User-based application for the restoration of medieval frescoes

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Context

A painting of Elias Garcia Martinez , 1930.

The original painting

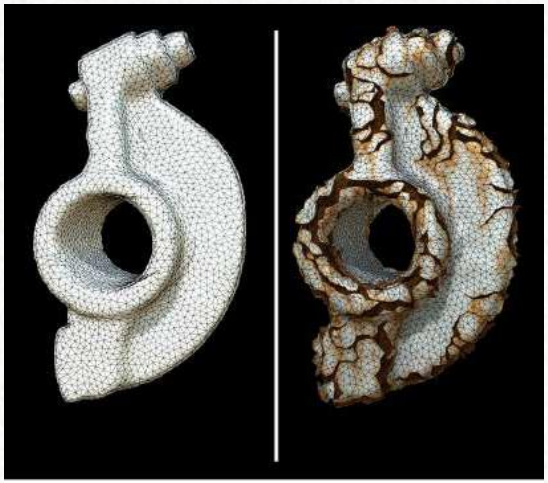
The painting restored by an expert

The painting restored by an amateur

A work on complex paintings

Fresco from the abbey of Saint Savin

State of the art



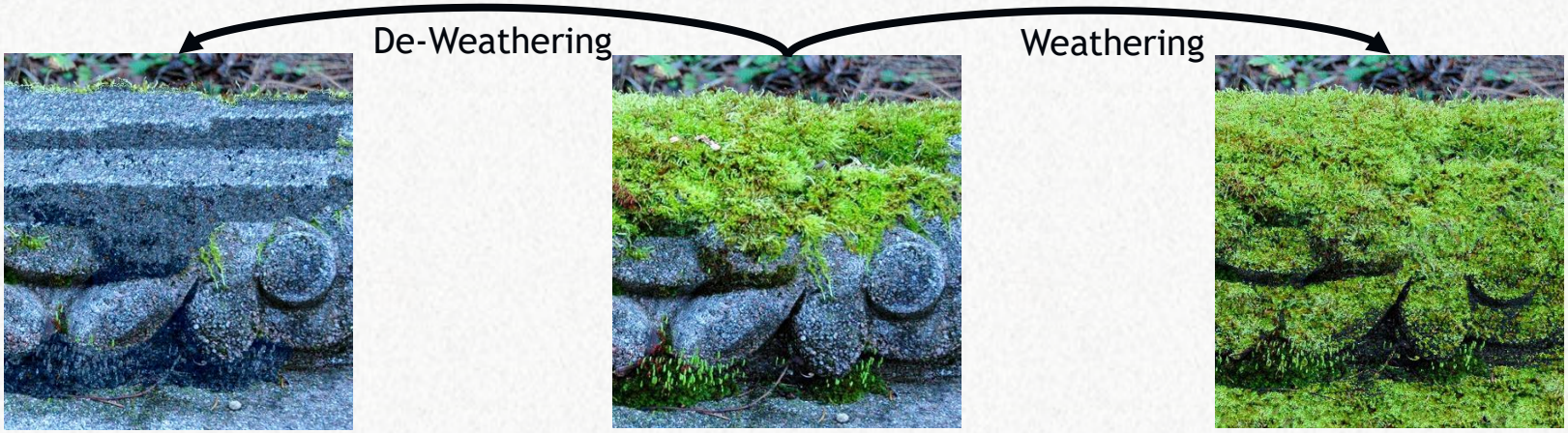
Physically-based weathering [1]

Data-driven weathering simulation [2]

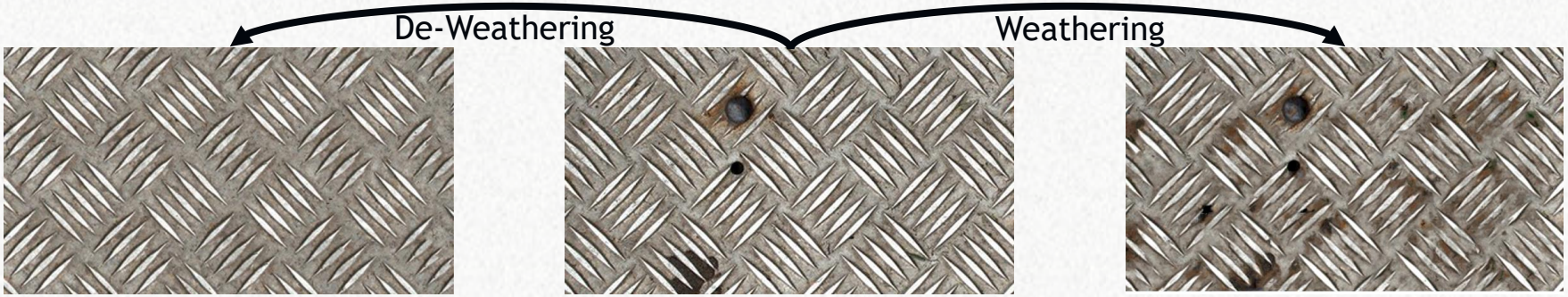
Manifold weathering simulation [3, 4]

2D weathering simulation [5, 6, 7]

State of the art – 2D



2D weathering simulation with a user input [5]



2D automatic weathering simulation [7]

Restoration of simple textures

1.

2.

1. The original weathered area from the painting
2. Restoration with an artificial intelligence model specialized in inpainting

Restorer-guided restoration

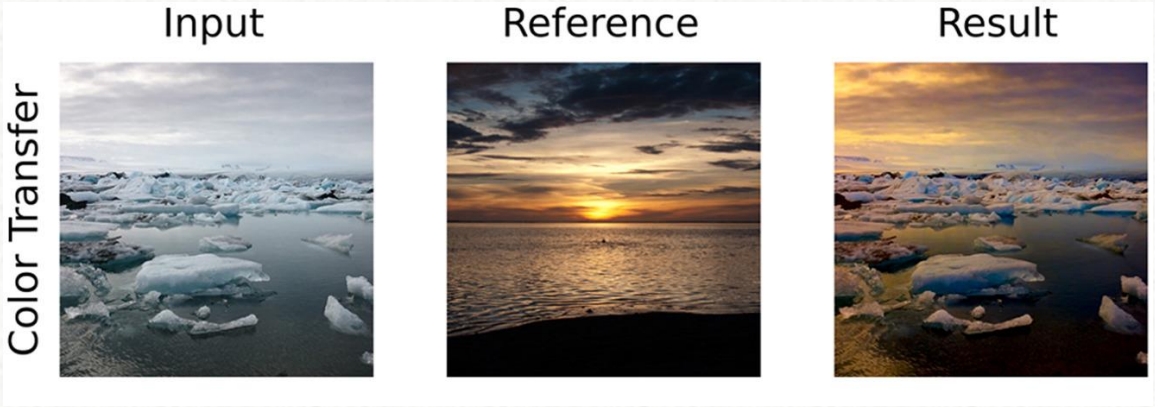
Small square of texture extracted

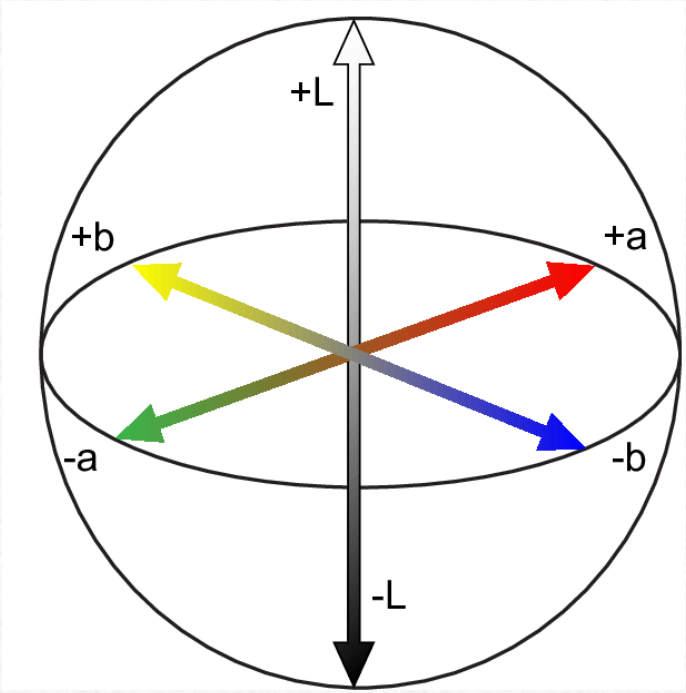
Single point of color extracted

Restorer-guided restoration -- Segmentation

Segmentation of a fresco with segment anything 2 [8]

Restorer-guided restoration – LAB color space





As explained in « Colour Spaces for Colour Transfer » [9] CIELab is the best color space to do a color transfer color

Restorer-guided restoration – color restoration

Restoration of the color

Restorer-guided restoration – Texture generation

Texture generation by example [10]

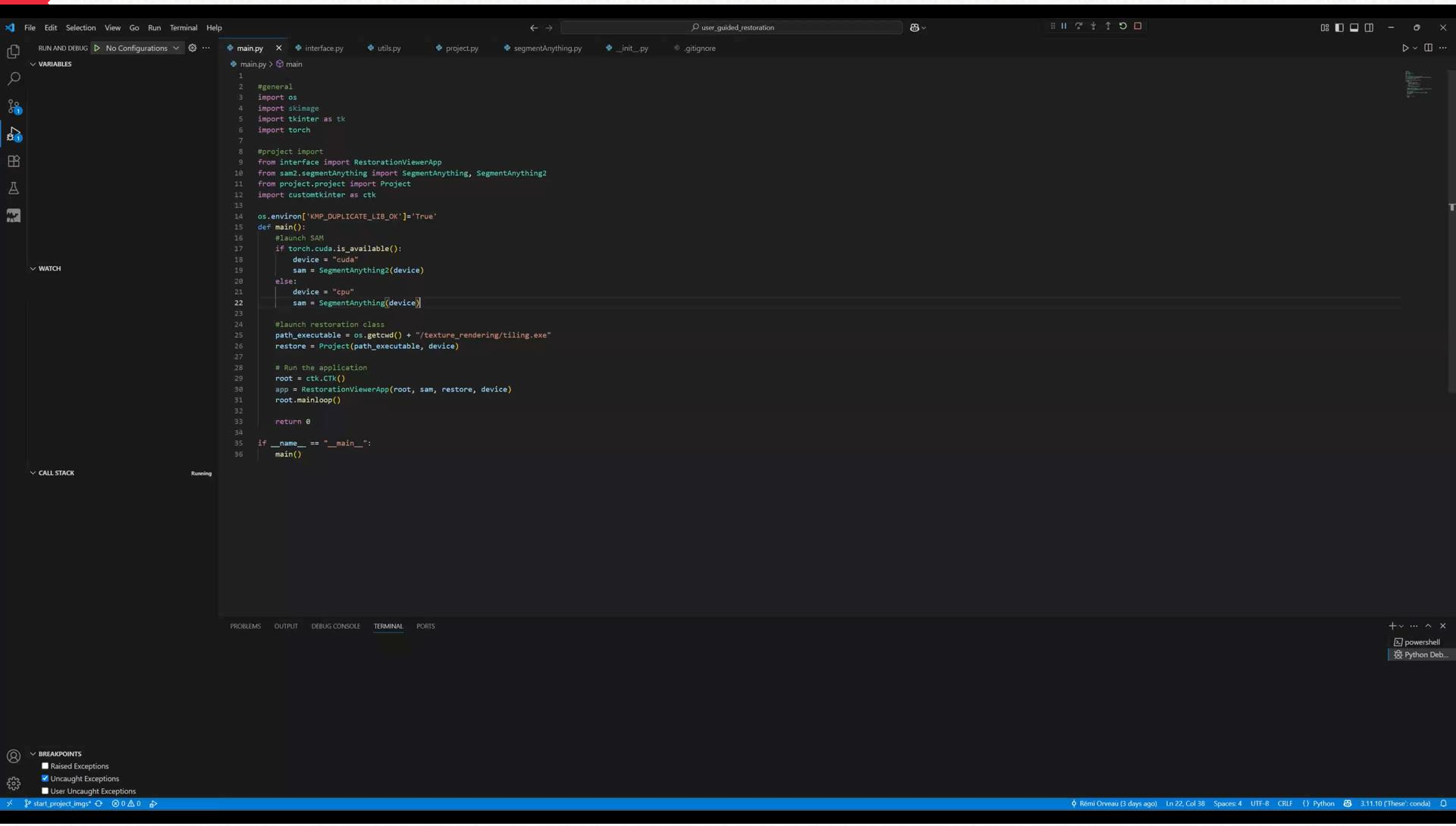
Restorer-guided restoration – Combination and errors

Interpolation

A mix between the original and the restored imaged

A map to interpolate the details of different color from the original image

Démo


File Edit Selection View Go Run Terminal Help
user_guided_restoration
RUN AND DEBUG No Configurations
main.py interface.py utils.py project.py segmentAnything.py __init__.py .gitignore
main.py > main
VARIABLES
WATCH
CALL STACK
Running
#general
import os
import skimage
import tkinter as tk
import torch
#project import
from interface import RestorationViewerApp
from sam2.segmentAnything import SegmentAnything, SegmentAnything2
from project.project import Project
import customtkinter as ctk
os.environ['KMP_DUPLICATE_LIB_OK']='True'
def main():
#launch SAM
if torch.cuda.is_available():
device = "cuda"
sam = SegmentAnything2(device)
else:
device = "cpu"
sam = SegmentAnything(device)
#launch restoration class
path_executable = os.getcwd() + "/texture_rendering/tiling.exe"
restore = Project(path_executable, device)
# Run the application
root = ctk.CTk()
app = RestorationViewerApp(root, sam, restore, device)
root.mainloop()
return 0
if __name__ == "__main__":
main()
PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL PORTS
powershell
Python Deb...
BREAKPOINTS
Raised Exceptions
Uncaught Exceptions
User Uncaught Exceptions
start_project_imgs*
Rémi Orveau (3 days ago) Ln 22, Col 38 Spaces: 4 UTF-8 CRLF Python 3.11.10 ('These': conda)

Conclusion

Synthesis

- A method of restoration by texture generation and color propagation.
- An application that works with a few clicks

Perspective

- A map to mix the original image and the restored one
- A global restoration application on multiple images from a single project
- A switch between Segment Anything 1 and 2 to work on a CPU
- Publication to the Journal of Computing and Cultural Heritage JOCCH

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