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.

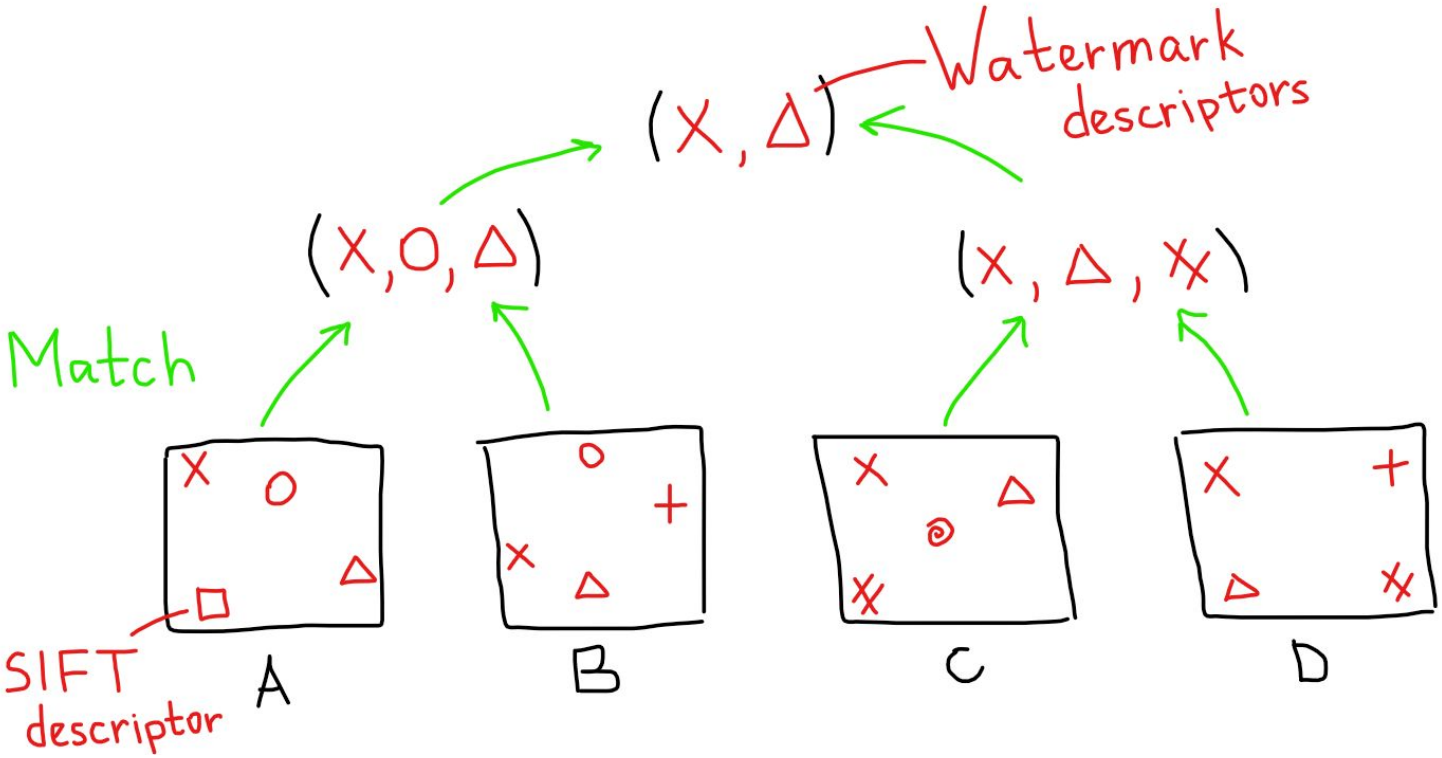
Idea #0: Pattern matching

Sample watermarked image

Pattern matching

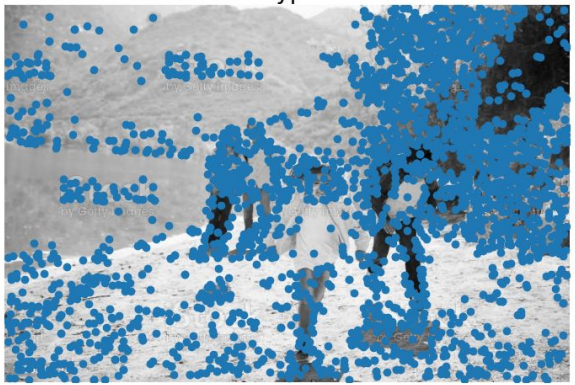
Ideal mask

Idea #1: SIFT intersection (dreams)



Idea #1: SIFT intersection (reality)

All keypoints

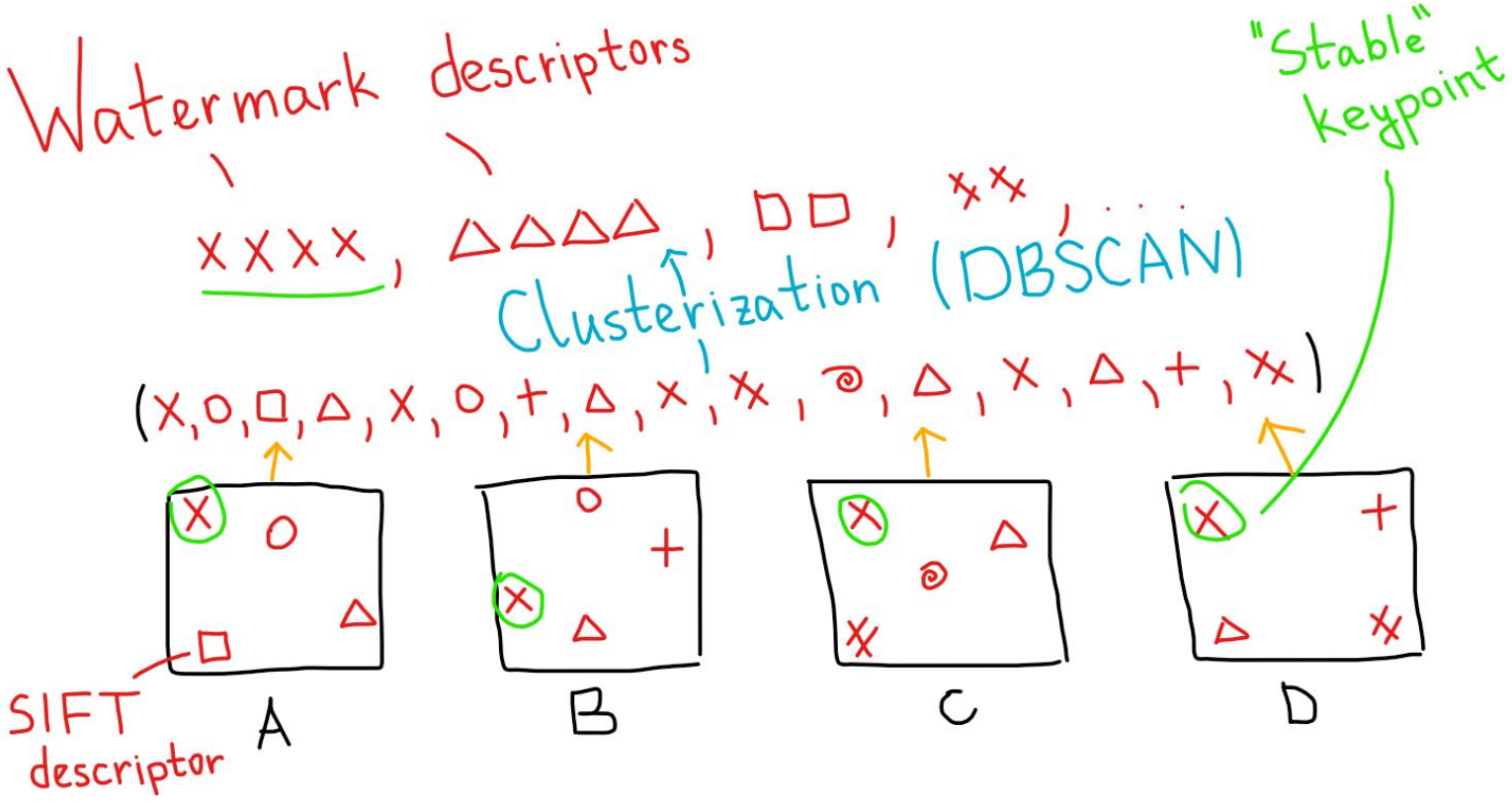


Matched keypoints of two images

Matched keypoints of two pairs of images

Matched keypoints of three pairs of images

Idea #2: SIFT clusterization (dreams)



Idea #2: SIFT clusterization (reality)

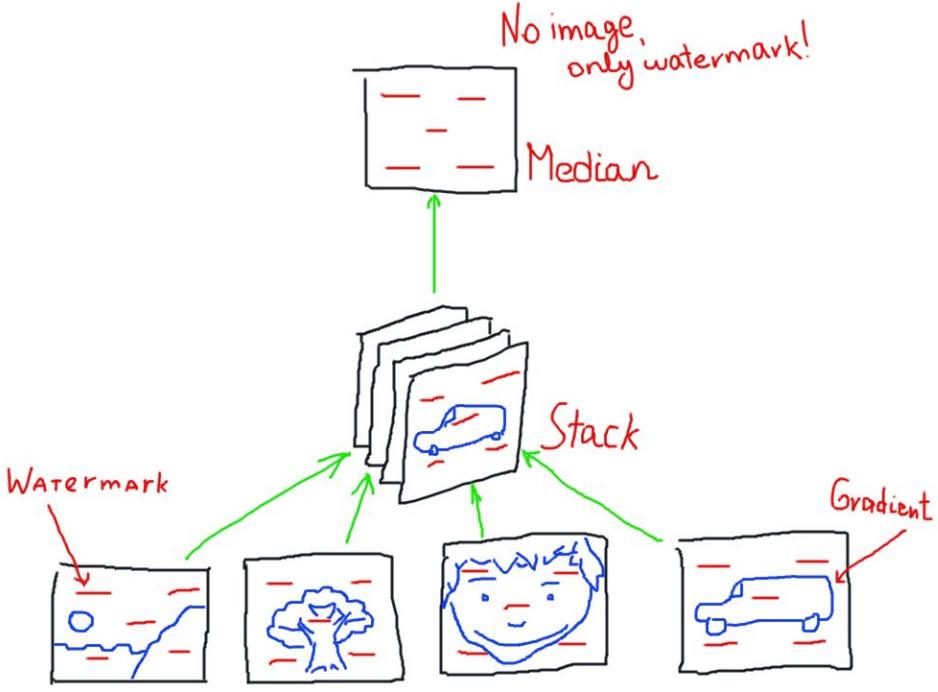
Stable keypoints, sample 11

Stable keypoints, sample 3

Idea #3: Median of gradients (dreams)

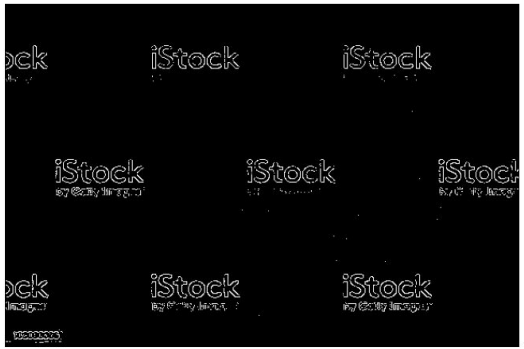
Assumption: watermarks on all images are located in the same (yet unknown) place

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.
  With few images it is hard to deal with small letters, for example.

Thank you for your attention!

We are ready for questions