✓	✓
> Proprietary color morphology	✓	✓
> Proprietary color morphology with selectable color space	✓	
> Binary, gray and color operations with user-defined kernels	✓	
> Extensive set of geodesy functions:		
Distance map, Direction Map, Local Min and Local Max	✓	✓
Ultimate erosion	✓	
Medial axis transform	✓	
End, Node and Saddle points	✓	
> Several metrics for distance transform including Euclidian	✓	✓
> Accurate separation of touching convex objects	✓	
> Multiphase connectivity algorithms:		
Labeling, Filling holes, Border kill and Scrap cleaning	✓	✓
> Watershed operator extracts ridges and basins in the intensity relief	✓	
> Link operator for connecting broken lines	✓	
> Hit and miss transform for binary template search	✓	

SIGNAL/PATTERN GENERATION FEATURES	ImageWarp	ImageWarp LE
> Built-in set of standard signal and pattern generators for prototyping and testing:		
Random noise with user-defined amplitude	✓	
Non-uniform light from point and line sources	✓	
Gray and color wedges	✓	
Gray and color grids	✓	
Sine wave of arbitrary amplitude, frequency, phase and orientation	✓	

CALIBRATION FEATURES	ImageWarp	ImageWarp LE
> Spatial calibration:		
Interactive	✓	✓
Automatic	✓	
> Interactive choice of the coordinate system origin and Y-axis direction	✓	✓
> View image dimensions in calibrated units on superimposed rulers	✓	✓
> Set up default spatial scale for video capture device	✓	✓
> Optical calibration with Lagrange and polynomial approximation	✓	
> Name, store and load calibration scales	✓	✓
> Store calibration data along with images:		
IWD	✓	✓
JPEG and TIFF	✓	

MEASUREMENT FEATURES	ImageWarp	ImageWarp LE
> Select from numerous parameters using comprehensible graphic representation:		
Object count, class, pixel count, equivalent diameter	✓	✓
Area, outline area, reference area	✓	✓
Phase area, box area, convex area	✓	
Perimeter, circular perimeter, elliptical perimeter	✓	✓
Convex perimeter	✓	
Best-fit radius	✓	
Circularity, ellipticity, rectangularity, convexity, roughness, aspect ratio	✓	✓
Starting and ending position, bounding box, box ratio, angle	✓	✓
Feret diameters (maximum, minimum, average), Feret angles, Feret ratio	✓	✓
Radii (maximum, minimum, average), radial angles, radial ratio	✓	
Diameters (maximum, minimum, average), diametric angles, elongation	✓	
Centroid, major and minor axes and angles	✓	✓
Center of gray	✓	
Raw and normalized binary moments, skewness and asymmetry	✓	
Chord length, vertical and horizontal intercept, anisotropy	✓	
Gray level, standard deviation	✓	✓
Transmission, optical density, roughness	✓	
Red, green and blue average levels and standard deviations	✓	
Number of holes, area of holes, perforation	✓	
> Parameter arrays of variable size:		
Histogram	✓	
Contour	✓	
Convex hull	✓	
Curvature	✓	
Radii	✓	
Diameters (maximum, minimum, average), diametric angles, elongation	✓	
> User-defined parameters programmed into scripting language syntax	✓	
> Manual count and classification	✓	✓
> Point, line, angle and area morphometry	✓	✓
> Multiphase field stereology	✓	
> Densitometry and position analysis	✓	
> Interactive object tracking by mouse or digitizer	✓	✓
> Automatic and interactive blob measurements	✓	✓
> Adjustable measurement settings: border processing, scanning precision, pixel connectivity	✓	✓
> Accumulation of results in interactive grids; clicking a line causes a correspondent in the image to blink	✓	✓
> Selection or removal of objects by using specified parameter limits	✓	
> Classification of objects by a specified parameter	✓	
> Interactive line profile	✓	✓
> 1D and 2D barcode recognition:	✓	
UPC-A, UPC-E, EAN-8	✓	
Code 128, Code 39, Interleaved 2/5	✓	
QR Code, DataMatrix, PDF417	✓	

ANALYSIS FEATURES	ImageWarp	ImageWarp LE
> Load, view and edit measurement data in multilevel tables and spreadsheets:		
Select from three data formats: fixed, scientific and general		✓
Choose between full list and selected class of objects	✓	✓
Calculate additional parameters using the built-in set of more than 200 spreadsheet functions including: Mathematical, Statistical, String, Logic, Date and Time and Miscellaneous	✓	
Switch to Statistics mode to view full statistic report for each parameter	✓	
Export data into text, HTML, dBase and MS Access format	✓	
Run-time DDE export to MS Excel	✓	✓
Switch to Graph mode to visualize the data in a form of multi-channel histogram, scattergram, line profile, pie and 3D plot	✓	
> High-performance global data grids:		
Display instantaneous measurement results in real time	✓	✓
Double-click a cell with a parameter array and it's elements are reported in a pop-up grid	✓	
Interactively connect grid cells to script variable	✓	
Open data charts linked to desired measurement parameters	✓	
> Analyze and edit the pixel values of an active in the interactive Digital Editor:		
Observe and edit pixel values separated into channels and formatted with regard to the type of an active image	✓	✓
Select between calibrated and raw pixel values	✓	
Scroll the pixel table to a new location and watch the marker on the image move accordingly	✓	✓
Drag the marker on the image to a new location and watch the table scroll accordingly (in development)	✓	✓
Change the active image selection using the Selection Tool, watch an instant change of values in Digital Editor	✓	✓
Apply any image processing function and watch an instant digital result	✓	✓
Click a table cell and use an emerged spin control to gradually change pixel values	✓	✓
Select a group of pixels on a table and fill it with a background color	✓	✓
Observe pixel values changing in real-time for live images and sequences	✓	✓
> Plot an intensity profile with the Line Profile tool:		
Choose among several profile shapes: vertical, horizontal, line, rectangle, ellipse, freehand	✓	✓
Switch between different channels of color images (R, G, B, H, L, S, Y, I, Q)	✓	✓
Select a desired intensity range for profile analysis	✓	✓
Switch between Table and Graph modes	✓	✓
View statistics collected along the profile line	✓	✓
Drag a profile line over the image and watch a synchronous update of the graph	✓	✓
Profile animation for live images and sequences	✓	✓
> Display comprehensive Excel-style data charts:		
Link a chart to a desired data table or global grid	✓	
Choose measurement parameters and channels for data series	✓	
Display the distribution of an object's population in the form of bar or line histograms	✓	
Select between regular, cumulative and weighed histogram with Gaussian curve overlay	✓	
Display the distribution of a parameter on a pie diagram	✓	
Analyze the correlation between two measurements using a scattergram with a polynomial fit	✓	
Plot several measurements against each other on a 3D multi-histogram	✓	
Adjust the appearance of titles, axes, tick marks and background	✓	
Live chart updates linked to real-time data	✓	

PROGRAMMING FEATURES	ImageWarp	ImageWarp LE
> Built-in high-level scripting language with parallel processing engine:		
Popular Visual Basic syntax	✓	✓
Automatic compilation for higher performance	✓	✓
Integer, floating point and string variables	✓	✓
Support of objects with dynamic memory allocation	✓	✓
Predefined frequently used constants	✓	✓
Nested arithmetic and logical expressions	✓	✓
IF/THEN/ELSE/END IF and GOTO branch operators	✓	✓
Cycle operators (FOR/TO/STEP/NEXT, WHILE/WEND, DO/LOOP)	✓	✓
Nested subroutines and functions (SUB/END SUB, FUNCTION/END FUNCTION)	✓	✓
THREAD operator for parallel processing	✓	
Terminal window for rapid data input/output (INPUT, PRINT)	✓	✓
Dialog window for interactive input/output (DIALOG)	✓	✓
Direct access to ImageWarp's global data tables for real-time data management	✓	✓
Set of serial communication commands (COM and Camera Link ports)	✓	✓
> Comprehensive Script Editor with command line support:		
Use Record button to log all the interface commands into the script	✓	✓
Use Play button to playback the recorded session	✓	✓
Use Step, Step Into and Step Over buttons to perform step-by-step execution	✓	✓
Insert breakpoints for halting the execution of the script at desired lines	✓	✓
Debug your script using variable watch and error window	✓	✓
Change the execution point by double-clicking on the desired line	✓	✓
Insert new operators and functions into the script by manual editing	✓	✓
Use keyword highlighting and popup tips for help on syntax	✓	✓
Enter a single command in the command line box and execute it outside the script	✓	✓
Save the current script and reload it later	✓	✓
> Dynamic Data Exchange (DDE)		
Take advantage of ImageWarp's functionality inside your own application	✓	✓
Have full control of ImageWarp by executing prerecorded scripts or issuing run-time image processing	✓	✓
Exchange images between your application and ImageWarp via Clipboard	✓	✓
Establish a hot link with ImageWarp and have it notify your application when an important event occurs	✓	✓
Retrieve the results of image analysis and process them further with your own algorithms	✓	✓
Run ImageWarp in an invisible mode providing a user interface through your application	✓	✓
> Automation (COM)		
Integrate ImageWarp into your application by using it as a COM-server	✓	
Access hundreds of ImageWarp functions through the set of COM-methods and properties	✓	
Exchange data and images between ImageWarp and your application in real time	✓	
Synchronize your application and ImageWarp with a set of COM-events	✓	
Run ImageWarp in an invisible mode and provide a user with your own GUI	✓	
> Send us your sample images and application requirements and we will create a demonstration script	✓	✓
> Customization services and interfacing to video devices available upon request	✓	✓