

MIF17 : Analyse d'image TP Mars 2022

In this TP students can choose and perform any one of these two topics

1. Image segmentation
2. Representative body parts (head, torso and arms) identification and hand tracking

Core of Topic 1: (2 members)/team

1. Purpose: Image segmentation

Object: to implement the segmentation method: region growing

Preliminaries :

The first part of this project was focused on learning and handling OpenCV as well as understanding some basic functions such as filtering, histogram manipulation, Using the tools available on OpenCV.

Core of the TP :

This step concerns the implementation of the region segmentation method: region growing. The aim is to carry out the variant with seed placement and processing of the different seeds simultaneously (like a parallel processing).

We recall that in this case two steps are required:

- (i) a region growing step around the seeds
- (ii) step of merging adjacent similar regions

This achievement requires further consideration and development of the following aspects:

1. The representation of the data structures: the data structures must be judiciously chosen in particular for the management of the stage of aggregation of the pixels around the seed and then the update of the adjacency of the regions following their merging. Attention the complexity aspect is one of the important aspects
2. Concerning the growing and merging criteria: you are expected to propose ideas/processes.
3. The distribution of seeds: you are encouraged to propose heuristics, ... heuristics.

What is expected in this task:

The lab will be done in pairs.

You will be asked to produce a program that works and that allows you to segment an image with the following deliverables:

- The source code of the task to be delivered in complete (and compilable) form including all dependencies and giving all instructions and compilation options.
- A well written (and well structured) report should explain your choices: representation of the data models, the proposed criteria. The report should also highlight the specificity of your achievement: don't hesitate to use your creativity! You are strongly encouraged to write the report in English.
- A demonstration of the project is required (the date will be fixed later). The presence of both members of the pair is required (count 15mn to 20mn for the demo/binomial). Absence from the demo session is considered as an absence from an exam.
- What is expected for the demonstration: the program must be able to segment an image and display the result as well identified regions. This means that each region must be visualised by a colour (other than the average value of its colour or its grey level). For example, each region can be given a random colour. It must also be possible to display only the borders of the regions obtained.

- Care must be taken to ensure that the processed images and the necessary parameters are not hard-coded. For example, to avoid having to relaunch a compilation because you change the image or the threshold value.

- For the "demonstration" session, you can prepare your "best of", images that you will have chosen yourself, but there will be some imposed images.

The lab can be done in C++ or Python under OpenCV. You can use the basic functionalities (image manipulation: reading, creating, viewing images) as well as filtering, histogram calculation, On the other hand, the whole part specific to the segmentation process must be developed by you. But! this should not prevent you from using the results obtained with OpenCV to compare the performance of your results with those obtained with OpenCV.

If you have any questions: Feel free to ask questions or discuss your ideas during the supervised sessions or post them on the group channel (Rocket.chat). Do not hesitate to answer the questions asked. This allows you to share your ideas and experiences with your peers and makes it easier to solve certain difficulties, without taking anything for granted.

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2. Representative body parts (head, torso and arms) identification and hand tracking

Preliminary:

Perform basic image operations: read and generate an image (different formats: color) and visualize it (students can refer / use OpenCV)

2 . To perform this TP, following preprocessing steps (already covered during the lectures and OpenCV Library) can be useful:

- a. noise removal / filtering
- b. image averaging / smoothing / low pass filtering (space smoothing)
- c. image averaging / smoothing (temporal smoothing)
- d. background subtraction

It is suggested to use some tools for preprocessing step(s) : filtering, convolution with a smoothing mask, Gaussian smoothing operator or other operators that are included in OpenCV.

Core of Topic 2: (2 or even 3 members)/team

This involves identifying body part (head, arm, chest) and following the movement. This step requires the background subtraction. **this step can be performed through OpenCV tools.**

This involves identifying main (but only) upper human body parts (head, arm, torso) and tracking the hand(s) motion. This step requires the background subtraction.

To save time, OpenCv algorithms can be used for the background subtraction stage : A comprehensive tutorial is available here :

https://docs.opencv.org/3.3.0/db/d5c/tutorial_py_bg_subtraction.html

1. To understand the task of background vs foreground object extraction, it is could be beneficial to read some papers (you can ask the teacher for those).

Note: this topic is more open than the first one but also more interesting. It requires curiosity, motivation and imagination, and some bibliography. Of course, the teacher is ready to help the group to identify a couple of (2-3) papers.

Points to remember:

Successful completing of task requires analytical thinking, critical analysis of different approaches and development of the following aspects:

1. Appropriate choice of data structures for different critical steps of algorithms. Warning!! it is important to handle computations complexity appropriately.
2. Termination criteria for (iterative) methodologies.
3. Selection of initial conditions.

TP deliverables:

Following deliverables are expected:

1. Students are expected to submit source code for the implemented algorithm. The source code should be complete and commented well. Submission should include all required tools and all other dependent files necessary for compilation (compilation guidelines should also be provided).
2. Report for the TP, which should address the following aspects:
 - a. Presentation of implemented algorithms with respect to other existing algorithm (analysis).
 - b. Specific achievements i.e. novelty of proposition (if any).
 - c. Results on different images, result at different steps (if possible)
 - d. Report should be well structured and complete.
3. A demonstration of the software/algorithm will be made. The presence of all team members is mandatory (~ 20 minutes for the demo). The absence from the demo session will be considered as an absence from an exam.

Notes:

1. The algorithms will be implemented preferably in C++, some OpenCV tools for basic functionalities (image manipulation: reading, creation, image visualization, etc.) can be used. GPU implementation will be appreciated (but not required).
2. the implementation will be done in C++ or Python.
3. You are strongly encouraged to write the report in English.

If you have any questions: Feel free to ask questions or discuss your ideas during the supervised sessions or post them on the group channel (Rocket.chat). Do not hesitate to answer the questions asked by your classmates as well. This allows you to share your ideas and experiences with your peers and makes it easier to solve certain difficulties, without losing any of your knowledge.

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