Image Enhancement

Contrast adjustment, morphological filtering, deblurring, and other image enhancement tools

Image enhancement techniques bring out the detail in an image that is obscured or highlight certain features of interest in an image. Enhancement techniques include contrast adjustment, filtering, morphological filtering, and deblurring. Image enhancement operations typically return a modified version of the original image and are frequently used as a preprocessing step to improve the results of image analysis techniques.

* [**Contrast Adjustment**](https://in.mathworks.com/help/images/contrast-adjustment-.html)  
  Contrast adjustment, histogram equalization, decorrelation stretching

## Functions

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| [imadjust](https://in.mathworks.com/help/images/ref/imadjust.html) | Adjust image intensity values or colormap |
| [imcontrast](https://in.mathworks.com/help/images/ref/imcontrast.html) | Adjust Contrast tool |
| [imsharpen](https://in.mathworks.com/help/images/ref/imsharpen.html) | Sharpen image using unsharp masking |
| [locallapfilt](https://in.mathworks.com/help/images/ref/locallapfilt.html) | Fast Local Laplacian Filtering of images |
| [localcontrast](https://in.mathworks.com/help/images/ref/localcontrast.html) | Edge-aware local contrast manipulation of images |
| [localtonemap](https://in.mathworks.com/help/images/ref/localtonemap.html) | Render HDR image for viewing while enhancing local contrast |
| [histeq](https://in.mathworks.com/help/images/ref/histeq.html) | Enhance contrast using histogram equalization |
| [adapthisteq](https://in.mathworks.com/help/images/ref/adapthisteq.html) | Contrast-limited adaptive histogram equalization (CLAHE) |
| [imhistmatch](https://in.mathworks.com/help/images/ref/imhistmatch.html) | Adjust histogram of image to match N-bin histogram of reference image |
| [decorrstretch](https://in.mathworks.com/help/images/ref/decorrstretch.html) | Apply decorrelation stretch to multichannel image |
| [stretchlim](https://in.mathworks.com/help/images/ref/stretchlim.html) | Find limits to contrast stretch image |
| [intlut](https://in.mathworks.com/help/images/ref/intlut.html) | Convert integer values using lookup table |
| [imnoise](https://in.mathworks.com/help/images/ref/imnoise.html) | Add noise to image |

# Image Filtering

Convolution and correlation, predefined and custom filters, nonlinear filtering, edge-preserving filters

## Functions

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| [imfilter](https://in.mathworks.com/help/images/ref/imfilter.html) | N-D filtering of multidimensional images |
| [imgaussfilt](https://in.mathworks.com/help/images/ref/imgaussfilt.html) | 2-D Gaussian filtering of images |
| [imgaussfilt3](https://in.mathworks.com/help/images/ref/imgaussfilt3.html) | 3-D Gaussian filtering of 3-D images |
| [fspecial](https://in.mathworks.com/help/images/ref/fspecial.html) | Create predefined 2-D filter |
| [imguidedfilter](https://in.mathworks.com/help/images/ref/imguidedfilter.html) | Guided filtering of images |
| [normxcorr2](https://in.mathworks.com/help/images/ref/normxcorr2.html) | Normalized 2-D cross-correlation |
| [wiener2](https://in.mathworks.com/help/images/ref/wiener2.html) | 2-D adaptive noise-removal filtering |
| [medfilt2](https://in.mathworks.com/help/images/ref/medfilt2.html) | 2-D median filtering |
| [medfilt3](https://in.mathworks.com/help/images/ref/medfilt3.html) | 3-D median filtering |
| [ordfilt2](https://in.mathworks.com/help/images/ref/ordfilt2.html) | 2-D order-statistic filtering |
| [stdfilt](https://in.mathworks.com/help/images/ref/stdfilt.html) | Local standard deviation of image |
| [rangefilt](https://in.mathworks.com/help/images/ref/rangefilt.html) | Local range of image |
| [entropyfilt](https://in.mathworks.com/help/images/ref/entropyfilt.html) | Local entropy of grayscale image |
| [nlfilter](https://in.mathworks.com/help/images/ref/nlfilter.html) | General sliding-neighborhood operations |

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| [gabor](https://in.mathworks.com/help/images/ref/gabor.html) | Create Gabor filter or Gabor filter bank |
| [imgaborfilt](https://in.mathworks.com/help/images/ref/imgaborfilt.html) | Apply Gabor filter or set of filters to 2-D image |
| [imboxfilt](https://in.mathworks.com/help/images/ref/imboxfilt.html) | 2-D box filtering of images |
| [imboxfilt3](https://in.mathworks.com/help/images/ref/imboxfilt3.html) | 3-D box filtering of 3-D images |
| [integralImage](https://in.mathworks.com/help/images/ref/integralimage.html) | Calculate integral image |
| [integralImage3](https://in.mathworks.com/help/images/ref/integralimage3.html) | Calculate 3-D integral image |
| [integralBoxFilter](https://in.mathworks.com/help/images/ref/integralboxfilter.html) | 2-D box filtering of integral images |
| [integralBoxFilter3](https://in.mathworks.com/help/images/ref/integralboxfilter3.html) | 3-D box filtering of 3-D integral images |

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| [bwareafilt](https://in.mathworks.com/help/images/ref/bwareafilt.html) | Extract objects from binary image by size |
| [bwpropfilt](https://in.mathworks.com/help/images/ref/bwpropfilt.html) | Extract objects from binary image using properties |
| [padarray](https://in.mathworks.com/help/images/ref/padarray.html) | Pad array |
| [freqz2](https://in.mathworks.com/help/images/ref/freqz2.html) | 2-D frequency response |
| [fsamp2](https://in.mathworks.com/help/images/ref/fsamp2.html) | 2-D FIR filter using frequency sampling |
| [ftrans2](https://in.mathworks.com/help/images/ref/ftrans2.html) | 2-D FIR filter using frequency transformation |
| [fwind1](https://in.mathworks.com/help/images/ref/fwind1.html) | 2-D FIR filter using 1-D window method |
| [fwind2](https://in.mathworks.com/help/images/ref/fwind2.html) | 2-D FIR filter using 2-D window method |
| [convmtx2](https://in.mathworks.com/help/images/ref/convmtx2.html) | 2-D convolution matrix |

# Morphological Operations

Dilate, erode, reconstruct, and perform other morphological operations

## Functions

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| [bwhitmiss](https://in.mathworks.com/help/images/ref/bwhitmiss.html) | Binary hit-miss operation |
| [bwmorph](https://in.mathworks.com/help/images/ref/bwmorph.html) | Morphological operations on binary images |
| [bwulterode](https://in.mathworks.com/help/images/ref/bwulterode.html) | Ultimate erosion |
| [bwareaopen](https://in.mathworks.com/help/images/ref/bwareaopen.html) | Remove small objects from binary image |
| [imbothat](https://in.mathworks.com/help/images/ref/imbothat.html) | Bottom-hat filtering |
| [imclearborder](https://in.mathworks.com/help/images/ref/imclearborder.html) | Suppress light structures connected to image border |
| [imclose](https://in.mathworks.com/help/images/ref/imclose.html) | Morphologically close image |
| [imdilate](https://in.mathworks.com/help/images/ref/imdilate.html) | Dilate image |
| [imerode](https://in.mathworks.com/help/images/ref/imerode.html) | Erode image |
| [imextendedmax](https://in.mathworks.com/help/images/ref/imextendedmax.html) | Extended-maxima transform |
| [imextendedmin](https://in.mathworks.com/help/images/ref/imextendedmin.html) | Extended-minima transform |
| [imfill](https://in.mathworks.com/help/images/ref/imfill.html) | Fill image regions and holes |
| [imhmax](https://in.mathworks.com/help/images/ref/imhmax.html) | H-maxima transform |
| [imhmin](https://in.mathworks.com/help/images/ref/imhmin.html) | H-minima transform |
| [imimposemin](https://in.mathworks.com/help/images/ref/imimposemin.html) | Impose minima |
| [imopen](https://in.mathworks.com/help/images/ref/imopen.html) | Morphologically open image |
| [imreconstruct](https://in.mathworks.com/help/images/ref/imreconstruct.html) | Morphological reconstruction |
| [imregionalmax](https://in.mathworks.com/help/images/ref/imregionalmax.html) | Regional maxima |
| [imregionalmin](https://in.mathworks.com/help/images/ref/imregionalmin.html) | Regional minima |
| [imtophat](https://in.mathworks.com/help/images/ref/imtophat.html) | Top-hat filtering |
| [watershed](https://in.mathworks.com/help/images/ref/watershed.html) | Watershed transform |
| [conndef](https://in.mathworks.com/help/images/ref/conndef.html) | Create connectivity array |
| [iptcheckconn](https://in.mathworks.com/help/images/ref/iptcheckconn.html) | Check validity of connectivity argument |

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| [applylut](https://in.mathworks.com/help/images/ref/applylut.html) | Neighborhood operations on binary images using lookup tables |
| [bwlookup](https://in.mathworks.com/help/images/ref/bwlookup.html) | Nonlinear filtering using lookup tables |
| [makelut](https://in.mathworks.com/help/images/ref/makelut.html) | Create lookup table for use with bwlookup |

## Classes

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| --- | --- |
| [strel](https://in.mathworks.com/help/images/ref/strel-class.html) | Morphological structuring element |
| [offsetstrel](https://in.mathworks.com/help/images/ref/offsetstrel-class.html) | Morphological offset structuring element |

# Deblurring

Deconvolution for deblurring

## Functions

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| [deconvblind](https://in.mathworks.com/help/images/ref/deconvblind.html) | Deblur image using blind deconvolution |
| [deconvlucy](https://in.mathworks.com/help/images/ref/deconvlucy.html) | Deblur image using Lucy-Richardson method |
| [deconvreg](https://in.mathworks.com/help/images/ref/deconvreg.html) | Deblur image using regularized filter |
| [deconvwnr](https://in.mathworks.com/help/images/ref/deconvwnr.html) | Deblur image using Wiener filter |
| [edgetaper](https://in.mathworks.com/help/images/ref/edgetaper.html) | Taper discontinuities along image edges |
| [otf2psf](https://in.mathworks.com/help/images/ref/otf2psf.html) | Convert optical transfer function to point-spread function |
| [psf2otf](https://in.mathworks.com/help/images/ref/psf2otf.html) | Convert point-spread function to optical transfer function |

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| [padarray](https://in.mathworks.com/help/images/ref/padarray.html) | Pad array |

# ROI-Based Processing

Define and operate on regions of interest (ROI)

## Functions

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| [roipoly](https://in.mathworks.com/help/images/ref/roipoly.html) | Specify polygonal region of interest (ROI) |
| [poly2mask](https://in.mathworks.com/help/images/ref/poly2mask.html) | Convert region of interest (ROI) polygon to region mask |
| [regionfill](https://in.mathworks.com/help/images/ref/regionfill.html) | Fill in specified regions in image using inward interpolation |
| [roicolor](https://in.mathworks.com/help/images/ref/roicolor.html) | Select region of interest (ROI) based on color |
| [roifilt2](https://in.mathworks.com/help/images/ref/roifilt2.html) | Filter region of interest (ROI) in image |
| [imellipse](https://in.mathworks.com/help/images/ref/imellipse.html) | Create draggable ellipse |
| [imfreehand](https://in.mathworks.com/help/images/ref/imfreehand.html) | Create draggable freehand region |
| [impoly](https://in.mathworks.com/help/images/ref/impoly.html) | Create draggable, resizable polygon |
| [imrect](https://in.mathworks.com/help/images/ref/imrect.html) | Create draggable rectangle |
| [imroi](https://in.mathworks.com/help/images/ref/imroi.html) | Region-of-interest (ROI) base class |

# Neighborhood and Block Processing

Define neighborhoods and blocks for filtering and I/O operations

## Classes

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| --- | --- |
| [ImageAdapter](https://in.mathworks.com/help/images/ref/imageadapter-class.html) | Interface for image I/O |

## Functions

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| [blockproc](https://in.mathworks.com/help/images/ref/blockproc.html) | Distinct block processing for image |
| [bestblk](https://in.mathworks.com/help/images/ref/bestblk.html) | Determine optimal block size for block processing |
| [nlfilter](https://in.mathworks.com/help/images/ref/nlfilter.html) | General sliding-neighborhood operations |
| [col2im](https://in.mathworks.com/help/images/ref/col2im.html) | Rearrange matrix columns into blocks |
| [colfilt](https://in.mathworks.com/help/images/ref/colfilt.html) | Columnwise neighborhood operations |
| [im2col](https://in.mathworks.com/help/images/ref/im2col.html) | Rearrange image blocks into columns |

# Image Arithmetic

Add, subtract, multiply, and divide images

## Functions

|  |  |
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| [imabsdiff](https://in.mathworks.com/help/images/ref/imabsdiff.html) | Absolute difference of two images |
| [imadd](https://in.mathworks.com/help/images/ref/imadd.html) | Add two images or add constant to image |
| [imapplymatrix](https://in.mathworks.com/help/images/ref/imapplymatrix.html) | Linear combination of color channels |
| [imcomplement](https://in.mathworks.com/help/images/ref/imcomplement.html) | Complement image |
| [imdivide](https://in.mathworks.com/help/images/ref/imdivide.html) | Divide one image into another or divide image by constant |
| [imlincomb](https://in.mathworks.com/help/images/ref/imlincomb.html) | Linear combination of images |
| [immultiply](https://in.mathworks.com/help/images/ref/immultiply.html) | Multiply two images or multiply image by constant |
| [imsubtract](https://in.mathworks.com/help/images/ref/imsubtract.html) | Subtract one image from another or subtract constant from image |