

Welcome to the

ADVANCED COMPUTER SCIENCE APPLICATIONS FOR CULTURAL HERITAGE

Laboratory

CA' FOSCARI UNIVERSITY

Lab Sessions

- Practical work (computer needed)
- Interaction (not only frontal lecture)
- Group work (changing groups)

About me

- Researcher at DAIS for Computer Vision and 3D Reconstruction
- Reach out via mail or come to the Zeta building
- Passionate about open source software

Open Source Software (OSS)

Using open source guarantee freedom of choice
and possible customization and empowers
community efforts.

Talk from R. Stallman

Tools for the course

| Software | Task | Link |
|-------------------|------------------------------------|---------------------------|
| GIMP | Generic Image Processing | install |
| Fiji | Scientific Image Processing | install |
| Photopea | Image Processing and Editing | web-based |
| Handbrake | Video Transcoder | install |
| Meshroom | 3D Reconstruction | install |
| Meshlab | 3D Processing | install |
| Blender | 3D Modelling and Rendering | install |
| Postgres | Advanced Database | install |
| QGIS | Geographic Information System | install |
| QField | Mobile tool for QGIS | install |
| Teachable Machine | AI-based framework for experiments | web-based |

The first block

1. Today: image processing
2. Friday: 3D reconstruction
3. Tuesday: 3D modelling and visualization

Metadata

| DSCF5002.JPG Properties | | X | |
|-------------------------|------------------------------|-----------|-------|
| Basic | Permissions | Open With | Image |
| Image Type | jpeg (JPEG) | | |
| Width | 6240 pixels | | |
| Height | 4160 pixels | | |
| Camera Brand | FUJIFILM | | |
| Camera Model | X-T30 | | |
| Exposure Time | 1/500 s | | |
| Exposure Program | Auto | | |
| Aperture Value | F8 | | |
| ISO Speed Rating | 320 | | |
| Flash Fired | No flash | | |
| Metering Mode | Multi-segment | | |
| Focal Length | 18.0 mm | | |
| Software | Digital Camera X-T30 Ver1.40 | | |
| Description | | | |
| Creator | | | |
| Created On | 2022:06:19 12:16:41 | | |
| Rating | 0 | | |

Data for today

Open [this link](#). It contains the datasets we will use today.

Compression

what does it mean?

Quick check

1. can you make an example of a compression algorithm?
2. when is compression lossless?
3. what is the resolution of an image?

The practical side

1. does changing the format affect the size of the image?
2. can you make an example when compression is useful? and useless?
3. how can you compress an image?

An example

size: 17.0 MB

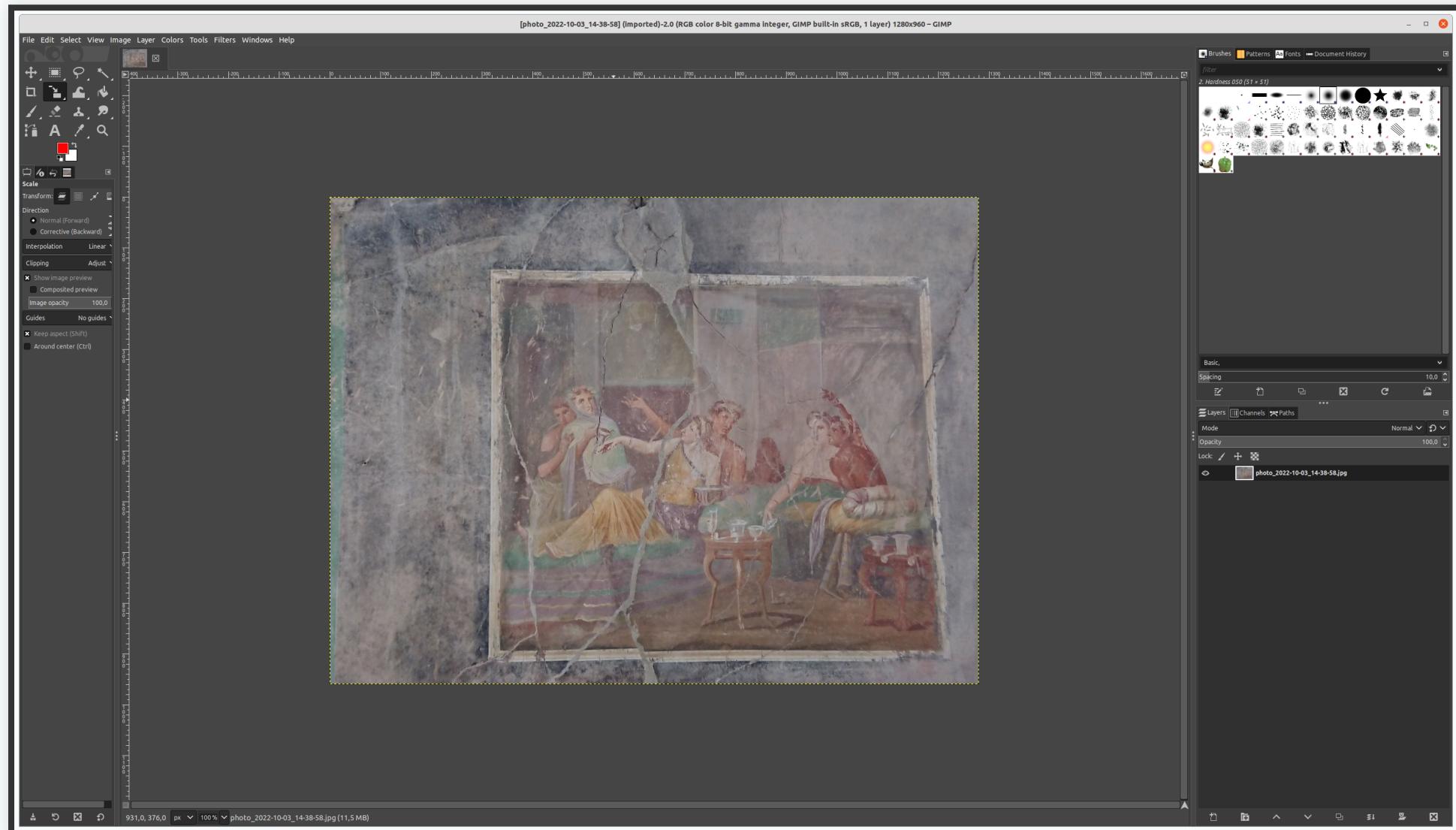
size: 1.7 MB

Another example

size: 1.0 MB

size: 13.0 MB

Compression with GIMP



Exercise

1. We divide in 3/4 groups, download software (GIMP) and images
2. Each group compress the images at their best
3. Images are shown with the original one for a test
4. The group whose images are smaller (in size) wins

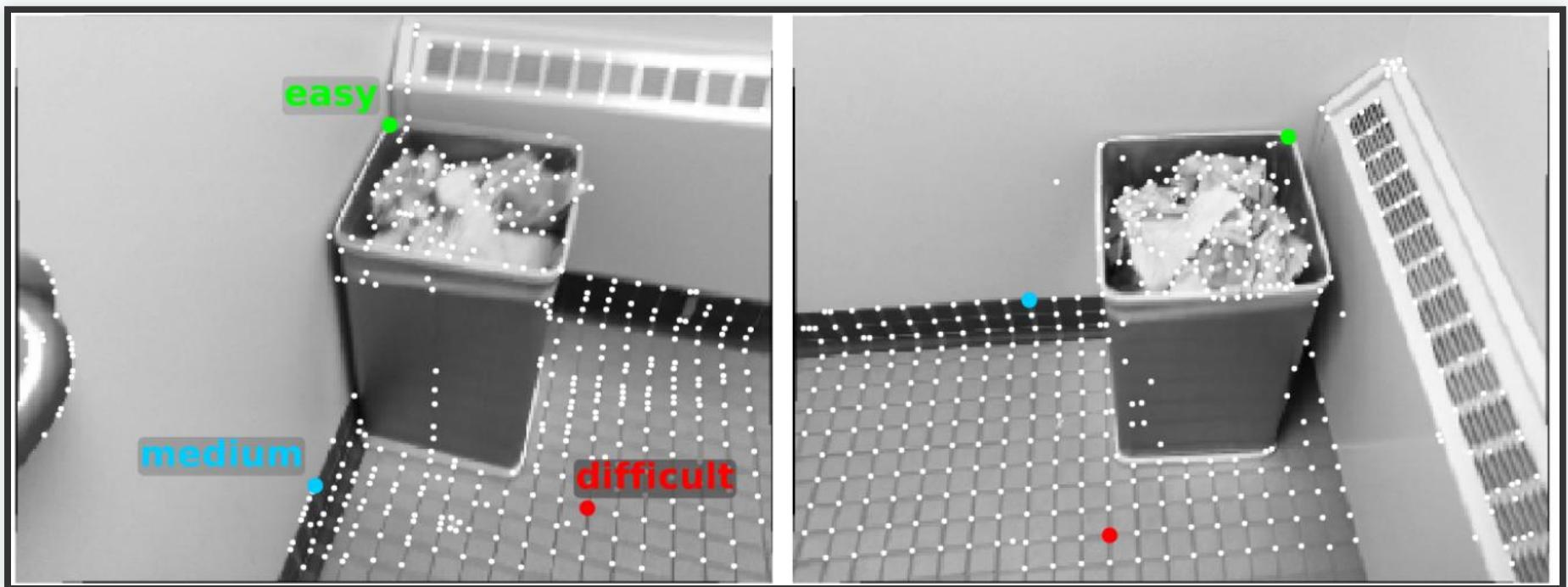
Image Alignment



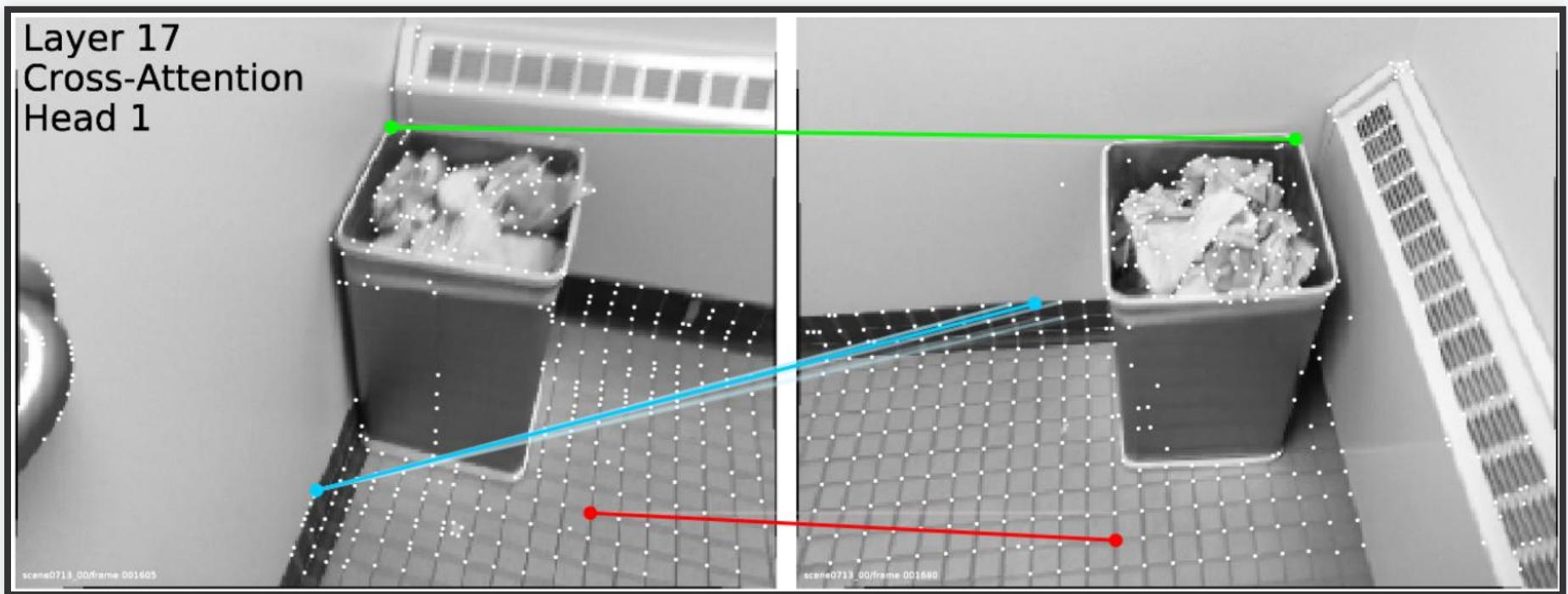
How does alignment work?



Keypoint Detection



Keypoint Match



Do we have different types of alignment?

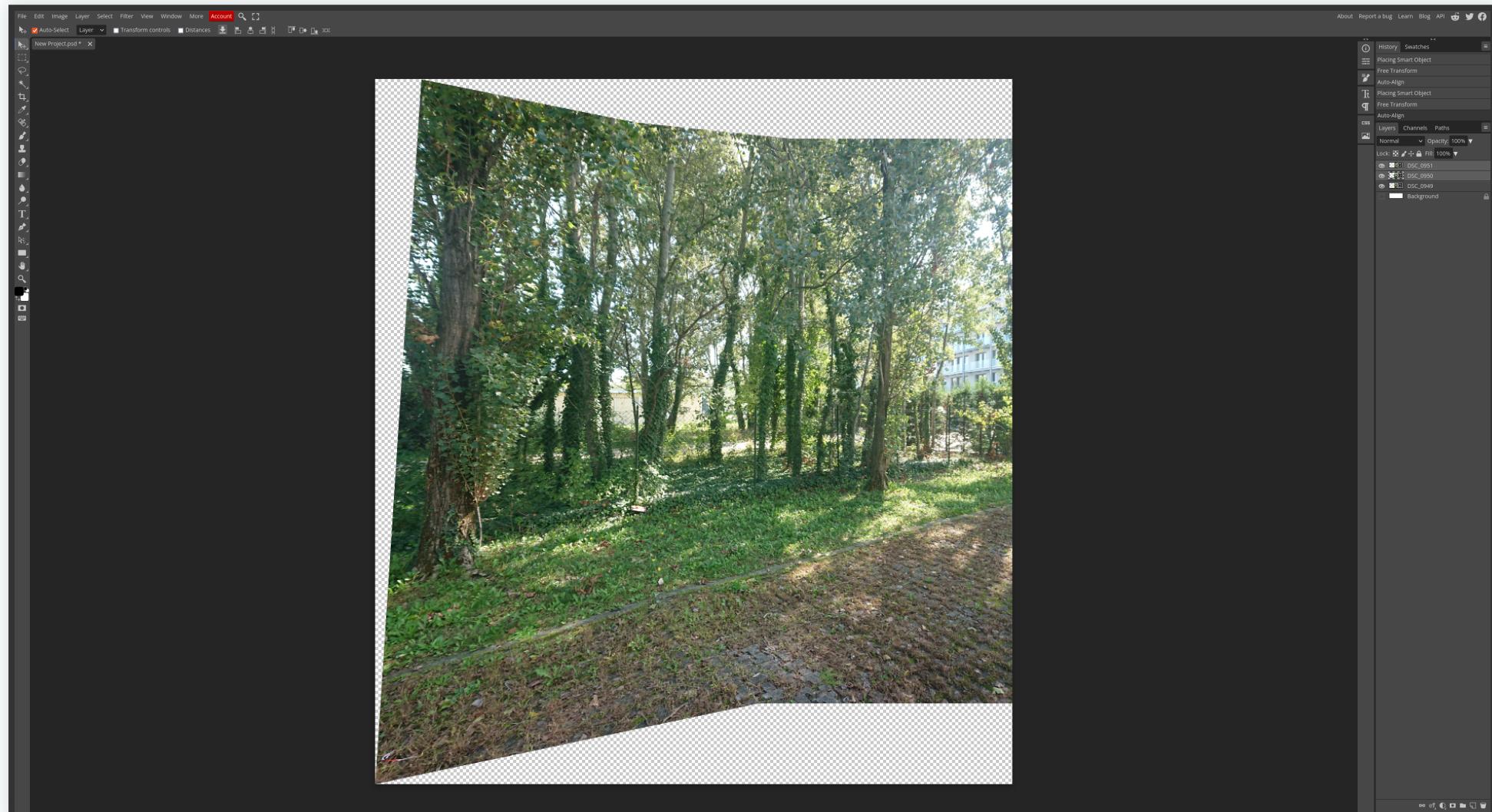
collage

spherical

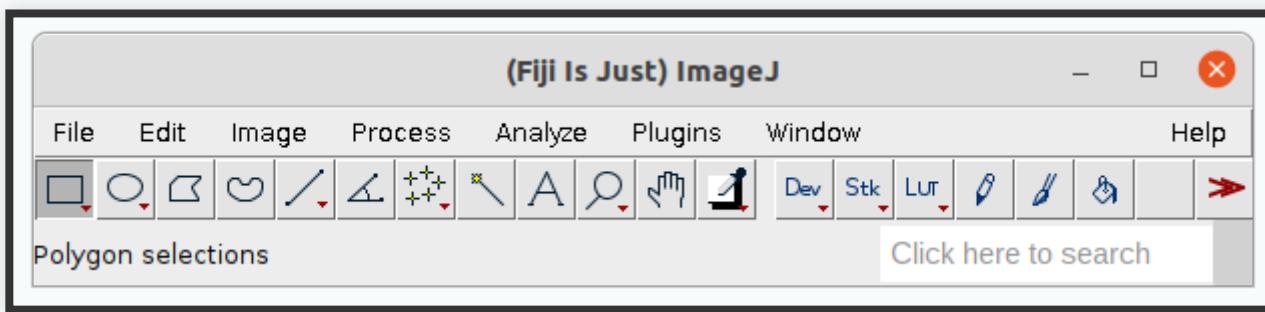
Alignment in practice

- Enough overlapping and features
- Same condition on capturing

Alignment with Photopea



Alignment with ImageJ (Fiji)



An example of alignment



Exercise

1. We divide in 3/4 groups, download the images
2. Each group tries to align the images at their best
3. Challenge 1: what is the minimum number of images to obtain full picture?
4. Challenge 2: what is the best number of images?

Video Compression

What is the difference between video and image
and how can this be used for compression?

An example

Higher Quality (24.0 MB)

Lower Quality (9.9 MB)

Handbrake

HandBrake

File Queue View Presets Help

Open Source Add To Queue Start Pause Presets Preview Queue Activity

Source: Gandhi in visita a Roma nel 1931-ZcUPkbYuhok, 600x480 (600x480), 5:4, 29,97 FPS, 1 Audio Track, 0 Subtitle Tracks

Title: 1 - 00h03m09s - Gandhi in visita a ... Range: Chapters: 1 - + - 1 - +

Preset: Official > General > Fast 1080p30

Summary Dimensions Filters Video Audio Subtitles Chapters Tags

Format: MPEG-4 (avformat) ▾
 Web Optimized
 Align A/V Start
 iPod 5G Support

Duration: 00:03:09

Tracks: H.264 (x264), 30 FPS PFR
English, AAC (avcodec), Stereo
Chapter Markers

Filters: Comb Detect, Decombe

Size: 444x338 storage, 444x338 display
1:1 Pixel Aspect Ratio
3,941:3 Display Aspect Ratio



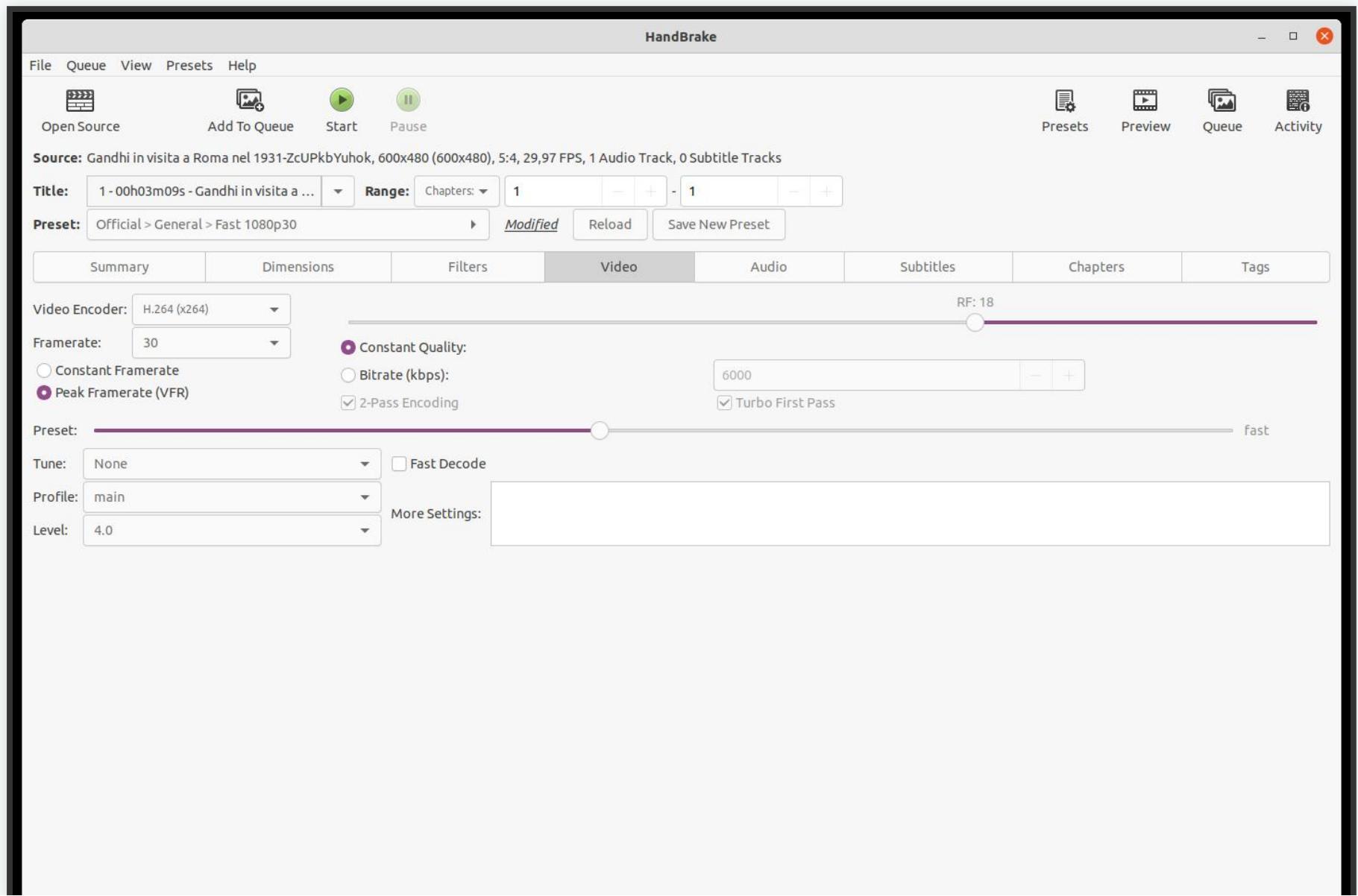
Save As:

To: ▾

Encode Done! 0 encodes pending

Video Compression Presets

Video Compression Parameters



Save As: Gandhi_18.mp4

To:  Videos ▾

Encode Done! 0 encodes pending

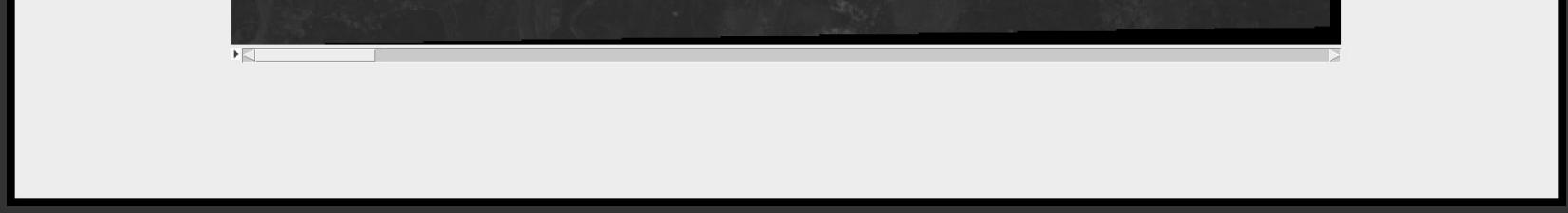
Exercise

Compress the video as much as possible - what is the limit?

Bonus: open hyperspectral images

Import from ImageJ





Bonus: colorize old images and videos

Colorizing and Restoring Photos & Video.

Bringing Color Back Since 2018.

OUR WORK



Online Demo

See your heritage in color

Upload black & white or faded color photos and be amazed by the results

 Upload photo

OR DRAG AND DROP ▾

COLORIZE



Colorize your black & white photos using the world's best
deep learning technology

RESTORE COLORS NEW



Restore the colors in faded color photos with the world's
best color restoration technology

Free signup is required. Photos uploaded without completing signup are automatically deleted to protect your privacy.

Licensed by MyHeritage from  DeOldify, created by Jason Antic and Dana Kelley.

Resources

- Github Repository
- Notebook for video colorization

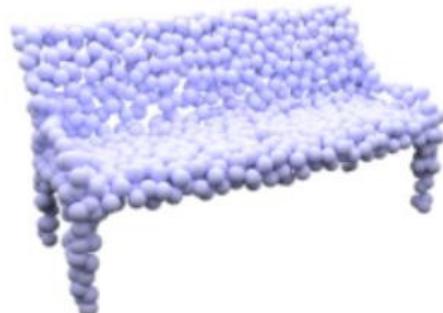
(it needs a `from deoldify.visualize import *` before the colorizer get_video() call)

3D Reconstruction

How can 3D data be stored?



(a) Voxel



(b) Point



(c) Mesh

Compression for 3D data?

For Friday

We will work on 3D Reconstruction

Please install Meshroom