ELEN-0016 – Computer Vision
Student projects 2021-2022

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Version 1.0

Contents

1 Introduction

The aim of the project is to "practice" computer vision with a practical application. To do so, your task is to implement a solution that *counts* and *detects* droplets and cells in high frame rate videos. The learning objectives are for you to

- handle images/videos,
- design methods,
- understand its components,
- evaluate the quality of the results, and
- be able to comment the solution.

In this project, you will work with series of frames (videos) which display droplets amongst which some contain a number of cells (ranging from 0 to a few). Droplets move inside of a tube, from left to right. As the frame rate is high (250 FPS), same droplet might be seen several times. A sample frame is shown in Figure 1.

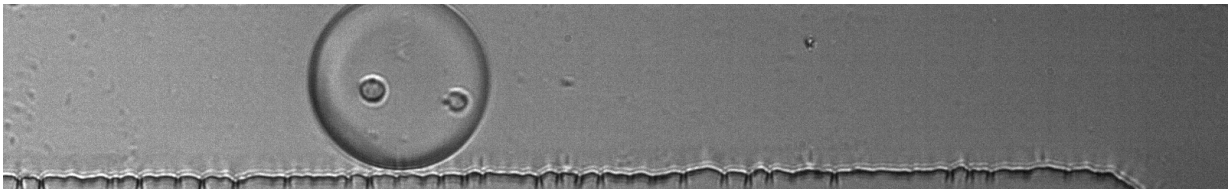

Figure 1: Sample frame showing 1 droplet containing 2 cells.

2 Tasks

To carry out this project, you will have to work on 3 main tasks: (1) the data, (2) the method, and (3) the evaluation. These tasks are discussed hereafter.

2.1 Annotation

For this task, you are requested to annotate annotate 1 sequence per group. Annotations are the bounding boxes for the droplets and for the cells. For the annotation, you will be give an access to the CYTOMINE platform, according to the tutorial session. For the annotations, you must keep track of the same droplets, given that the counter should not be increased if we see the same droplet multiple times. At the end of the annotation process, the sequences of each group will be shared, so that you can use at your convenience all the data. The annotation will start the **29th of September** and has to be finished for the week after.

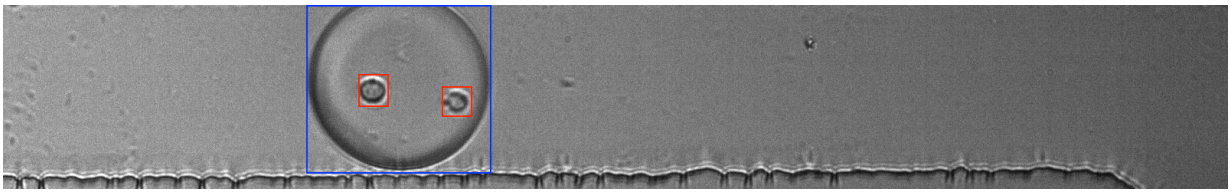

Figure 2: An annotated frame with the bounding boxes draw on the image.

2.2 Method

When the annotation process is done, you must ***clearly define what is the problem statement (or, in other words, the task)*** that you want to solve and send it to r.vandeghen@uliege.be, with the following object: "ps_group_*id*.pdf".

2.2.1 Background subtraction

The first task that you have to implement is a background subtraction method, which will be useful to remove noise in the sequence. This first task is due by **Wednesday, the 20th of October**.

2.2.2 Counting

The main task that you have to undertake is the counting of droplets as well as the counting of the number of cells per droplet, which will give a histogram representing the distribution of cells per droplet, with the highest frame rate. To do so, you are allowed to use the method(s) that you want, as far as you understand all its component. You will have to discuss the choice of your method regarding the performance/inference time trade-off.

By the end of the project, you have to provides the code(s) of your solution. You are allowed to use the programming language and the libraries that you want. However, we will provide helps only with `python`.

2.3 Evaluation

Finally, you have to assess the performance of you method. To do so, you are asked to

- provide a quantitative assessment of your method, by comparing the predictions with respect to the ground truths.
- propose the comparison metrics that you consider the most suitable for your application.
- understand those metrics.

Your evaluation must at least be done on your own sequences.

3 Schedule/calendar

Date	In short	Description
24/09	**Constitution of groups**	**Each group must complete the Google Sheet no later than Friday, the 24th of September, no later than 18h**
29/09	**Introduction to CYTOMINE + start annotation**	
6/10	**Deadline task 1: annotation**	
20/10	**Deadline task 2.2.1: background subtraction**	**Submit results on the Montefiore submission platform**
1/12	**Challenge trial 1/2**	**Submit results on the Montefiore submission platform**
8/12	**Challenge trial 2/2**	**Submit results on the Montefiore submission platform**
9/12	**Send poster**	**Submit project on the Montefiore submission platform**
15/12	**Poster presentation**	

4 Organization and practical details

1. Groups comprise 2 or 3 persons (no exception).
2. Write your poster according to the template give at ...
3. Programming languages: C/C++ or Python. In the code, it is mandatory to clearly identify (with start and end tags) code extracts taken from others programmers. Any failure to identify the extracts is considered as plagiarism and it will result in a global note of 0/20 for all the members of the group!