



DpuScan

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DpuScan 6.x

Reference Manual

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Actuality

It may happen that a more recent version of this manual for DpuScan is available for download from the Internet. Therefore, it is recommended that you should compare the version by means of the date printed on this page with the version on the Internet. You should please use the most up-to-date version of the manual. The actual version of this First Steps Manual is found on the Web at the following address:

https://www.dpuscan.com/pdf/en_manual/DpuScan-Reference-Manual.pdf

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1 Deskew Parameter Setup

The parameter get defined separately for **bitonal**, **gray** and **color** images.

The setup is split into these steps:

- Parameter for detecting borders and calculating the destination rectangle, including manipulations to the rectangle and rectangle size checking.
- Image processing parameters based on the rectangle.
- Additional image manipulation settings.

Please note: if step 1 (rectangle detection or size checking) fails on runtime, none of the defined image proressings are done to the image!

Find Rectangle Parameter

Detection Mode	<p>Brightness (Black&White only) Skip black pixel (the background), find white pixel (the document).</p> <p>Brightness (manually) (Gray or Color only) Skip dark pixel (the background), find bright pixel (the document); define the background color level by parameter <i>Threshold</i>.</p> <p>Brightness (auto) (Gray or Color only) Skip dark pixel (the background), find bright pixel (the document); the background color level is decided by the rectangle processor, independently for every image.</p> <p>Color Sensitive (manually) (Color only) Skip pixel near the defined <i>Background Color</i>, find pixel color outside the defined <i>Tolerance</i> (the document).</p> <p>Color Sensitive (auto) (Color only) Same as above, but <i>Background Color</i> and <i>Tolerance</i> are decided by the rectangle processor, independently for every image.</p>
Background Color (Color only)	<p>Default: Black</p> <p>Defines the scanners background color within the 24 bit color space. For non-standard colors format: 0xrrggbb is used (with rr (red), gg (green), bb (blue) in range of [00..FF]).</p>
Threshold (Gray or Color only)	<p>Range [0..255], Default: 20</p> <p>Threshold for searching the borders. A border point is found, if a stream of more than <i>Min Color Pixel</i> (see dialog "more...") points are brighter than <i>Threshold</i> value.</p>
Tolerance (Color only)	<p>Range [0..255], Default: 20</p> <p>Similar to threshold: while threshold gives a value based on color "Black", gives <i>Tolerance</i> a color space arround defined <i>Background Color</i>.</p>
Required Borders	<p>Range [1..4], Default: 2</p> <p>The detector needs to find [1..4] borders to accept the destination rectangle.</p>
more ...	<p>The button opens the dialog "<i>More Settings</i>". (These special settings should be changed by experts only.)</p>
Modify Rectangle Size	<p>Check, if the detected rectangle should be manipulated. Use button "<i>Modify settings ...</i>" to setup manipulation parameters.</p>

Check Rectangle Size Check, if the rectangle size should be inspected.
Use button "*Check settings ...*" to setup inspection parameters.

Process Parameter

Process Selector Default: Deskew
Cropping: The corner points of the rectangle are used to cut off the image frame. Normally, this process reduces the image size in a short processing time.
Deskew: The rectangle is cut out of the image and turned into the nearest perpendicular position. This replaces the original image.

Mode Range [Fast / 1 Point (Default for Black&White), 1 Point, 2 Point (Default for Gray and Color), 4 Point, Bicubic (16 Point)]
When turning the image, most destination points don't have a corresponding source point. Example: The new image point at [line 9 column 15] is calculated to get from [line 47.35 column 34.86].
There are different processors to calculate the destination points. Use parameter *Mode* to select the processor you like:
Fast / 1 Point (Black&White only): If skew angle is less than ± 7 degrees, a special, very fast processor is used. If the skew angle is larger, 1 Point processor is used automatically.
1 Point: Processor just takes the nearest original point (in given example, it would be [line 47 column 35]. Advantage: fast processor; disadvantage: clean outlines may become rough.
2 Point: The destination point is calculated as the mean value of the two nearest original points.
4 Point: The destination point is calculated as the mean value of the four nearest original points. This processor produces smooth outlines best, but is not so fast and the resulting image may lose sharpness.
Bicubic (16 Point) (Gray or Color only): This is an enhanced method with a special border smoothing.

Fill Color Range [Black, White, 0x...], Default: Black
Areas of the destination rectangle outside the scanned image (typically corner areas, because scan area was smaller than the skewed document), have to be created by the deskew process. These areas will be filled by the chosen color.
Aside from standard colors **Black** and **White**, experts are free to enter any color of the available color space: 0xpp on gray, 0xrrggbb on color images (with pp, rr, gg, bb in range of [00..FF]).
Note: If Windows color selection dialog is used to select a color for gray images, the corresponding gray level will be used.

Fill Border If checked, the background color will be replaced by the given *Border Color*, starting from the image borders, till non-background color is detected. This process is controlled by parameters in "*Fill settings ...*" dialog.

Border Color Range [Black, White, 0x..., Image Color *], Default: Black
Define the color that replaces background color near the image borders.
Aside from standard colors **Black** and **White**, experts are free to enter any color of the available color space: 0xpp on gray, 0xrrggbb on color images (with pp, rr, gg, bb in range of [00..FF]).
If **Image Color *** is used, the processor steps through background color inside the image, takes a color near this point, and fills up the background area using this color. It should not be used to fill large areas!

Additional Features

Adjust Image Size	If checked, the resulting image can be adjusted in size. Enter " <i>Adjust settings ...</i> " dialog to setup size values.
Frame Color	<p>Range [Black, White, 0x..., Image Color *], Default: Black</p> <p>Define the color of added image areas (frame).</p> <p>Aside from standard colors Black and White, experts are free to enter any color of the available color space: 0xpp on gray, 0xrrggbb on color images (with pp, rr, gg, bb in range of [00..FF]).</p> <p>If Image Color * is used, the processor steps through background color inside the image, takes a color near this point, and fills up the background area using this color. It should not be used to fill large areas!</p>

Global

Default	Set all parameter back to default values.
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1.1 Deskew - Find Rectangle - More Settings**Expert Settings**

These special parameters controlling the rectangle detector should be changed by experts only!

Min Border Pixel	<p>Range [0..255], Default: 5</p> <p>The border detector starts <i>Min Border Pix</i> points away from the page border. This is to minimize the influence of noise at the scan area margins. Decrease this value, if the images have extremely narrow page borders.</p>
Min Color Pixel	<p>Range [1..16], Default: 4</p> <p>Number of points which must exceed, at a stretch, the <i>Threshold</i> value (or must be white in bitonal images) to detect a border point. Increase this value if the image background is noisy.</p>
Gradient Error	<p>Range [1..20], Default: 2</p> <p>By definition, all 4 rectangle borders are right-angled. The rectangle detector compares all normalized gradients of the found borders, and finally processes only those borders, which normalized gradient is less than the given <i>Gradient Error</i> value.</p> <p>Increase this value if the papers are not exactly right-angled or if one or more border(s) are not straight (which disallows calculation of a fix gradient).</p>
Max Error	<p>Range [1..99], Default: 3</p> <p>The optimal image border line will be created by a linear regression of the detected border points. This regression line will be accepted if all point distances to this line is smaller than <i>Max Error</i>. Otherwise, the worst point is removed from detection list and regression process is restarted.</p> <p>Increase this value if the image borders are not straight lines.</p>
Defect Factor	<p>Range [1..99], Default: 4</p> <p>If the destination rectangle holds dark areas near the border, the border detector will identify a border point inside the rectangle (that is the areas</p>

end). To prefer removal of these inner points, their distance to the regression line is weight by *Defect Factor*. Increase this value if the images have dark areas near the border and the process cuts too much.

Deskew Parameter Setup

1.2 Deskew - Adjust Image Size

Resize Image to	Check to size-up the image to a specified format.
Original Image Size	Select to bring the image back to the size it had before deskewing/cropping.
Format	Select to bring the image to the specified absolute format. From selection list, choose a standard format, or choose " <i>Custom Size</i> " and enter image dimensions (unit [Pixel, mm, Inch]).
Landscape	Check to select landscape size of a standard format.
Resize Mode	Choose, how to bring the deskewed/cropped image to the selected size. Add Frame: Borders are added around the image; or, in other words, the image is placed into a cleared image of the selected size. See position parameters below. Scale Image: The image is scaled into the selected format. To prevent from undesirable distortion it's recommended to enable " <i>Skip Resizing, if Size Relation exceeds ...</i> " (see below).
Image Position	Available if resize mode " <i>Add Frame</i> " is chosen.
<i>Horizontal</i>	Range [Left, Horiz. Centered, Right] default: Horiz. Centered Choose, on what horizontal position inside the new size the deskewed/cropped image should be placed.
<i>Vertical</i>	Range [Top, Vert. Centered, Bottom] default: Vert. Centered Choose, on what vertical position inside the new size the deskewed/cropped image should be placed.
Skip Resizing, if Size Relation exceeds ... %	If checked, the resize process is canceled if size relation exceeds the given value. It's urgently recommended to enable this inspection with resize mode " <i>Scale Image</i> ".
Add Borders	Check to add one or more fix-sized borders to the image.
Left	Size of border to add to the left side of the image.
unit2all	Click this button to set units for <i>Right</i> , <i>Top</i> and <i>Bottom</i> value to the unit selected for <i>Left</i> value.
Right	Size of border to add to the right side of the image.
Top	Size of border to add to the upper side of the image.
Bottom	Size of border to add to the lower side of the image.

Unit Range: [Pixel, mm, Inch]
 Note: mm and Inch values are independent from changes in resolution.

Mirror horizontal values on backside images
 Check to exchange *Left* and *Right* value when processing back sides.

Deskew Parameter Setup

1.3 Deskew - Check Rectangle Size

Use this option to protect your images from merciless cutting. If one or more of the following checked rules becomes TRUE, the process will be canceled without changing the image.

No Deskew/Cropping, if ...

Ratio becomes smaller than $xxx : 100$
 Lower limit for side ratio.
 The ratio is calculated as: $large\ side / small\ side$.
 Here are some ratio values of standard paper formats:
 All A-Formats: 141 : 100
 Letter: 129 : 100
 Double Letter: 156 : 100
 Legal: 165 : 100

Ratio becomes larger than $xxxx : 100$
 Upper limit for side ratio.
 See lower limit description above.

Width or Length becomes smaller than $xxxx\ %$
 Border relation limit.

Width becomes smaller than
 Absolute lower horizontal limit.

Width becomes larger than
 Absolute upper horizontal limit.

Length becomes shorter than
 Absolute lower vertical limit.

Length becomes larger than
 Absolute upper vertical limit.

Unit Range: [Pixel, mm, Inch]
 Note: mm and Inch values are independent from changes in resolution.

Deskew Parameter Setup

1.4 Deskew - Fill Border

The "Fill Border" processor detects background color, starting from the image borders. The detected areas are filled with chosen *Border Color*.

Filling Limit

Use limit parameters to prevent the images from running the processor too much inside the document. By default, all are unchecked; that is: unlimited processing.

Left	Left border processing limit.
unit2all	Click this button to set units for <i>Right</i> , <i>Top</i> and <i>Bottom</i> value to the unit selected for <i>Left</i> value.
Right	Right border processing limit.
Top	Upper border processing limit.
Bottom	Lower border processing limit.
<i>Unit</i>	Range: [Pixel, mm, Inch] Note: mm and Inch values are independent from changes in resolution.

Mirror horizontal values on backside images

Check to exchange *Left* and *Right* value when processing back sides.

Expert Settings

Min Corner Pixel	Range [0..32], Default: 8 For filling it's important to identify the document corners carefully, because fillings from two directions will meet there. Enter the number of pixels that must surpass the threshold subsequently so that a document corner can be supposed. Higher values will better filter out interferences from the background.
Go Inside	Range [0..32], default = 5 After deskewing, the pixel color very close to the image border often do neither belong to the background color, nor match the color of the document. Taking this into account, the detection algorithm will start the given pixels inside the image.

Deskew Parameter Setup

1.5 Deskew - Modify Rectangle Size

The borders of the detected rectangle can be moved manually by the following settings. A positive value moves the corresponding border out (enlarge rectangle), a negative value moves it in (cut more). Use values in absolute measurement (mm or Inch) to be independent from changes in resolution.

Left, Right, Top, Bottom	Default: 0 Value to move the corresponding border.
<i>Unit</i>	Range: [Pixel, mm, Inch] Note: mm and Inch values are independent from changes in resolution.
unit2all	Click this button to set units for <i>Right</i> , <i>Top</i> and <i>Bottom</i> value to the unit selected for <i>Left</i> value.

Mirror horizontal values on backside images

Check to exchange *Left* and *Right* value when processing back sides.

Deskew Parameter Setup

1.6 Deskew - Doubleside Processing Setup

The doubleside deskew processor increases deskew quality when scanning both sides: Front and back side images of one scan show the same document (the rectangle to found) with the same size and the same skew. So it's save to detect the rectangle on any image, and to process process deskew on all images by these result.

Sometimes it's difficult to detect one (or more) borders of the rectangle, because the background color is used in large parts of the original document near the border(s). The best solution is, to detect both side rectangles, align the results and use them to de-skew.

Front/Back Side Rectangle

Define independently for each side, where to detect the rectangle:

- Search Front Side
- Search Back Side
- Search Both Sides, take Best Result (default)

Offset

If there is a static difference in front and back side document position in scanned images (because scanners front and back side camera are not mounted at the same position), this can be corrected by offset setting.

It's recommendet to make settings in absolute measurement (mm or Inch) for to be independent from choosen resolution.

Horizontal Enter a positive value to move the back side to the left (if using front side rectangle to deskew back side).

Vertical Enter a positive value to move the back side upwards (if using front side rectangle to deskew back side).

Tolerance

It may happen when aligning both side detection results, that the rectangles differ a little in size or skew angle. The result is accepted anyway, if the differences are in the given tolerance.

Size Range [0..10.0%], default: 2.0%

Angle Range [0..10.00°], default: 0.50°

2 Select Scanner

Use this dialog to manage scanner / driver selection and deselection.

Please note: in fact, by this dialog a *driver* gets selected, not really a *scanner*. In mode "Select by Scanner" a large list of supported scanners is listed, but this is only done to make it easy to find a suitable driver.

To facilitate selection, in mode "Select by Scanner" the dialog tries to identify scanners connected to the PC, and marks this in column "State". But, the dialogs procedure is not able to detect all possible connections. So it may happen, that correctly connected scanners are not marked here.

Select by Scanner / Driver	<p>Choose, how to display the list of available scanner drivers.</p> <p>by Scanner: the table shows all known scanner models and the matching driver.</p> <p>by Driver: the table shows all available drivers (including drivers version number).</p>
Selection Table	<p>Mark the Scanner / Driver which you want to select (or deselect).</p> <p>To sort the table, click one of the column title bars.</p>
Deselect	<p>Click button to deselect the marked Scanner / Driver.</p> <p>Available only, if a selected Scanner / Driver is marked.</p> <p>If deselection is processed error-free, the "Select Scanner" dialog is closed afterwards.</p>
Select	<p>Click button to select the marked Scanner / Driver.</p> <p>If an other Scanner / Driver is already selected, it will be deselected first.</p> <p>If selection is processed error-free, the "Select Scanner" dialog is closed afterwards.</p>

3 JPEG2000 Wavelet Compression Parameter Setup

Parameters for JPEG2000 Wavelet Compression

Compression Mode	select of: Lossless Quality (Default) Compression Data Size
Quality	Range [1..100], Default: 60% T.
Compression	Range [1..1000], Default: 15 : 1 S!
Data Size	Default: 100 KB (gray); 300 KB (color) Dt.
Codestream Sorted by	Dt. Quality (Default) xxxx Resolution xxx Position xxxx Color xxxx
Optimize	Used during lossy compression. The following modes are defined: Speed (Default) High speed compression, but may create images with a lower quality. Quality Optimal quality, but slower compression.
General	This selector defines what DPU does when JPEG2000 compressed image data is needed, but JPEG2000 compressed image data is already available, generated by an other compressor or compressed by other parameter. If Use original wavelet compressed data, if available (Default) is selected, the original JPEG2000 data is used, regardless of the given JPEG2000 compression parameter. If Always compress with these parameters is selected, the original JPEG data is dropped, and a new JPEG2000 wavelet compression is done using the given compression parameter.
Preview	Show an image to demonstrate current compression parameters result.
Default	Set all parameter back to default values.

4 JPEG Compression Parameter Setup

JPEG is a standardized image compression mechanism. JPEG stands for "Joint Photographic Experts Group", the original name of the committee that defined the standard. JPEG is designed for compressing either full-color or gray-scale images.

JPEG is "lossy", meaning that the decompressed image is not the exact original image, but JPEG achieves much greater compression than is possible with lossless methods. JPEG is designed to exploit known limitations of the human eye, notably the fact that small color changes are perceived less accurately than small changes in brightness. Thus, JPEG is intended for compressing images that will be looked at by humans. For later machine-analysis of decompressed images, the small errors produced by JPEG compression may be a problem.

A useful property of JPEG is that the degree of loss can be varied by adjusting compression parameters. This means that the image maker can trade off file size against output image quality. It is possible to make extremely small files but with poor image quality; this is useful for applications such as indexing image archives. Conversely, if you are not happy with the output quality at the default compression setting, you can jack up the quality until you are satisfied, and accept lesser compression.

JPEG compression can be used in different file formats. The most popular format is the JPEG File Interchange Format (JFIF), known as .JPG files. Also, JPEG compression can be used in Portable Document Format (.PDF) or in Tagged Image File Format (.TIFF) files.

JPEG Compression Parameter

Luminance Quality	Range [0..255], Default: 223 The quality value modifies the quantization values. If the quality value is 223, the default quantization value from the table is used without modification. If the quality value is greater than 223, the quantization value is scaled down (less loss - lower compression, more quality). If the quality value is less than 223, the quantization value is scaled up (more loss - higher compression, less quality).
Chrominance Quality (color only)	Range [0..255], Default: 223 The quality value modifies the quantization values. If the quality value is 223, the default quantization value from the table is used without modification. If the quality value is greater than 223, the quantization value is scaled down (less loss - lower compression, more quality). If the quality value is less than 223, the quantization value is scaled up (more loss - higher compression, less quality).
Subsampling (color only)	Range: Horizontal [ON, OFF], Vertical [ON, OFF], Default: both OFF Subsampling is a method of reducing the size of an image by storing color data with lower resolution than luminance data. The first step in JPEG compression is to create a map of one brightness value and two hue values for each pixel in the image. During "subsampling", the two hue values are averaged into one value, decreasing the image by at least one-third. This process is based on the principle that small changes in color (hue) are less likely to be perceived by the human eye than small changes in brightness. Subsampling can be enabled or disabled independently in both directions, but note: not all decoders accept vertical subsampling without horizontal subsampling!

Optimize Huffman Codes	<p>Default: ON (checked)</p> <p>The advantage of optimized Huffman tables is a slightly smaller file. The disadvantage is it requires a pass through the quantized coefficients to perform a statistical analysis to generate the optimized set of symbols, which needs processing time.</p> <p>There is no influence to the image quality if Huffman optimization is used or not.</p>
General	<p>This selector defines what DPU does when JPEG compressed image data is needed, but JPEG compressed image data is already available, generated by an other compressor or compressed by other parameter.</p> <p>If Use original JPEG compressed data, if available (Default) is selected, the original JPEG data is used, regardless of the given JPEG compression parameter.</p> <p>If Always compress with these parameters is selected, the original JPEG data is dropped, and a new JPEG compression is done using the given compression parameter.</p>
Preview	<p>Show an image to demonstrate current compression parameters result.</p>
Default	<p>Set all parameter back to default values.</p>

5 LZW-TIFF Compression Parameter Setup

The LZW (Lempel-Ziv-Welch) compression method the best case (all zeros) provides a compression approaching 1365:1 for long files, but the worst-case expansion is at least a factor of 1.125, which can increase to nearly 1.5 in some implementations. LZW and Flate encoding compress more compactly if their input data is highly predictable. One way of increasing the predictability of many continuous-tone sampled images is to replace each sample with the difference between that sample and a predictor function applied to earlier neighboring samples. If the predictor function works well, the postprediction data will cluster toward 0.

Two groups of predictor functions are supported. The first, the TIFF group, consists of the single function that is Predictor 2 in the TIFF standard. (In the TIFF standard, Predictor 2 applies only to LZW compression, but here it applies to Flate compression as well.) TIFF Predictor 2 predicts that each color component of a sample will be the same as the corresponding color component of the sample immediately to its left.

Lossless compression, can be used in Tagged Image File Format (.TIFF) files.

LZW - TIFF Compression Parameter

max. Stripe Size	Range [single line..Unlimited], Default: 8 KB).
Horizontal Differencing Prediction	On or Off, Default: Off).
Add Color Table (gray only)	On or Off, Default: Off).
Default	Set all parameter back to default values.

6 MDIT (Multi Dimensional Intelligent Thresholding)

The Thresholder converts a gray-scale image (256 gray colors) to a bitonal image.

The easiest and fastest way for conversion is to define one (static) level inside the 256 level color space. The thresholder compares every source pixel to this level and sets the destination pixel to black or white, regardless of any other pixel.

Often a more intelligent algorithm is required. If the level "dynamically" floats, based on the surrounding image area, images with different colored background areas are converted to a bitonal image containing all important information of the gray image.

The DPU Thresholder can be configured to run in both modes.

Mode	Range [Manual, Auto, Best Image, Barcode Optimized], Default: Best Image Manual: Make all settings manually. Auto: Static and dynamic level values are set automatically by analysing the image. Best Image: Like Auto mode, with special handling of noisy areas. Barcode Optimized: Like <i>Best Image</i> , but with enhanced processing of dark areas, minimizes outline effect.
Static Level	Range [0..255], Default: 40 Generally, all pixel darker than this level become black, all other white. Note: The default value 40 is wise when using the dynamic thresholder. If the dynamic thresholder should not be used, find a value in middle position, for example 127.
Backtracker	ON or OFF, Default: OFF If activated, the range of <i>Static Level</i> is automatically adapted to the current background color. This is useful when processing images with variable background color.
Dynamic	ON or OFF, Default: ON Activates a special process, which includes colors of surrounding pixel in conversion. The process is controlled by the following parameters. Available in <i>Manual Mode</i> only.
.. Weight	Range [1..255], Default: 200 Defines the influence of local brightness variations. Available in <i>Manual Mode</i> only.
.. Matrix Size	Range [$n \times n$ Pixel] Defines the array of pixel surrounding the pixel to convert, which are included in calculation of the average background brightness. Because the dynamic thresholder reacts on brightness variations, regular colored areas are converted to framed areas (outline effect). This result can be desired, e.g. to frame areas colored by a marker pen. The <i>Dynamic Matrix Size</i> should be enlarged to avoid this effect on normal text characters.
Dark Area Enhancement	ON or OFF, Default: OFF If activated, pixel below the <i>Static Level</i> value will be converted to white, if a local variation in brightness is detected.
Noise Removal	ON or OFF, Default: OFF If activated, an additional noise filter is included in conversion process. This

noise filter minimizes thresholder reactions on isolated dark pixel.

Note: The "Noise Remover" increases conversion time!

.. Area Size	Range [Small, Medium, Large], Default: Small Defines the area size the "Noise Remover" includes into the calculation process (normally "Small" should be selected).
.. Weight	Range [0..255], Default: 200 Defines the intervention level of the "Noise Remover". Greater values reduce noise filter influence (image will be darker). The value should be equal to or a bit greater than <i>Dynamic Weight</i> value.
Keep Character	ON or OFF, Default: ON If activated, the <i>NoiseRemover</i> is disabled nearly static pixel.
.. Weight	Range [1..5], Default: 3 With value 1 the <i>NoiseRemover</i> will be disabled for pixels very close to static pixel only; larger values enlarge the sensitive area.
Remove Black Cluster	ON or OFF, Default: OFF If activated, an additional process improves the generated black&white image. Clusters of black pixel (up to the given size) are detected and converted to white. Note: The "Black Pixel Cluster Remover" increases conversion time!
.. up to Pixel	Range [1..32], Default: 3 Defines the maximum size of <i>PixelClusters</i> to remove.
Remove White Cluster	ON or OFF, Default: OFF If activated, an additional process improves the generated black&white image. Clusters of white pixel (up to the given size) are detected and converted to black. Note: The "White Pixel Cluster Remover" increases conversion time!
.. up to Pixel	Range [1..32], Default: 3 Defines the maximum size of <i>PixelClusters</i> to remove.

7 Preview

The Preview Window demonstrates how the current set of parameters will work to convert an image.

Tools:

- Use [open . . .] to load an image file;
- click image left to zoom in;
- click image right to zoom out;
- click+hold left to move the image;
- click+hold right to move the images frame.

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