Watermark removal

Intro to CV 2022

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Problem description

- There are plenty of beautiful images in the internet…
- but they often have watermarks.

Problem description

Why it is important:

- it allows to apply the knowledge from the course
- it’s fun

Expected value:

- clean beautiful images

Problem description (dataset)

We gathered a small dataset of 64 images from iStock.

- 32 watermarked images
- 32 corresponding clean images
- most images have resolution of 600x400

Ideas

We had a lot of them

General pipeline

A sane approach to watermark removal is

- Detect watermarks
- Obtain an accurate mask for each watermark
- Run inpainting

We focus on detection part and consider a number of approaches.
To refine masks, we use morphological operations, and use `cv2.inpaint(...)` for the last stage.

Let’s discuss the detection.

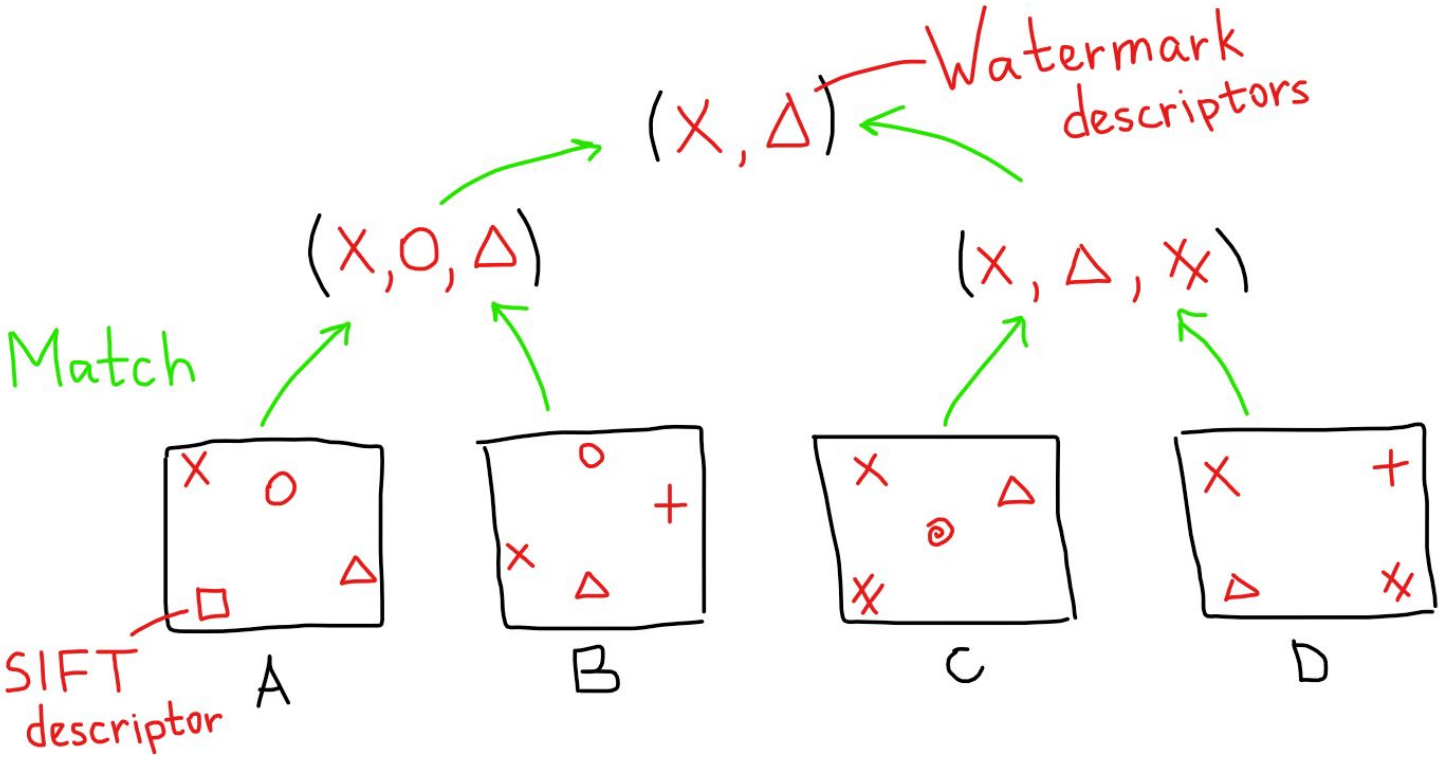
Idea #0: Pattern matching

Sample watermarked image

Pattern matching

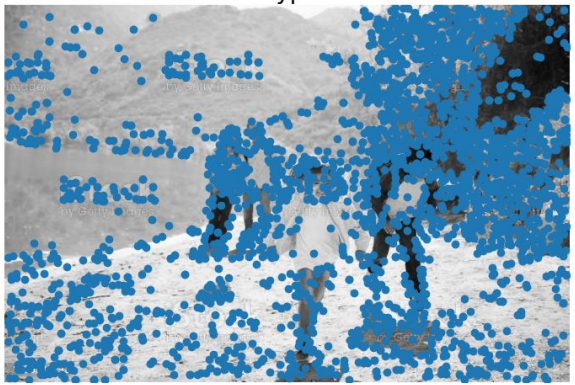
Ideal mask

Idea #1: SIFT intersection (dreams)



Idea #1: SIFT intersection (reality)

All keypoints

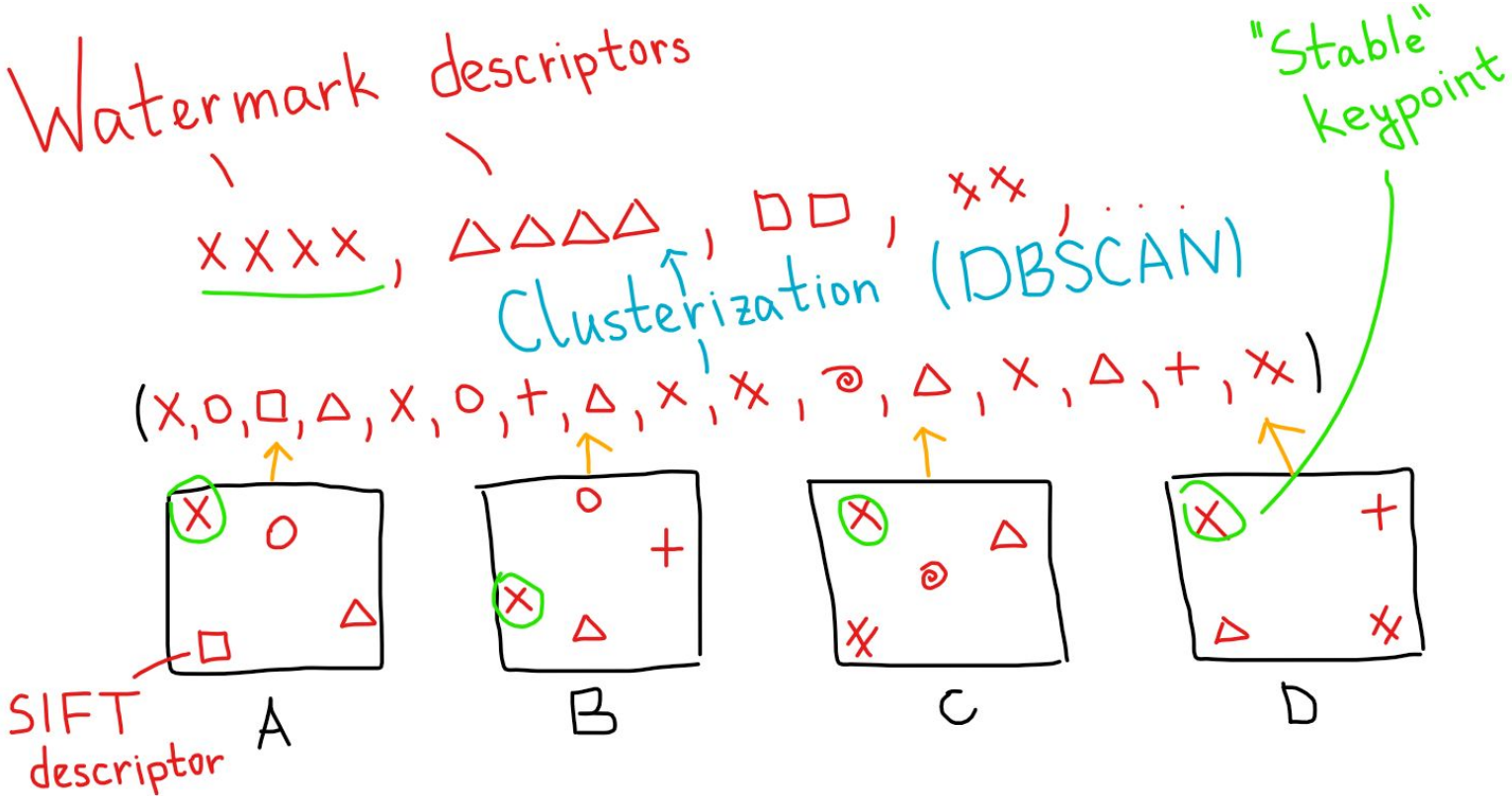


Matched keypoints of two images

Matched keypoints of two pairs of images

Matched keypoints of three pairs of images

Idea #2: SIFT clusterization (dreams)



Idea #2: SIFT clusterization (reality)

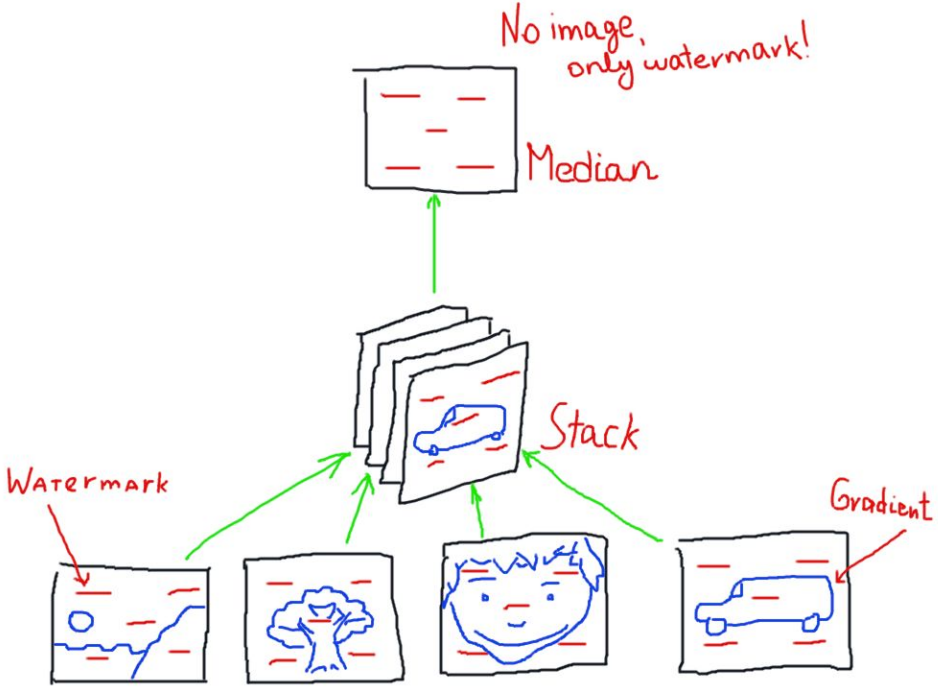
Stable keypoints, sample 11

Stable keypoints, sample 3

Idea #3: Median of gradients (dreams)

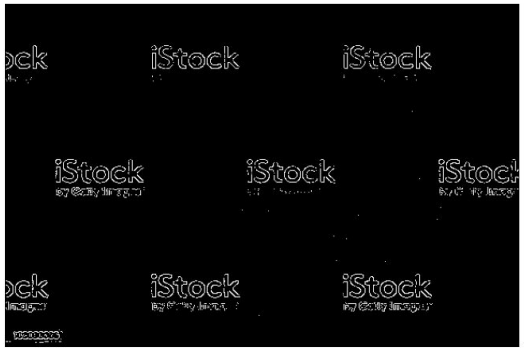
Assumption: watermarks on all images are located in the same (yet unknown) place

Paper:



Idea #3: Median of gradients (reality)

Raw mask



Mask after morphological operations

Ideal mask

Idea #3: Median of gradients (reality) (good)

Original image with watermark

Original image without watermark

Inpainted via mask from median of gradients

Inpainted via ideal mask

Idea #3: Median of gradients (reality) (bad)

Original image with watermark

Original image without watermark

Inpainted via mask from median of gradients

Inpainted via ideal mask

Idea #3: Median of gradients (metrics)

Image pair	PSNR
Clean + With watermark	28.52
Clean + Ideal inpainting	29.14
Clean + Gradient mask inpainting	27.69

Overall

- Pattern matching fails
- SIFT intersection is too noisy
- SIFT clusterization is promising, but requires complicated pipelines
- Median gradient is very simple and sometimes works ok,
  but the metrics are low because the mask is extremely coarse

Thank you for your attention!

We are ready for questions