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IPT FUNCTION LIST

MATLAB 数字图象处理工具箱函数列表

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## Import, Export, and Conversion

### Basic Import and Export

imread Read image from graphics file

imwrite Write image to graphics file

imfinfo Information about graphics file

### Scientific File Formats

dicomanon Anonymize DICOM file

dicomdict Get or set active DICOM data dictionary

dicominfo Read metadata from DICOM message

dicomlookup Find attribute in DICOM data dictionary

dicomread Read DICOM image

dicomuid Generate DICOM unique identifier

dicomwrite Write images as DICOM files

nitfinfo Read metadata from National Imagery Transmission Format (NITF) file

nitfread Read image from NITF file

analyze75info Read metadata from header file of Analyze 7.5 data set

analyze75read Read image data from image file of Analyze 7.5 data set

interfileinfo Read metadata from Interfile file

interfileread Read images in Interfile format

### High Dynamic Range Images

hdrread Read high dynamic range (HDR) image

hdrwrite Write Radiance high dynamic range (HDR) image file

makehdr Create high dynamic range image

tonemap Render high dynamic range image for viewing

### Large Image Files

ImageAdapter Interface for image I/O

isrset Check if file is R-Set

openrset Open R-Set file

rsetwrite Create reduced resolution data set from image file

### Image Type Conversion

gray2ind Convert grayscale or binary image to indexed image

ind2gray Convert indexed image to grayscale image

mat2gray Convert matrix to grayscale image

rgb2gray Convert RGB image or colormap to grayscale

ind2rgb Convert indexed image to RGB image

label2rgb Convert label matrix into RGB image

demosaic Convert Bayer pattern encoded image to truecolor image

imquantize Quantize image using specified quantization levels and output values

multithresh Multilevel image thresholds using Otsu's method

im2bw Convert image to binary image, based on threshold

graythresh Global image threshold using Otsu's method

grayslice Convert grayscale image to indexed image using multilevel thresholding

im2double Convert image to double precision

im2int16 Convert image to 16-bit signed integers

im2java2d Convert image to Java buffered image

im2single Convert image to single precision

im2uint16 Convert image to 16-bit unsigned integers

im2uint8 Convert image to 8-bit unsigned integers

### Synthetic Images

checkerboard Create checkerboard image

phantom Create head phantom image

imnoise Add noise to image

## Display and Exploration

### Basic Display

imshow Display image

montage Display multiple image frames as rectangular montage

subimage Display multiple images in single figure

immovie Make movie from multiframe image

implay Play movies, videos, or image sequences

warp Display image as texture-mapped surface

iptgetpref Get values of Image Processing Toolbox preferences

iptprefs Display Image Processing Toolbox Preferences dialog box

iptsetpref Set Image Processing Toolbox preferences or display valid values

### Interactive Exploration with the Image Viewer App

imtool Image Viewer app

imageinfo Image Information tool

imcontrast Adjust Contrast tool

imdisplayrange Display Range tool

imdistline Distance tool

impixelinfo Pixel Information tool

impixelinfoval Pixel Information tool without text label

impixelregion Pixel Region tool

immagbox Magnification box for scroll panel

imoverview Overview tool for image displayed in scroll panel

iptgetpref Get values of Image Processing Toolbox preferences

iptprefs Display Image Processing Toolbox Preferences dialog box

iptsetpref Set Image Processing Toolbox preferences or display valid values

### Build Interactive Tools

imageinfo Image Information tool

imcolormaptool Choose Colormap tool

imcontrast Adjust Contrast tool

imcrop Crop image

imdisplayrange Display Range tool

imdistline Distance tool

impixelinfo Pixel Information tool

impixelinfoval Pixel Information tool without text label

impixelregion Pixel Region tool

impixelregionpanel Pixel Region tool panel

immagbox Magnification box for scroll panel

imoverview Overview tool for image displayed in scroll panel

imoverviewpanel Overview tool panel for image displayed in scroll panel

imsave Save Image Tool

imscrollpanel Scroll panel for interactive image navigation

imellipse Create draggable ellipse

imfreehand Create draggable freehand region

imline Create draggable, resizable line

impoint Create draggable point

impoly Create draggable, resizable polygon

imrect Create draggable rectangle

imroi Region-of-interest (ROI) base class

getline Select polyline with mouse

getpts Specify points with mouse

getrect Specify rectangle with mouse

getimage Image data from axes

getimagemodel Image model object from image object

axes2pix Convert axes coordinates to pixel coordinates

imattributes Information about image attributes

imgca Get handle to current axes containing image

imgcf Get handle to current figure containing image

imgetfile Open Image dialog box

imhandles Get all image handles

iptaddcallback Add function handle to callback list

iptcheckhandle Check validity of handle

iptgetapi Get Application Programmer Interface (API) for handle

iptGetPointerBehavior Retrieve pointer behavior from HG object

ipticondir Directories containing IPT and MATLAB icons

iptPointerManager Create pointer manager in figure

iptremovecallback Delete function handle from callback list

iptSetPointerBehavior Store pointer behavior structure in Handle Graphics object

iptwindowalign Align figure windows

makeConstrainToRectFcn Create rectangularly bounded drag constraint function

truesize Adjust display size of image

## Geometric Transformation, Spatial Referencing, and Image Registration

### Geometric Transformations

imcrop Crop image

imresize Resize image

imrotate Rotate image

imtranslate Translate image

impyramid Image pyramid reduction and expansion

imwarp Apply geometric transformation to image

fitgeotrans Fit geometric transformation to control point pairs

imtransform Apply 2-D spatial transformation to image

findbounds Find output bounds for spatial transformation

fliptform Flip input and output roles of TFORM structure

makeresampler Create resampling structure

maketform Create spatial transformation structure (TFORM)

tformarray Apply spatial transformation to N-D array

tformfwd Apply forward spatial transformation

tforminv Apply inverse spatial transformation

checkerboard Create checkerboard image

affine2d 2-D Affine Geometric Transformation

affine3d 3-D Affine Geometric Transformation

projective2d 2-D Projective Geometric Transformation

images.geotrans.PiecewiseLinearTransformation2D 2-D piecewise linear geometric transformation

images.geotrans.PolynomialTransformation2D 2-D Polynomial Geometric Transformation

images.geotrans.LocalWeightedMeanTransformation2D 2-D Local Weighted Mean Geometric Transformation

### Spatial Referencing

imwarp Apply geometric transformation to image

imregister Intensity-based image registration

imregtform Estimate geometric transformation that aligns two 2-D or 3-D images

imshow Display image

imshowpair Compare differences between images

imfuse Composite of two images

imref2d Reference 2-D image to world coordinates

imref3d Reference 3-D image to world coordinates

### Automatic Registration

imregister Intensity-based image registration

imregconfig Configurations for intensity-based registration

imregtform Estimate geometric transformation that aligns two 2-D or 3-D images

imregcorr Estimates geometric transformation that aligns two 2-D images using phase correlation

imregdemons Estimate displacement field that aligns two 2-D or 3-D images

imfuse Composite of two images

imshowpair Compare differences between images

registration.metric.MattesMutualInformation Mattes mutual information metric configuration object

registration.metric.MeanSquares Mean square error metric configuration object

registration.optimizer.RegularStepGradientDescent Regular step gradient descent optimizer configuration object

registration.optimizer.OnePlusOneEvolutionary One-plus-one evolutionary optimizer configuration object

### Control Point Registration

cpselect Control Point Selection Tool

fitgeotrans Fit geometric transformation to control point pairs

cpcorr Tune control-point locations using cross correlation

cpstruct2pairs Convert CPSTRUCT to valid pairs of control points

normxcorr2 Normalized 2-D cross-correlation

cp2tform Infer spatial transformation from control point pairs

## Image Enhancement

### Contrast Adjustment

imadjust Adjust image intensity values or colormap

imcontrast Adjust Contrast tool

imsharpen Sharpen image using unsharp masking

histeq Enhance contrast using histogram equalization

adapthisteq Contrast-limited adaptive histogram equalization (CLAHE)

imhistmatch Adjust histogram of image to match N-bin histogram of reference image

decorrstretch Apply decorrelation stretch to multichannel image

stretchlim Find limits to contrast stretch image

intlut Convert integer values using lookup table

imnoise Add noise to image

### Image Filtering

imfilter N-D filtering of multidimensional images

normxcorr2 Normalized 2-D cross-correlation

fspecial Create predefined 2-D filter

wiener2 2-D adaptive noise-removal filtering

padarray Pad array

freqz2 2-D frequency response

fsamp2 2-D FIR filter using frequency sampling

ftrans2 2-D FIR filter using frequency transformation

fwind1 2-D FIR filter using 1-D window method

fwind2 2-D FIR filter using 2-D window method

convmtx2 2-D convolution matrix

imguidedfilter Guided filtering of images

nlfilter General sliding-neighborhood operations

medfilt2 2-D median filtering

ordfilt2 2-D order-statistic filtering

stdfilt Local standard deviation of image

rangefilt Local range of image

entropyfilt Local entropy of grayscale image

bwareafilt Extract objects from binary image by size

bwpropfilt Extract objects from binary image using properties

### Morphological Operations

bwhitmiss Binary hit-miss operation

bwmorph Morphological operations on binary images

bwulterode Ultimate erosion

bwareaopen Remove small objects from binary image

imbothat Bottom-hat filtering

imclearborder Suppress light structures connected to image border

imclose Morphologically close image

imdilate Dilate image

imerode Erode image

imextendedmax Extended-maxima transform

imextendedmin Extended-minima transform

imfill Fill image regions and holes

imhmax H-maxima transform

imhmin H-minima transform

imimposemin Impose minima

imopen Morphologically open image

imreconstruct Morphological reconstruction

imregionalmax Regional maxima

imregionalmin Regional minima

imtophat Top-hat filtering

watershed Watershed transform

conndef Create connectivity array

iptcheckconn Check validity of connectivity argument

applylut Neighborhood operations on binary images using lookup tables

bwlookup Nonlinear filtering using lookup tables

makelut Create lookup table for use with bwlookup

strel Create morphological structuring element (STREL)

getheight Height of structuring element

getneighbors Structuring element neighbor locations and heights

getnhood Structuring element neighborhood

getsequence Sequence of decomposed structuring elements

isflat True for flat structuring element

reflect Reflect structuring element

translate Translate structuring element (STREL)

### Deblurring

deconvblind Deblur image using blind deconvolution

deconvlucy Deblur image using Lucy-Richardson method

deconvreg Deblur image using regularized filter

deconvwnr Deblur image using Wiener filter

edgetaper Taper discontinuities along image edges

otf2psf Convert optical transfer function to point-spread function

psf2otf Convert point-spread function to optical transfer function

padarray Pad array

### ROI-Based Processing

roipoly Specify polygonal region of interest (ROI)

poly2mask Convert region of interest (ROI) polygon to region mask

roicolor Select region of interest (ROI) based on color

roifill Fill in specified region of interest (ROI) polygon in grayscale image

roifilt2 Filter region of interest (ROI) in image

imellipse Create draggable ellipse

imfreehand Create draggable freehand region

impoly Create draggable, resizable polygon

imrect Create draggable rectangle

imroi Region-of-interest (ROI) base class

### Neighborhood and Block Processing

ImageAdapter Interface for image I/O

blockproc Distinct block processing for image

bestblk Determine optimal block size for block processing

nlfilter General sliding-neighborhood operations

col2im Rearrange matrix columns into blocks

colfilt Columnwise neighborhood operations

im2col Rearrange image blocks into columns

### Image Arithmetic

imabsdiff Absolute difference of two images

imadd Add two images or add constant to image

imapplymatrix Linear combination of color channels

imcomplement Complement image

imdivide Divide one image into another or divide image by constant

imlincomb Linear combination of images

immultiply Multiply two images or multiply image by constant

imsubtract Subtract one image from another or subtract constant from image

## Image Analysis

### Object Analysis

bwboundaries Trace region boundaries in binary image

bwtraceboundary Trace object in binary image

edge Find edges in intensity image

imfindcircles Find circles using circular Hough transform

viscircles Create circle

corner Find corner points in image

cornermetric Create corner metric matrix from image

imgradient Gradient magnitude and direction of an image

imgradientxy Directional gradients of an image

hough Hough transform

houghlines Extract line segments based on Hough transform

houghpeaks Identify peaks in Hough transform

qtdecomp Quadtree decomposition

qtgetblk Block values in quadtree decomposition

qtsetblk Set block values in quadtree decomposition

### Region and Image Properties

regionprops Measure properties of image regions

bwarea Area of objects in binary image

bwareafilt Extract objects from binary image by size

bwconncomp Find connected components in binary image

bwconvhull Generate convex hull image from binary image

bwdist Distance transform of binary image

bwdistgeodesic Geodesic distance transform of binary image

bweuler Euler number of binary image

bwperim Find perimeter of objects in binary image

bwpropfilt Extract objects from binary image using properties

bwselect Select objects in binary image

graydist Gray-weighted distance transform of grayscale image

imcontour Create contour plot of image data

imhist Histogram of image data

impixel Pixel color values

improfile Pixel-value cross-sections along line segments

corr2 2-D correlation coefficient

mean2 Average or mean of matrix elements

std2 Standard deviation of matrix elements

bwlabel Label connected components in 2-D binary image

bwlabeln Label connected components in binary image

labelmatrix Create label matrix from bwconncomp structure

bwpack Pack binary image

bwunpack Unpack binary image

### Texture Analysis

entropy Entropy of grayscale image

entropyfilt Local entropy of grayscale image

rangefilt Local range of image

stdfilt Local standard deviation of image

graycomatrix Create gray-level co-occurrence matrix from image

graycoprops Properties of gray-level co-occurrence matrix

### Image Quality

immse Mean-squared error

psnr Peak Signal-to-Noise Ratio (PSNR)

ssim Structural Similarity Index (SSIM) for measuring image quality

### Image Segmentation

activecontour Segment image into foreground and background using active contour

imsegfmm Binary image segmentation using Fast Marching Method

gradientweight Calculate weights for image pixels based on image gradient

graydiffweight Calculate weights for image pixels based on grayscale intensity difference

graythresh Global image threshold using Otsu's method

multithresh Multilevel image thresholds using Otsu's method

### Image Transforms

bwdist Distance transform of binary image

bwdistgeodesic Geodesic distance transform of binary image

graydist Gray-weighted distance transform of grayscale image

hough Hough transform

dct2 2-D discrete cosine transform

dctmtx Discrete cosine transform matrix

fan2para Convert fan-beam projections to parallel-beam

fanbeam Fan-beam transform

idct2 2-D inverse discrete cosine transform

ifanbeam Inverse fan-beam transform

iradon Inverse Radon transform

para2fan Convert parallel-beam projections to fan-beam

radon Radon transform

fft2 2-D fast Fourier transform

fftshift Shift zero-frequency component to center of spectrum

ifft2 2-D inverse fast Fourier transform

ifftshift Inverse FFT shift

## Color

rgb2lab Convert RGB to CIE 1976 L\*a\*b\*

rgb2ntsc Convert RGB color values to NTSC color space

rgb2xyz Convert RGB to CIE 1931 XYZ

rgb2ycbcr Convert RGB color values to YCbCr color space

lab2rgb Convert CIE 1931 L\*a\*b\* to RGB

lab2xyz Convert CIE 1931 L\*a\*b\* to CIE 1931 XYZ

xyz2lab Convert CIE 1931 XYZ to CIE 1976 L\*a\*b\*

xyz2rgb Convert CIE 1931 XYZ to RGB

ycbcr2rgb Convert YCbCr color values to RGB color space

ntsc2rgb Convert NTSC values to RGB color space

lab2double Convert L\*a\*b\* data to double

lab2uint16 Convert L\*a\*b\* data to uint16

lab2uint8 Convert L\*a\*b\* data to uint8

xyz2double Convert XYZ color values to double

xyz2uint16 Convert XYZ color values to uint16

iccfind Search for ICC profiles

iccread Read ICC profile

iccroot Find system default ICC profile repository

iccwrite Write ICC color profile to disk file

isicc True for valid ICC color profile

makecform Create color transformation structure

applycform Apply device-independent color space transformation

imapprox Approximate indexed image by reducing number of colors

whitepoint XYZ color values of standard illuminants

## Code Generation

bwdist Distance transform of binary image

bwlookup Nonlinear filtering using lookup tables

bwmorph Morphological operations on binary images

bwpack Pack binary image

bwselect Select objects in binary image

bwtraceboundary Trace object in binary image

bwunpack Unpack binary image

conndef Create connectivity array

edge Find edges in intensity image

fitgeotrans Fit geometric transformation to control point pairs

fspecial Create predefined 2-D filter

getrangefromclass Default display range of image based on its class

histeq Enhance contrast using histogram equalization

im2double Convert image to double precision

im2int16 Convert image to 16-bit signed integers

im2single Convert image to single precision

im2uint16 Convert image to 16-bit unsigned integers

im2uint8 Convert image to 8-bit unsigned integers

imadjust Adjust image intensity values or colormap

imbothat Bottom-hat filtering

imclearborder Suppress light structures connected to image border

imclose Morphologically close image

imcomplement Complement image

imdilate Dilate image

imerode Erode image

imextendedmax Extended-maxima transform

imextendedmin Extended-minima transform

imfill Fill image regions and holes

imfilter N-D filtering of multidimensional images

imhist Histogram of image data

imhmax H-maxima transform

imhmin H-minima transform

imlincomb Linear combination of images

imopen Morphologically open image

imquantize Quantize image using specified quantization levels and output values

imreconstruct Morphological reconstruction

imregionalmax Regional maxima

imregionalmin Regional minima

imtophat Top-hat filtering

imwarp Apply geometric transformation to image

iptcheckmap Check validity of colormap

iptcheckconn Check validity of connectivity argument

label2rgb Convert label matrix into RGB image

mean2 Average or mean of matrix elements

medfilt2 2-D median filtering

multithresh Multilevel image thresholds using Otsu's method

ordfilt2 2-D order-statistic filtering

padarray Pad array

rgb2ycbcr Convert RGB color values to YCbCr color space

strel Create morphological structuring element (STREL)

stretchlim Find limits to contrast stretch image

ycbcr2rgb Convert YCbCr color values to RGB color space

imref2d Reference 2-D image to world coordinates

imref3d Reference 3-D image to world coordinates

affine2d 2-D Affine Geometric Transformation

projective2d 2-D Projective Geometric Transformation

## GPU Computing

edge Find edges in intensity image

histeq Enhance contrast using histogram equalization

imadjust Adjust image intensity values or colormap

imfill Fill image regions and holes

imfilter N-D filtering of multidimensional images

imgradient Gradient magnitude and direction of an image

imgradientxy Directional gradients of an image

imhist Histogram of image data

imnoise Add noise to image

imregdemons Estimate displacement field that aligns two 2-D or 3-D images

imresize Resize image

imrotate Rotate image

imshow Display image

mean2 Average or mean of matrix elements

medfilt2 2-D median filtering

padarray Pad array

std2 Standard deviation of matrix elements

stdfilt Local standard deviation of image

stretchlim Find limits to contrast stretch image

bwdist Distance transform of binary image

bwlabel Label connected components in 2-D binary image

bwlookup Nonlinear filtering using lookup tables

corr2 2-D correlation coefficient

normxcorr2 Normalized 2-D cross-correlation

iradon Inverse Radon transform

radon Radon transform

im2double Convert image to double precision

im2single Convert image to single precision

im2uint8 Convert image to 8-bit unsigned integers

im2uint16 Convert image to 16-bit unsigned integers

imabsdiff Absolute difference of two images

imcomplement Complement image

imlincomb Linear combination of images

bwmorph Morphological operations on binary images

imbothat Bottom-hat filtering

imclose Morphologically close image

imdilate Dilate image

imerode Erode image

imopen Morphologically open image

imreconstruct Morphological reconstruction

imtophat Top-hat filtering

mat2gray Convert matrix to grayscale image

rgb2gray Convert RGB image or colormap to grayscale

rgb2ycbcr Convert RGB color values to YCbCr color space

ycbcr2rgb Convert YCbCr color values to RGB color space