

Basics of Image Processing

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December 11, 2011



Agenda

- 1 Image
- 2 ImageProcessing
- 3 GIMP-Basics
- 4 Screenshots
- 5 Cropping
- 6 Scaling
- 7 Latex

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Image - definitions

Raster image (bitmap)

- In computer graphics, a raster graphics image or bitmap:
 - is a data structure representing a generally rectangular grid of pixels, or points of color, viewable via a monitor, paper, etc.
 - raster images are stored in image files with varying formats.

Vector image

- In computer graphics, a vector graphics:
 - is the use of geometrical primitives (points, lines, curves, and shapes or polygons), which are all based upon mathematical equations, to represent images

Images may be

- two-dimensional: a photograph, screen display,
- three-dimensional: such as a statue.

Bitmap Image - Characterization

Bitmap image is technically characterized

- by the width and height of the image in pixels
 - giving the resolution of the image
 - VGA: 640x480 pixel
 - SGA: 800x600
 - XGA: 1024x768
- by the the number of bits per pixel
 - meaning the color depth, which determines the number of colors it can represent.
- quality of raster image determinded by resolution and color depth

Bitmap Image - Color

Color Spaces:

- RGB color space: Red, Green, Blue additive colors
 - color depth: defined by three bytes — one byte for each color.
 - standard for computer displays since 1995
- Monochrom space: an image with only black and white pixels
 - requires only a single bit for each pixel.
- others: sRGB, Adobe-RGB, CMYK (printers), etc.

Image Formats

- JPEG, TIFF, PNG, etc.
- RAW data by digital SLR cameras
 - lossless compression
 - 10, 12, 14 bit color depth (!!)
 - image processing in RAW mode, after conversion to JPG
- **always shot in RAW mode**

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Image Processing Overview

Image Processing operations are among many other

- Geometric transformations: enlargement, reduction, and rotation
- Color corrections such as
 - brightness and contrast adjustments, quantization, or conversion to a different color space
- Image editing: increase the quality of a digital image
 - manipulate, enhance, and transform images
- HDR - High dynamic range imaging
 - Extending dynamic range by combining differently exposed images

Special Software needed for Digital Image Processing (DIP)

- DIP is done by special software to manipulate images in many ways
 - Adobe Photoshop line
 - GIMP - GNU Image Manipulation Program
 - DPP - Canon Digital Photo Professional for Canon DSLRs
 - ACDSee - more simple application

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GIMP - The Gnu Image Manipulation Program

Features - I

What is GIMP

- a free raster graphics editor
- to process digital graphics and photographs
 - image composition: creating graphics and logos
 - photo retouching: removing unwanted image features
 - resizing and cropping photos
 - converting between different image formats (very important use)
 - create basic animated images in GIF format
 - altering colors, combining multiple images
- free software replacement for Adobe Photoshop
 - it is not designed to be a Photoshop clone
- the project was started in 1995
- current version (2.6.10) works with numerous OS:
 - Linux, Microsoft Windows, Apple's Mac OS X, OpenSolaris, FreeBSD

GIMP - The Gnu Image Manipulation Program

Features - II

Effects and filters and formats

- GIMP has approximately 150 standard effects and filters
 - Drop Shadow, Blur, Motion blur and Noise.
 - operations can be automated with scripting languages
 - Scheme (LISP) interpreter named Script-Fu is built in
 - external Perl, Python, or Tcl can be used
- File formats (read and write)
 - BMP, JPEG, PNG, GIF, TIFF
 - Autodesk flic animations, Corel Paint Shop Pro images
 - Adobe Photoshop Documents, PostScript documents
- File formats (read only)
 - Adobe PDF documents
 - raw image formats used by many digital cameras

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Screenshot

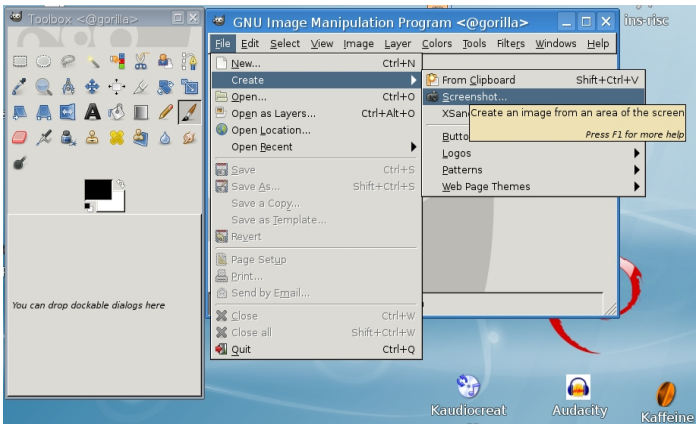
General requirements

- make a snapshot from a window or from the full screen or from a region of the screen
- set a delay to prepare effects on the screen/window
- convert output to different formats

Software for generating screenshots

- gnome-screenshot
 - basic functions, command line parameters, lightweight
- ksnapshot
 - very professional, all requirements implemented
 - this is a screenshot generator only
- GIMP
 - very usable, all necessary functions available
 - DIP program !

Screenshot with GIMP



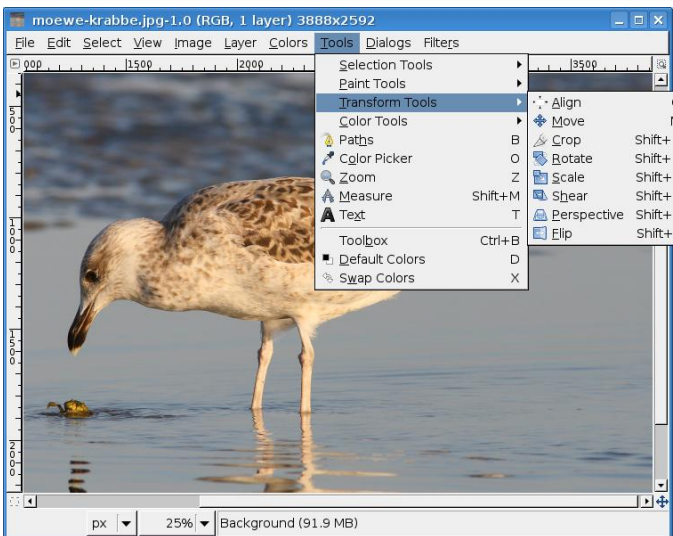
Now an online demo with GIMP !

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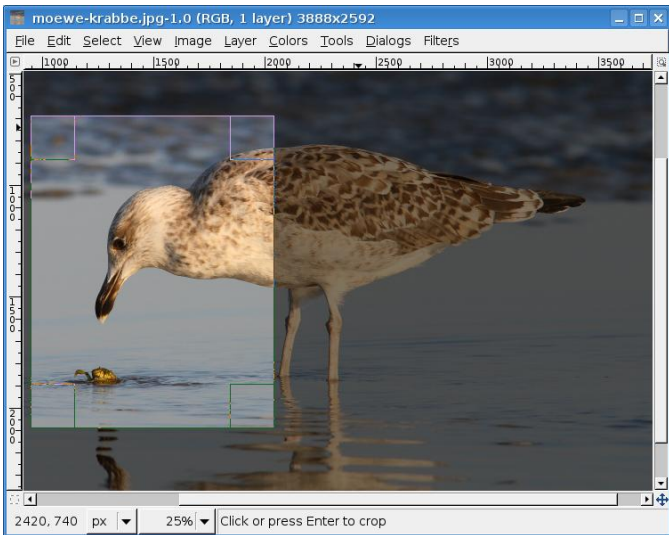
Cropping

Select Crop



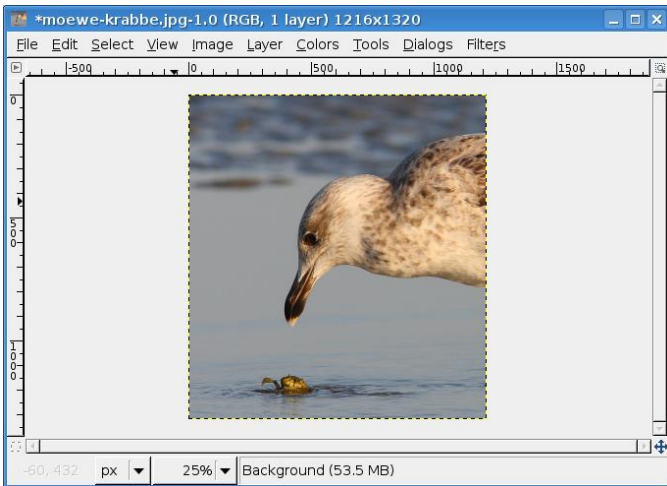
Cropping

Choose area to crop



Cropping

crop now - final image

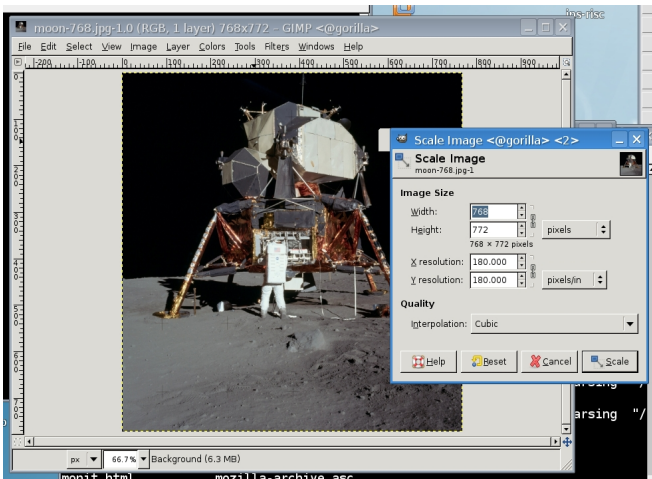


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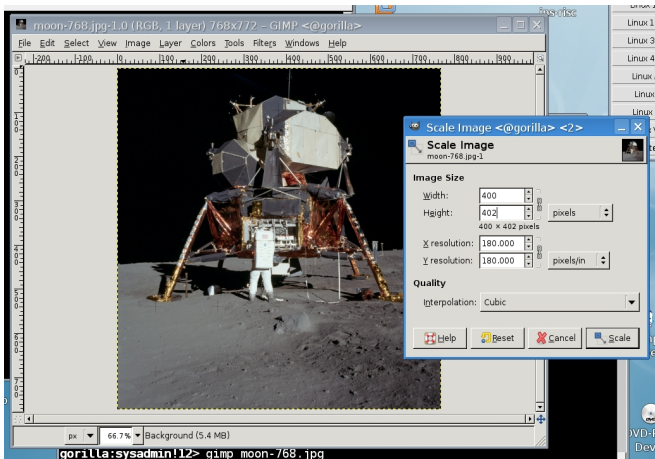
Scaling in GIMP

Select: Scale Image



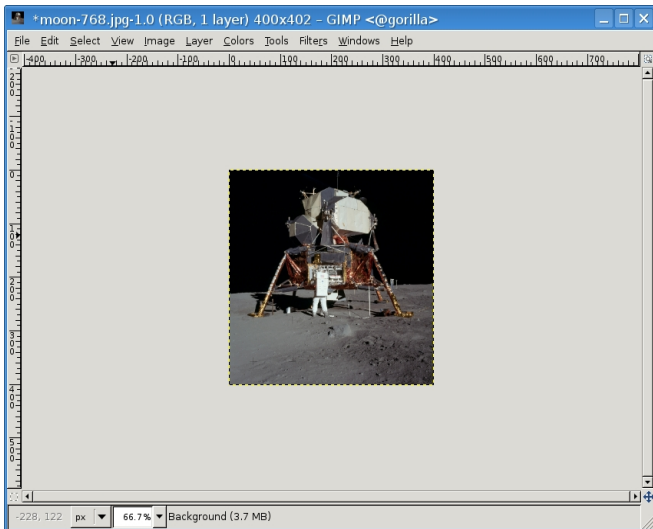
Scaling in GIMP

Image - Scale Image



Scaling in GIMP

Window for new dimensions - set them



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How to include graphics in Latex

Using Latex you can include only .eps graphics (example.tex)

```
\documentclass{article}
\usepackage{graphicx}
\includegraphics[height=4in]{graphic.eps}
\end{document}
```

- compile it by `latex example.tex`

Using PdfLatex you can include png, pdf, jpg, files (pdf-example.tex)

```
\documentclass{article}
\usepackage[pdftex]{graphicx}
\includegraphics[height=4in]{emtex.pdf}
\end{document}
```

- compile it by `pdflatex pdf-example.tex`

Includegraphics Details

The full command structure

Full command

```
\includegraphics [key=value,...]{file}
```

- the optional parameter accepts comma separated list of keys with associated values
- the keys can be used to change the width, height and rotation of the included graphics
- **file** is the graphics. The type may be .eps only using **latex**
- **file** is the graphics. The type may be: .png, .pdf, .jpg using **pdflatex**
- the most important keys:
 - **width**: scale graphics to the specified width
 - **height**: scale graphics to the specified height
 - **angle**: rotate graphics counterclockwise
 - **scale**: scale graphics

Includegraphics Examples

Parameters for includegraphics

```
\includegraphics{sample0_a.pdf}
```

- will use the graphics as it is

```
\includegraphics[scale=0.7]{sample0_a.pdf}
```

- scales the inserted PDF image by factor 0.7

```
\includegraphics[width=12.5cm]{sample0_a.pdf}
```

- will show the image transformed to width 12.5 cm

```
\includegraphics[height=4in]{sample0_a.pdf}
```

```
\includegraphics[width=0.4\textwidth]{sample0_a.pdf}
```

- textwidth is the width of a standard paragraph

```
\includegraphics[height=0.65\textwidth]{sample0_a.pdf}
```

```
\includegraphics[width=.9\columnwidth,bb=67 385 525 742]{cpu.eps}
```

```
\includegraphics[angle=90,width=\columnwidth]{arch.eps}
```

Includegraphics Details

File conversion and Compatibility

- programs to convert graphics formats:
 - epstopdf
 - GIMP
- For compatibility between latex and pdflatex:
 - do NOT use file extensions in the file parameter
 - create the appropriate versions of the graphics in the directory
 - latex will look for `.eps` files
 - pdflatex will look for `.png`, `.pdf`, `.jpg` files in this order !

End of Basics of Image Processing

Thanks for your attention !