MLRF Lecture 02

J. Chazalon, LRE/EPITA, 2025

Agenda for lecture 2

1. Introduction
2. Local feature detectors
3. Local feature descriptors

Introduction

Lecture 02 part 01

Previously, in MLRF…

Summary of last lecture

Global image descriptors

- Color histogram
- Limited descriptive power
- Which distance function?

~~Character descriptors~~

- ~~Light and powerful~~

~~Texture descriptors~~

- ~~Limited use~~

Clustering

- K-Means
- Hierarchical Agglomerative Clustering

Debriefing of practice session 1

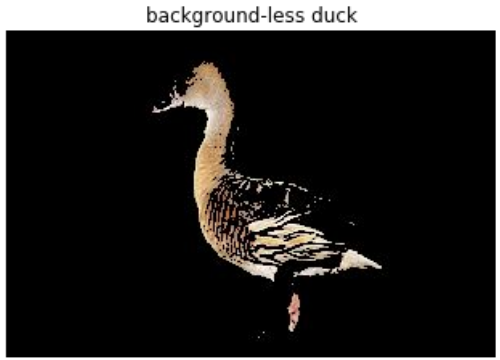
PS1 content

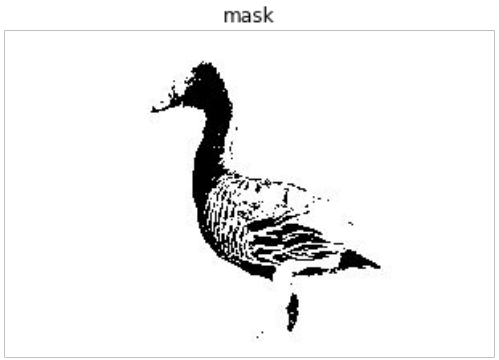
1. Jupyter tricks
2. NumPy reminders
3. Intro to image manipulations
4. Color histograms

Discussion

- Who completed part 1? 2? 3? 4? 5?
- Any remarks, comments, questions?
- Things to keep, change, remove?

Practice session 1: Take home messages (1/2)





How annoying was it
to manually adjust color thresholds
to select the duck?

How could have we automated it?

Practice session 1: Take home messages (2/2)

Color histogram

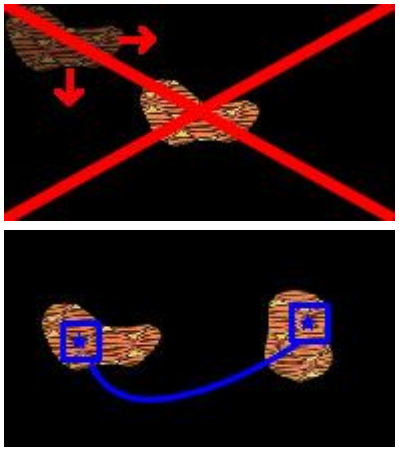
- Very lightweight
- Good filtering stage
- But limited descriptive power

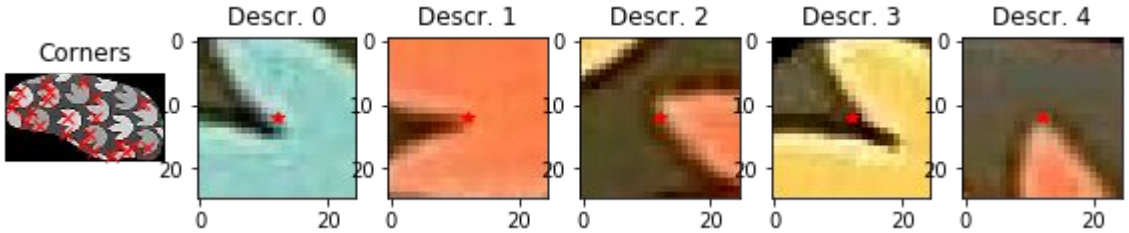
Next practice session(s)

Next practice session

Twin it!, again, with a slightly more elaborated approach:

1. Pre-select bubbles based on their colors ⇒ Color histograms
2. **For the pre-selected bubbles, check their content is similar**
   ⇒ Detect stable points and extract the patches around them

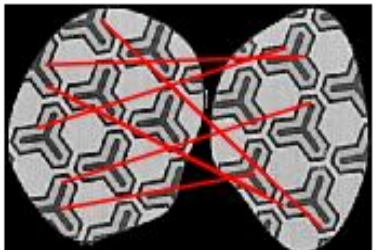




Next practice session

Twin it!, again, with a slightly more elaborated approach:

1. Pre-select bubbles based on their colors ⇒ Color histograms
2. **For the pre-selected bubbles, check their content is similar**
   ⇒ Detect stable points and extract the patches around them
   ⇒ Compare (match) those patches



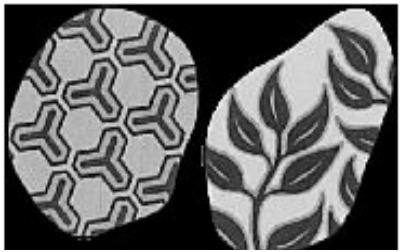


Image descriptors

Issues with methods based on pixel comparison

What is important? What do they consider? **Raw pixels!**

⇒ We want to be able to make use of **domain knowledge**!

Like sensitivity to shape, or dominant color information.

They are terribly **slow** and works **only for small images.**

⇒ We want to **summarize an image** to a much smaller vector.

They are **sensible to rotation, scaling**, and many other perturbations.

⇒ We want to adjust sensitivity/invariance to perturbations.

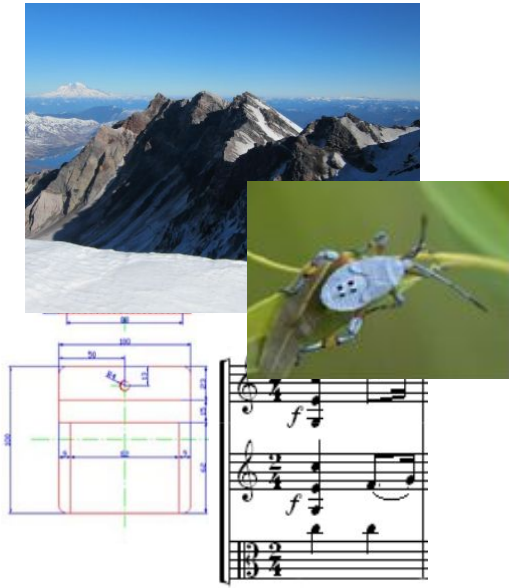
Do we tolerate translation? Rotation? Intensity shift?

How can we compare different pairs of images? **Metric issues.**

⇒ We want to be able to achieve **more than 1 vs all comparisons.**

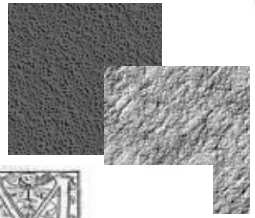
Image descriptors: Overview

Different sizes and contents ⇒ Different kind of descriptors



Large images, many parts

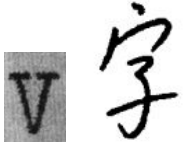
Complex small images



Textured areas

Logos

Words



Isolated symbols and letters

Local image patches, lines, etc.

≈ 500×500 px and more

≈ 20×20 px and less

Image descriptors: Overview

Different sizes and contents ⇒ Different kind of descriptors

Different problems ⇒ Different choices

- Computation / memory constraints
- Which perturbations to we have to tolerate?
  rotation, translation…
- What is the expected output?
  classification, detection, ranking, segmentation…

Many, many approaches ⇒ Impossible to list them all

- Examples of several categories
- Focus on very useful or instructive ones