

The portable darktable



**the portable
darktable**

Gunang Waney

Contents

Preface: What this book is for.....	vii
Chapter 1: Overview and legal stuff.....	9
Chapter 2: Installation.....	11
Installing on macOS.....	12
Installing on Linux Ubuntu.....	12
Installing on other Linux and Unix.....	12
Installing on Windows.....	12
Chapter 3: Getting started now.....	13
Chapter 4: How darktable works.....	15
darktable views.....	16
Chapter 5: Import options.....	17
Importing individual photos.....	18
Importing folders.....	18
Importing from camera or external storage.....	18
Chapter 6: Management options.....	19
Filtering photos.....	20
Sorting photos.....	20
Rating photos.....	20
Viewing EXIF information.....	20
Adding metadata.....	20
Identifying areas in focus.....	20
Chapter 7: Processing options.....	23
Creating HDR photos.....	24
Development options.....	24
Adjusting the composition.....	24
Changing color to black and white.....	24
Adjusting the exposure.....	25
Adjusting color impression: white balance.....	25
Corrections to lens flaws.....	25
Reducing noise and sharpening photo.....	26
Chapter 8: Exporting images to new files.....	29

Chapter 9: Tethered shooting..... 31
 Verifying your camera for tethering (UNIX and Linux)..... 32
 Tethering under Windows..... 32

Chapter 10: Locations on map.....33
 View geotagged photos on map..... 34
 Placing photo on map.....34

Chapter 11: Presentation..... 35
 Presenting in slideshow..... 36
 Printing photos..... 36

Chapter 12: Integrations.....37
 Opening photo from Shotwell photo manager.....38
 Opening photo from Ristretto viewer..... 38

Glossary..... 39

Index.....41

Preface

What this book is for

This book is for new users of darktable. You can look up things that you want to do in the table of contents.

After a while, you can find your way in darktable yourself and discover other stuff that you need. See the [official darktable manual on darktable.org](#) for further reading.

If you want to make your first steps, you can read the chapter about [Installation](#) on page 11 to continue with the [Getting started now](#) on page 13 tutorial. Then, you get your first edited photo quickly.

Have fun.

Gunang Waney

Information Developer

gunangwaney@gmail.com

Chapter 1

Overview and legal stuff

darktable is a photography workflow application for Linux, macOS, and Windows. Broadly speaking, you can do the following things.

- Managing your digital images.
- Viewing your digital images.
- Developing [RAW](#) images.
- Doing tethered shooting.
- Managing printing.
- Viewing photos on a map that carry a geographical mark, a geotag.

darktable always keeps your original file that contains your photo.

darktable is free software. The license falls under the terms of the [General Public License \(GNU\)](#) as published by the Free Software Foundation.

Chapter

2

Installation

Topics:

- [Installing on macOS](#)
- [Installing on Linux Ubuntu](#)
- [Installing on other Linux and Unix](#)
- [Installing on Windows](#)

You can install darktable on the following operating systems.

- UNIX and Linux, for example Ubuntu.
- macOS on 64-bit architecture.
- Microsoft Windows.

You can install darktable either from installation packages or from source code. For more information, see the [chapter Install on darktable.org](#).



Note: Since release 2.4.0r2, darktable supports Microsoft Windows.

Installing on macOS

You can install darktable on macOS 10.7 Lion and newer in the 64-bit architecture.

1. Locate the newest release at the [GitHub darktable page](#). Then, download the installation file.
For MacOS, the extension is DMG.
2. Double click the DMG file to mount the DMG file.
3. Drag the darktable icon into the **applications** folder.

Installing on Linux Ubuntu

1. Open a Terminal window: **Ctrl+Alt+T**.
2. Add `ppa:pmjdebruijn/darktable-release` to your system's software sources.
Type in the Terminal window the following commands.

```
sudo add-apt-repository ppa:pmjdebruijn/darktable-release
sudo apt update
```

3. Install darktable through the following command.

```
sudo apt install darktable
```

Installing on other Linux and Unix

Locate the newest release at the [GitHub darktable page](#).

Installing on Windows

1. Locate the newest release at the [GitHub darktable page](#).
For Windows, the extension is EXE.
2. Run the EXE file.

Chapter

3

Getting started now

You need to have a photo in [RAW](#) file format.

These steps give you an example how you can process a [RAW](#) photo.

1. Open darktable.
2. Expand **import**. Then, click **image**.
3. Navigate to your photo in the screen. Then, click **open**.
4. Click **basic group** in the right panel.



Figure 1: basic group

5. Expand **contrast brightness saturation**.

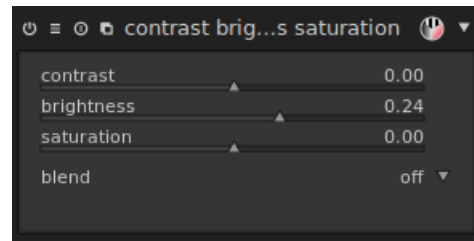


Figure 2: contrast brightness saturation

6. Move the sliders to adjust the contrast brightness saturation.
7. Click **correction group**.



Figure 3: correction group

8. Click the On Off button of the **lens correction** module to the On position.

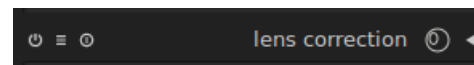
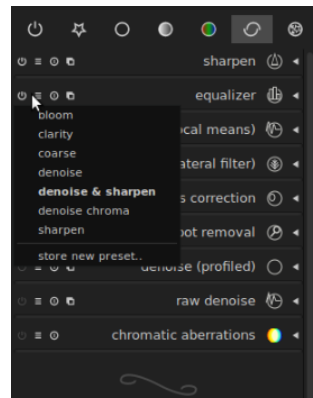


Figure 4: lens correction tool

9. Click the On Off button of the [chromatic aberration](#) module to the On position.
10. Click **presets > denoise & sharpen** of the equalizer tool.



11. Press **Ctrl+E** to export your photo.

You processed a photo through darktable.

Related concepts

[Import options](#) on page 17

[Processing options](#) on page 23

Chapter

4

How darktable works

Topics:

- [darktable views](#)

darktable provides a workflow that consists of the following steps.

1. Opening photos.
2. Editing photos.
3. Exporting photos.

The figure represents the workflow in detail.

1. Opening photos into the **lighttable** view (**L**) from either a [storage device](#) (**I**) or through [Tethering](#). (**T**).
 - Viewing geotagged photos on a geographic chart (**M**).
2. [Processing photos](#).
 - Creating [HDR](#) or editing with predefined steps (**H**).
 - Developing in the **darkroom** view (**D**).
3. Exporting photos (**E**) to JPEG format or other format.
4. Presenting photos.
 - Presenting photos in a slideshow(**S**).
 - Printing photos (**P**).

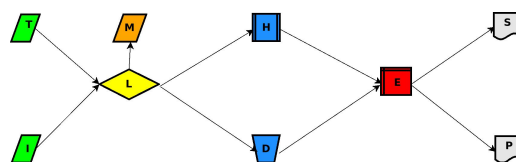


Figure 5: Workflow

Related tasks

- [Importing individual photos](#) on page 18
- [Importing folders](#) on page 18
- [Importing from camera or external storage](#) on page 18
- [View geotagged photos on map](#) on page 34
- [Exporting images to new files](#) on page 29
- [Creating HDR photos](#) on page 24
- [Presenting in slideshow](#) on page 36
- [Printing photos](#) on page 36

darktable views

darktable provides views that offer different functions

The following table gives you an overview of the darktable views.

View	Description	Shortcut
lighttable	Managing photos: rating, tagging, importing, exporting photos	l
darkroom	Developing photos	d
tethering	Shooting with a camera that you connected to a computer	t
map	Viewing geotagged photos on a map	m
slideshow	Presenting photos in a slideshow	s
print	Managing print jobs	p

You can switch between the views as follows.

- Clicking the view name at the top of the right panel.
- Typing the shortcut character of the view.

Chapter

5

Import options

Topics:

- [Importing individual photos](#)
- [Importing folders](#)
- [Importing from camera or external storage](#)

You can import files in the following formats.

- [RAW](#).
- JPEG.

However, under [RAW](#) format, you have more possibilities for manipulating your photo.

You can import photos in the following ways.

- As individual files.
- As contents of an entire folder.
- As files from an external storage device, for example an SD card in a digital camera that you mounted to your computer.

Related tasks

[Getting started now](#) on page 13

[Verifying your camera for tethering \(UNIX and Linux\)](#) on page 32

Importing individual photos

1. Press **L** to open the **lighttable** view.
2. Expand **import**.
3. Click **image**.
The **import image** dialog opens.
4. Highlight the file that you want to import. Use the **Ctrl** key to highlight more files.
5. Click **open**.

The photos open in the **lighttable** view.

Related concepts

[How darktable works](#) on page 15

Importing folders

You can import an entire folder as filmroll.

1. Press **L** to open the **lighttable** view.
2. Expand **import**.
3. Click **folder**.
The **import image** dialog opens.
4. Highlight the folder that you want to import.
5. Click **open**.

The photos open in the **lighttable** view.

Related concepts

[How darktable works](#) on page 15

Importing from camera or external storage

Connect your camera or other external storage. Then, mount the storage.

You can import from an external medium including your digital camera through a USB port.

1. Press **L** to open the **lighttable** view.
2. Click **scan for devices**.
3. Click **import from camera**.
The dialog **import from images from camera** opens.
4. Select the photos that you want to import. Use the **Ctrl** key to select more photos.
5. Click **import**.

The photos open in the **lighttable** view.

Related concepts

[How darktable works](#) on page 15

Chapter

6

Management options

Topics:

- [Filtering photos](#)
- [Sorting photos](#)
- [Rating photos](#)
- [Viewing EXIF information](#)
- [Adding metadata](#)
- [Identifying areas in focus](#)

After you imported your photos, you can make a selection of which photos you want to develop. To make your selection easier, you can do the following actions.

- Assigning star ratings.
- Assigning color labels.
- Adding to groups.
- Moving and copying to another folder.
- Adding and changing geo-information.

Sorting can set your priorities easier. You can sort your photos by the following properties.

- Filename.
- Time.
- Rating.
- ID.
- Color label.
- Group.
- Full path.

You can filter your photos through the number of stars.

Related tasks

[View geotagged photos on map](#) on page 34

[Placing photo on map](#) on page 34

Filtering photos

1. Press **L** to open the **lighttable** view.
 2. Click **all** right from **view**.
 3. Select the number of stars.
 4. Select the operator.
- < *** yields all photos with 2, 1, and 0 star rating.

Sorting photos

1. Press **L** to open the **lighttable** view.
2. Click the downward pointing triangle on the right side of **sort by**.
3. Choose a sorting criterion.
This action changes the sequence of your photos in the lighttable view.

Rating photos

You can give your photos a 1-, 2-, 3-, 4-, or 5-star rating. You can sort and filter your photos by rating.

1. Press **L** to open the **lighttable** view.
2. Select a photo.
3. Click **show image overlays** the star icon on the right upper part of the view.
You see five empty stars at the bottom of each photo
4. Click the star that corresponds to your rating that you want to give.

Viewing EXIF information

The **lighttable** view contains the [EXIF](#) information of the photo.

1. Press **L** to open the **lighttable** view.
2. Expand **image information**.
Now, you see the [EXIF](#) information.

Adding metadata

Metadata can be important to describe or identify the photo.

1. Press **L** to open the **lighttable** view.
You can highlight multiple photos.
2. Expand the **metadata editor** at the right panel.
3. Complete the fields manually or choose one of the **presets**.
4. Click **apply**.

Identifying areas in focus

A photo can have areas that are in focus and areas out of focus. You want to see whether your main subject is in focus.



Note: This trick works only for [RAW](#) photos.

1. Press **L** to open the **lighttable** view..
2. Press **Ctrl+Z**.
You fully zoom into your photo and see the areas that are in focus as rounded rectangles.

Chapter 7

Processing options

Topics:

- [Creating HDR photos](#)
- [Development options](#)

darktable provides tools to process a particular aspect of your photo. An example is the **crop and rotate** tool. With this tool you can crop your photo and turn your photo in any angle.

You can find most editing tools in the darkroom view.

The **lighttable** view contains the following tools.

- Creating HDR
- Editing from existing history stack.

The **darkroom** view divides the editing tools in groups.

- **basic group.**
- **tone group.**
- **color group.**
- **correction group.**
- **effects group.**



Figure 6: tools groups

Each tool has two, three, or four switches.

- **On Off.**
- **Presets.**
- **Reset parameters.**
- **Multiple instance actions.**

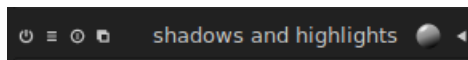


Figure 7: four switches of the shadows and highlights tool

Related tasks

[Getting started now](#) on page 13

Creating HDR photos

Only from a [RAW](#) shot, you can make an [HDR](#) photo. Darktable stores the [HDR](#) image into a file of the following format.

*-hdr.dng

1. Press **L** to open the **lighttable** view.
2. Open your photo in the **lighttable**. Then, select your photo.
3. Expand **selectes image[s]**.
4. Click **create**.

You can now locate your HDR photo in the **lighttable**. You can recognize the file on `hdr.dng` in the full path.

Related concepts

[Development options](#) on page 24

[How darktable works](#) on page 15

Development options

In the darkroom or development view, you can adjust and enhance your photo through the various tools.

The tools are divided in the following groups.

- **basic group.**
- **tone group.**
- **color group.**
- **correction group.**
- **effects group.**



You can manage the tools into a favorite group. You can arrange the tools that you use most often into this favorite group to minimize search efforts. In the group bar, the second group from the left contains your favorite groups.

Related tasks

[Creating HDR photos](#) on page 24

Adjusting the composition

You can crop and rotate your photos and follow compositional methods like the golden section, rule of third.

1. Click **D** to open the darkroom or development view.
 2. Click the **basic group** icon.
 3. Expand the **crop and rotate** tool.
- Now, you can apply the options to adjust your composition.

Changing color to black and white

You have two options to change a color photo into a photo.

1. Click **D** to open the darkroom or development view.
2. Click one of the following groups.

Group

basic group

Steps

- a. Expand **contrast, brightness, saturation**.

Group**color group****Steps**

- b.** Slide the **saturation** all the way to the left.
- a.** Expand **monochrome**.
- b.** Click the **On Off** button.

Adjusting the exposure

1. Press **D** to open the **darkroom**view.
2. Open the **basic group**.
3. Expand **exposure**.
You have the following options.
 - **black**, to adjust the black level.
 - **exposure**, to adjust the value.
 - **clipping threshold**, to adjust the percentage of bright values out. You can toggle the color pickle to activate. The color pickle is located in the left panel.

Adjusting color impression: white balance

1. Press **D** to open the **darkroom**view..
2. Click color group **color group**.
3. Expand **white balance**.
4. Adjust the **white balance** through the sliders.

Corrections to lens flaws

The darkroom view provides tools to correct for the following lens faults.

- **optical distortion**.
- **chromatic aberration**.
- **Vignetting**.

The tool identifies the camera lens combination automatically, but you can change the combination yourself manually.



Note: darktable identifies only camera lens combinations that darktable supports.

Correcting for distortion

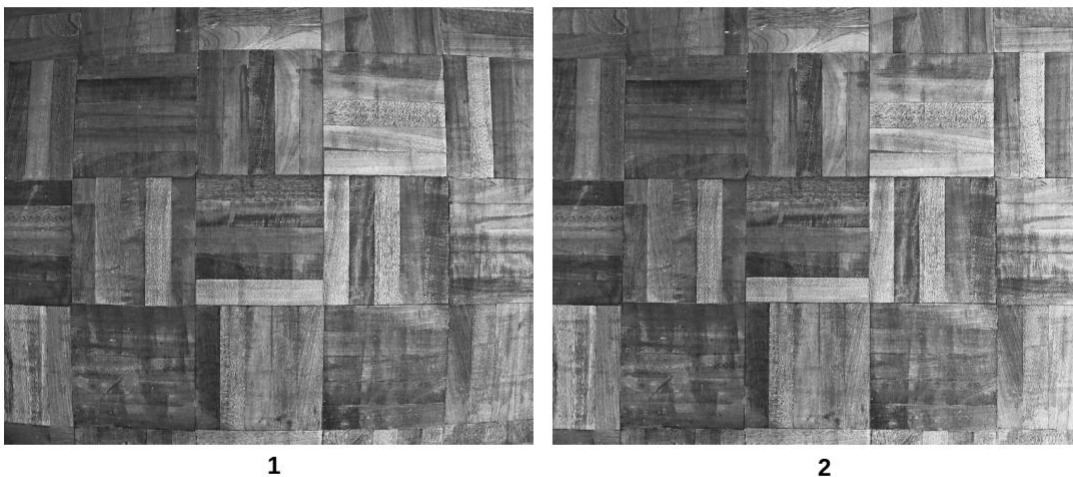
1. Press **D** to open the **darkroom**view.
2. Click the **correction group** icon.



3. Locate the **lens correction** tool in the right panel.

The tool applies the corrections automatically

Figure 8: (1) BEFORE (2) AFTER



Correcting for chromatic aberration

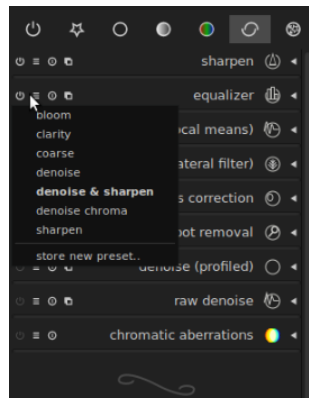
1. Click **D** to open the darkroom or development view.
2. Click the **correction group** icon.
3. Locate the **chromatic aberration** tool in the right panel.
4. Click the **On Off** icon
The tool applies the corrections automatically

Reducing noise and sharpening photo

1. Click **D** to open the **darkroom**.
2. Click the **correction group** icon.



3. Expand the **equalizer** tool.
4. Click **presets>denoise & sharpen**



Chapter

8

Exporting images to new files

When you're done with processing your photo, you can export your photo to another file. darktable retains your original file and writes the processed photo into a new file.

darktable supports the following formats among other formats.

- JPEG
- PDF
- TIFF
- PNG

The default format is JPEG, but you can set other formats in the **lighttable** view under **format options** on the right pane of the view.

Exporting consists of a single step.

Press **Ctrl+E** to export your photo.

During the export procedure, you see the path of your export file on the screen.

Related concepts

[How darktable works](#) on page 15

Chapter

9

Tethered shooting

Topics:

- [Verifying your camera for tethering \(UNIX and Linux\)](#)

In [tethering](#), you can control your camera through darktable.

darktable uses libgphoto2 for [tethering](#). Therefore, gphoto2 must support your camera fully to do tethered shooting. For now, gphoto2 supports only a few cameras for tethered shooting. For more information see [Projects :: libgphoto2 :: supported cameras](#).

1. Plug your camera into your computer.
2. Press **T** to open the [tethering](#) view..

Verifying your camera for tethering (UNIX and Linux)

darktable uses gphoto2. Therefore, gphoto2 must fully support your camera.

Only a few cameras support [tethering](#). Troubleshoot if you receive the following message in the [tethering](#) view.

```
no camera with tethering support available for use
```

Verify the following things.

- gphoto2 is installed on your computer.
- Your camera is connected to your computer.

1. Verify that gphoto2 detects your camera

```
LANG=C gphoto2 --auto-detect
```

You can see whether gphoto3 detects your camera.

2. Verify camera driver abilities

```
env LANG=C gphoto2 --port usb: --abilities
```

Verify that Capture choices" ability supports Image and that Configuration support is yes.

3. Verify camera remote capture.

```
env LANG=C gphoto2 --port usb: --capture-image-and-download
```

This step captures an image and download it to your computer if your camera is supported.

4. Verify camera tethered capture

```
env LANG=C gphoto2 --port usb: --capture-tethered
```

This step downloads your images to your computer after you pushed the shutter on the camera.

For more information, see the page [Supported cameras](#).

Related concepts

[Import options](#) on page 17

Tethering under Windows

1. Close darktable.
2. Install [Zadig](#) a tool for USB driver installation.
3. Use Zadig to replace the current Windows camera driver with the WinUSB driver.

Read the [Zadig user guide](#).

Now you can try [tethering](#).

Chapter

10

Locations on map

Topics:

- [View geotagged photos on map](#)
- [Placing photo on map](#)

You can view geotagged photos pinned on a map. You can also manually place photos without geotag onto the map.

Newer cameras, including smartphones, have GPS receivers and tag the image files with the coordinates.

darktable takes maps from open map sources on the internet.

View geotagged photos on map

Select a photo with a geotag in the **lighttable** view.

You can view the location where you shot the photo on a map.

1. Press **M** to open the **map** view.
2. Expand **map settings**.
3. Select **show osd**.
4. Choose the **map source**.
5. Zoom in or zoom out the map to discover the location.
6. Locate your photo on the map.

Related concepts

[Management options](#) on page 19

[How darktable works](#) on page 15

Placing photo on map

If you place a file onto a map, the file gets a geotag. This geotag consists of the coordinates of the map, the latitude and longitude.

1. Press **M** to open the **map** view.
2. Expand **map settings**
3. Select **show osd**.
4. Choose the **map source**.
5. Zoom in or zoom out the map to discover the location.
6. Drag your photo to that location on the map.

Related concepts

[Management options](#) on page 19

Chapter 11

Presentation

Topics:

- [Presenting in slideshow](#)
- [Printing photos](#)

After you export your photos, you can present your photos. You have the following options.

- Compile a slideshow on the screen.
- Print on paper.

Presenting in slideshow

Make a slideshow from a photo collection.

1. Press **L** to open the **lighttable** view.
2. Expand **collect images**.
3. Expand the left selection box. Then, select the filter.
4. Double click an item in the list. Then, choose the filter value.
5. Expand the right selection box. Then, change your collection.
6. Press **S** to open the **slideshow** view.
Your slideshow starts.

Related concepts

[How darktable works](#) on page 15

Printing photos

1. Press **L** to open the **lighttable** view.
2. Press **P** to open the **print** view.
3. Expand **printer settings**.
4. Review the settings and optionally change settings.
5. Click **print**.

Now, the printer prints your photo.



Note: Check the [darktable FAQ pages](#) for the status of printing under Windows.

Related concepts

[How darktable works](#) on page 15

Chapter 12

Integrations

Topics:

- [Opening photo from Shotwell photo manager](#)
- [Opening photo from Ristretto viewer](#)

Shotwell and Ristretto integrate with darktable.

You can open a photo in darktable directly from [Shotwell](#) or [Ristretto Image Viewer](#).

Shotwell is a photo manager that you can install on Ubuntu and Fedora.

Shotwell ships as the default photo manager from Ubuntu 14.04 (Trusty Tahr). You can manage your photos in Shotwell and develop them in darktable.

Ristretto is an open-source lightweight picture viewer for Linux.

Opening photo from Shotwell photo manager

Open one or more photos in [RAW](#) format in Shotwell.

First, configure Shotwell.

1. Click **Edit > Preferences**.
2. Click **External Editors**.
3. Choose darktable from the dropdown box **External Raw Editor**.
4. Close the dialog **Shotwell Preferences**.

To open a photo in darktable, right click your photo. Then, click **Open With RAW Editor**.

Opening photo from Ristretto viewer

1. Open your photo in Ristretto.
2. Right click **Open with > Darktable**.

Your photo is open in the **lighttable** view.

Glossary

Glossary of terms

chromatic aberration

Effect of a lens that refracts light of different colors to different extends. For example, your lens bends a blue light ray more than a red light ray. The consequence is that the blue ray hits the camera sensor at a different spot than the red ray. You might see a red spot and a blue spot. However, in reality the light ray is a single ray.

EXIF

Exchangeable Image File Format (EXIF) is a standard that specifies the formats for information from digital cameras. Among other things, the EXIF file provides you the following information about your photo shot.

- Shutter speed
- Film speed (ISO)
- Aperture
- Focal length
- Lens type
- Geolocation

HDR

Stands for high dynamic range In an HDR photo, you see more contrast in lighter parts and darker parts of your photo than in a standard photo. HDR photos can give a surrealistic appearance to photos. Also, for medicinal and surveillance purposes, photographers apply HDR to extend the contrast range. A alternative to the HDR function in darktable is a tool that is dedicated to HDR imaging. An example is Luminance HDR You van make HDR photos through the following shots. A set of JPG shots of the same subject that have different exposure values. A RAW shot. This format is the only format that darktable supports.

optical distortion

Or optical aberration is the effect that deforms straight lines. In the photo, the lines look curvy and right angles are no longer right. The design of the lens is the cause of the distortion.

RAW

Your camera's raw image file contains minimally processed data from the image sensor. The name raw comes from the fact that your camera did not yet process the image data. Camera manufacturers store RAW images in proprietary formats. The following table shows examples of these formats. Manufacturer RAW format Canon CIFF Nikon NPX Olympus ORF

tethering

Shooting from a remote device. Here, that device is a computer. You connect your camera to your computer.

When you shoot your photo, you bypass the camera and save your photo directly on your computer.

Tethered shooting has the following advantages.

- You can see your shot on a bigger screen.
- You have more storage at your disposal.
- Your imaging software has direct access to your photo. You can immediately verify your shot.
- You can take backups through your computer software.

The word tethering originally means fastening an animal with a rope or chain to limit the animal's freedom of movement.

vignetting

Darkening of the edges of a photo in comparison to the center. Sometimes photographers use vignetting to draw the attention of the viewer to the center. You can consider vignetting as a lens flaw.

white balance

Balance of the colors that make up white. When you adjust the white balance, you remove unrealistic color casts. Things that are white in the real world, now appear white in your photo.

Index

Numerics

64-bit [12](#)

A

architecture [11](#)

B

basic group [13](#), [23](#), [24](#), [24](#), [24](#), [25](#)

black and white [24](#)

C

chromatic aberration [25](#), [26](#)

clipping [25](#)

color group [23](#), [24](#), [25](#), [25](#)

color labels [19](#)

contrast brightness saturation [13](#), [13](#)

correction group [13](#), [23](#), [24](#), [25](#), [26](#), [26](#)

crop and rotate [24](#)

D

darkroom [16](#), [23](#), [25](#), [25](#), [25](#), [26](#)

DMG [12](#)

E

effects group [23](#), [24](#)

equalizer [13](#), [26](#)

export [14](#), [29](#), [29](#), [29](#), [29](#)

exposure [25](#)

F

favorite group [24](#)

Fedora [37](#)

filter [19](#)

G

General Public License [9](#)

geotag [9](#), [15](#), [33](#), [33](#), [34](#), [34](#), [34](#)

GitHub darktable page [12](#), [12](#), [12](#)

GNU [9](#)

golden section [24](#)

gphoto2 [31](#), [32](#)

GPS [33](#)

H

HDR [23](#), [24](#)

I

import [17](#), [17](#), [18](#), [18](#), [18](#), [18](#), [18](#)

import from camera [18](#)

import image [13](#), [18](#), [18](#)

import images from camera [18](#)

installation [11](#)

J

JPEG [15](#), [17](#), [29](#), [29](#)

L

lens correction [13](#), [25](#)

libgphoto2 [31](#)

license [9](#)

Linux [11](#)

M

macOS [9](#), [11](#), [12](#)

map [16](#), [16](#), [34](#), [34](#), [34](#), [34](#), [34](#), [34](#), [34](#)

map settings [34](#), [34](#)

map source [34](#), [34](#)

metadata [20](#)

Microsoft [11](#)

mount [18](#)

O

Optical distortion [25](#)

P

paper [35](#)

PDF [29](#)

PNG [29](#)

print [16](#), [36](#)

printer [36](#)

R

rating [20](#), [20](#)

RAW [9](#), [13](#), [13](#), [17](#), [24](#), [38](#)

Ristretto [37](#), [38](#)

rule of third [24](#)

S

SD card [17](#)

Shotwell [37](#), [37](#), [37](#), [38](#)

show osd [34](#), [34](#)

slideshow [15](#), [16](#), [16](#), [31](#), [35](#), [36](#), [36](#), [36](#)

sorting [19](#), [20](#)

star ratings [19](#)

switches [23](#)

T

tethering [9](#), [16](#), [31](#), [31](#), [32](#), [32](#), [32](#)

TIFF [29](#)

tone group [23](#), [24](#)

Trusty Tahr [37](#)

U

Ubuntu [11](#), [37](#), [37](#)

UNIX [11](#)

USB driver [32](#)

V

vignetting [25](#)

W

white balance [25](#), [25](#)

Windows [11](#), [32](#), [36](#)

workflow [15](#)

Z

Zadig [32](#)