Photo Handling with Linux — Part 2

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CLUG — Canterbury Linux Users' Group

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2 Image Processing Theory and Photo Editing





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Summary of Part 1

- Transfer photos to computer
- Image formats
- Meta data EXIF, IPTC
- Image editing and viewing
- Organising photos
- Publishing, photo albums
- Software: exiftool, gimp, digikam, picasa Also: f-spot¹, MaPiVi², LightZone³

³http://sonic.net/~rat/lightcrafts/

¹http://f-spot.org/

²http://mapivi.sourceforge.net/

Most Frequent Editing Operations

- Brightness (linear), Levels (non-linear)
- Contrast / Gamma (γ)
- Colour
 - White balance
 - Cast/Tint removal
- Cropping
- Anything to make image "look nicer"
 - Sharpening

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Transfer Functions

• Value substitution; straight line: no change



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Transfer Functions 2

- Levels
 - Brightness
 - value scaling (rotate line around (0,0)
 - value adding (move line up/down)
 - Contrast
 - Rotate line around its centre point
 - S-shape curve (γ -function), stretch/shrink around middle
 - Histogram equalisation
- Curves
 - Non-linear, arbitrary effects
 - Construct transfer-function curve in gimp

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- Histogram number of times each brightness value is used
- Histogram equalisation: stretching the "ends" of the graph to minimum and maximum brightness levels, making full use of the dynamic range (auto balance).

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Colour

- What is colour?
 - Electromagnetic radiation
 - Light with specific wavelengths (or frequencies)
- Colours of objects?
 - Light reflected from the surface
- Visible spectrum: approx. 400 nm–800 nm
 UV violet blue green yellow orange red infrared

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Colour Mixing



Colour Mixing



Colour Mixing



Colour Mixing

Additive mixing



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Colour Mixing

Additive mixing



Subtractive mixing



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Colour Mixing

Additive mixing





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Colour Mixing





Colour Mixing

Additive mixing





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Colour Plots

- Colour wheel ⁴
- Hue, saturation



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⁴good: http://jemimap.freeshell.org/style/color/wheel.html

Colour Temperature

- Concept to describe light with a certain colour composition
- Black-body radiation. Planck, 1900: $L(\lambda, T) = \frac{2\hbar c^2}{\lambda^5} \frac{1}{e^{(\hbar c)/(k\lambda T)} - 1} \frac{1}{\Omega_0}$



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Colour Spaces – CIE

- CIE 1931 ⁵
- Range of visible colours
- Defined in 1931 from measurements in the 1920s
- Mathematical definition
- Colour space chromaticity diagram ("horseshoe graph"⁶)
- Basis for many other colour spaces



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⁵http://en.wikipedia.org/wiki/CIE_1931_color_space
⁶graph: wikipedia (⁵)

Colour Spaces 2

- RGB red, green, blue
- CMYK (CcMmYyK, ...) cyan, magenta, yellow, black
- HSV hue, saturation, brightness
- Many others, often related to colour TV (broadcast signals)
- sRGB ⁷, Adobe RGB, ...
- Further info: http://en.wikipedia.org/wiki/Color_space

⁷http://www.color.org/sRGB.html

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Colour Editing

Gimp⁸

- Application of transfer functions
- Tint/cast: apply brightness changes to individual colour component(s)
- Can change single colours
- Colour balance adjustment, but not white balance
- Excellent curve tool
- Tools too far to reach for efficient working
- Inefficient handling of multiple images

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⁸http://gimp.org/

Colour Management

- Colour profiles (ICC profiles) ⁹
 - Description of device characteristics
 - For each device: scanner, screen, printer
- Calibration
 - By visual comparison of displayed test patterns
 - By measuring colour patches with a hardware device
 - By scanning colour reference chart
- Software applies profiles of the devices used
- Keep profiles with images!

⁹http://www.color.org/iccprofile.html

Colour Management 2

• Argyll ¹⁰

Collection of little tools to create and load profiles

- Gimp 2.2 (current) doesn't support profiles
- GAMMApage ¹¹ aid for adjusting display gamma
 - Many other similar tools, e.g. KDE
 - Load per-colour gamma into X server (xgamma)
- Create profile using other OS (use same hardware!)
- Use a grey card

¹¹http://www.pcbypaul.com/software/GAMMApage.html

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¹⁰http://www.argyllcms.com/

Raw Format

• Make the best of your camera's image capabilities

• 16-bit editing, white balance information, tone curves

- dcraw command line; 2 gimp plugins based on dcraw
 - gimp is only 8 bit, all adjustments before loading photo

¹²http://www.sphoto.com/techinfo/rawconverters/rawconverters.htm

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• Commercial (from ¹²):

	Adobe	Bibble	Breeze	Capture	Canon	Raw
	Camera		Browser	One	Digital	Shooter
	Raw			Pro	Photo	
Microsoft	Х	Х	Х	Х	Х	Х
Apple	Х	Х		Х	Х	
Linux		Х				

¹²http://www.sphoto.com/techinfo/rawconverters/rawconverters.htm

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Bibble

Bibble ¹³ (US\$130)

- Image browser, and quickly accessible tools
 - Sharpening, noise reduction, colour adjustments, crop, ... Below average: curve tool
- Adjustments can be easily copied, and saved!
- User-definable queues for processing; workflow support
- Full colour profile and colour space support
- Fast development; good support forum
- No 64 bit version; bad file extension handling; no undo

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¹³http://www.bibblelabs.com/

LCD Monitors

- Relevant for the characteristic is the LCD panel type ¹⁴
 - TN fast, cheap
 - Colours, brightness different with each viewing angle
 - Only 6 bit per colour (262144 colours)
 - Unsuitable for photo work
 - P-MVA / PVA
 - Newer models acceptable for photo work
 - S-IPS
 - Good colour precision and maximum viewing angle
 - Expensive, slow; current models fast enough for TV
 - Best choice for photo work
- Monitor vendors never specify the panel type... ^{15, 16}

¹⁴http://www.xbitlabs.com/articles/other/display/lcd-guide.html ¹⁵http://www.flatpanels.dk/panels.php



- Scanners: film and flatbed
- Image types:
 - Colour, gray, bi-tone, 1 bit, 8 bit, 16 bit
 - Text
 - Photos (halftoned)

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Scanning Applications 1

SANE ¹⁷ (scanner access now easy)

- Backend: library, drivers for each hardware
 - Knows the capabilities of each device
- Frontend: user interface
 - Command line: scanimage
 - GUI: xsane (not as good: xscanimage, kooka)
 - Available options depend on hardware capabilities
 - Messy user interfaces with too many windows
- LAN scanning capability
- No colour management, no infrared cleaning, no multi-frame film-strip scanning

Scanning Applications 2

VueScan ¹⁸ (US\$90)

- Good user interface; tabbed
- Handles most scanners, but no longer many cheap flatbeds
- Colour profiles
- Infrared cleaning
- Calibrated for many films on the market
- Multi-frame batch scanning

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¹⁸http://www.hamrick.com/vsm.html

Text Extraction from Scanned Image

- OCR (optical character recognition)
- Results highly dependent on: Text font and size, optical quality of original, algorithm. Obviously need sufficient scan resolution.
- With OSS, results are disappointing. Can't compete with commercial software.

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Printing

- gimpprint, STP / ghostscript
 - Used by gimp, and in combination with print spooling
 - Supports Epson printers well
 - Colour accuracy has become a lot better
- TurboPrint ¹⁹ (30€)
 - Supports many "no-information" printers, esp. Canon
 - Integrates well with CUPS
 - Good reputation for colour accuracy

¹⁹http://www.turboprint.de/

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Print Longevity

- Prints:
 - Photographic paper (exposed; developed chemically)
 - Ink: dye-based (cheaper), pigment-based (less fading)
- Longevity numbers are extrapolated from short-time high-intensity tests.
- Treat manufacturer's claims with great caution (or ignore).
- Always ask about the test conditions!!
- How useful is a prediction based on prints hung under heavily UV-protective glass in a dimly lit hallway?

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Print Longevity 2

- Good quality paper and original printer manufacturer's ink perhaps the best option.
- Ink prints need not be worse than photographic prints.
- If you want your prints to last, store them dry, cool, and in the pitch black. (Same as film.)

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Print Longevity 2

- Good quality paper and original printer manufacturer's ink perhaps the best option.
- Ink prints need not be worse than photographic prints.
- If you want your prints to last, store them dry, cool, and in the pitch black. (Same as film.)
- Keep your digital files. . .

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