Technical Questionnaire

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Taks 1 - Video streaming and image processing

The code executes the following function.
The webcam is opened, and all the following operations are made on the incoming frames.
The variable SECONDS define the time acquisition frequency: every SECONDS one frame is stored. The camera acquires images at x fps, and multiplying x with SECONDS, we obtain the variable *interval*, that tell us how many frames we have to wait to save the image. The program creates a directory called "frames"within the parent directory, where all the images are stored.
The callback function to listen to mouse event is necessary to read input of the user: when the user presses the left bottom of the mouse, a point of reference is stored: its coordinate and its RGB values. Every successive frame we look in the all image for the point whose RGB values are the closest to the one of the reference point. Of course this approach is prone to error, unless a very peculiar point is taken. When the user presses again the left bottom of the mouse the reference point is re-initialized.

Task 3 - Computer Vision and Machine Learning

I suggest an algorithm to detect *bananas* in an image.
I would propose the user to watch a video, where many different varieties of *bananas* are shown. I then ask the user to create a box every time he spots an object that he identifies as a *banana*, and to create boxes around objects, parts of the scene, that he recognizes as *non-banana*.
I would thank the user, and collect the samples in two sets: a positive set, where all the images of the *bananas* are stored, and a negative set, where all the *non-banana* are saved.
At this point I would ask myself, which are the features in the images that could distinguish a bananas? Maybe the color, typical yellow-green, and the shape, with strong horizontal gradients towards the edges of the banana. I make a list of possible features, and I proceed extracting those features from the images belonging to both the positive set and the negative set. Now for every training image I have a vector of features of n dimensions. I would represent all the feature of vectors in a n dimensional vector space, and I would try to find the n dimensional vector, the support-vector, that better separates the positive image from the negative image. If, with such technique, the error is large (many false positive and true negative), then I would ask myself if I chose the right set of

feature to describe the *banana*, and I would try with a different set of features. If the error is low, then I would exploit the vector derived before, to analyse new incoming images. Every time I acquire a new image, I would look for patches of different dimensions and in different positions within the image. From every patch I extract all the predefined *banana*-features, and stack them in a vector of feature. I would then compare this vector with the support-vector: if the vector of features lays down on the "positive" side of the plane (where most of the positive images lay down), then I would conclude that in the patch there is an object identified as *banana*, otherwise I would conclude saying that I could not find any *banana* in the patch. Analysing all the patches, I would end up analysing the entire image.
In this case, the *banana* should have clear, and distinguishing features, so a geometric intuitive approach such the one described above could work: divide the hyperplane in two separated sets: the positive one, where most of the positive images lay down, and the negative one, where the negative images lay down; for every patch in the image to analyse, compute the vector of features, and place it in the hyperplane. Based on its position determined whether the desired object was detected or not.

Task 4 - Roadmap and Brainstorming

Features Task 1

Feature 1 Make the tracking more robust. There could be many points with the same RGB values of ref_col. Assign a score based on a linear combination between color-distance and space-distance: pixels with similar color to ref_col, but very distant from the original point will have a lower score than points with similar color to ref_col, but very close from the original point.

Feature 2 Enable multi tracking. Improve the features of the program, allowing the user to press the left bottom of the mouse in multiple positions, and track each time a different point.

Feature 3 Improve user experience. At the beginning open a window dialog that explains the user how to interact with the program: what happens when he presses the left bottom of the mouse, how to exit the program, and so on.

Feature 4 Use your own creativity!

Feature	Priority	Time
1	3	10
2	2	6
3	1	4
4	1	?

Legend

- *Priority* $\in (1, 2, 3)$, where 3 is the highest priority, and 1 the lowest
- *Time*: expressed in hours

I decided to assign higher priority to features that can improve the robustness of the program. Second, the introduction of new features, and last the user experience. The user will have anyway a bad experience if the program is not robust, or the features are very limited. Then, some freedom and creativity, if time allows.

Features Task 2

Feature 1 Extend Object Detection. We want to sell the software to a big chain of supermarket, and we want to be able to identify every fruits, not only bananas. Without changing the set of features chosen for the banana, prepare and run the training process for the detection algorithm, implement it and test it up against new incoming images.

Feature 2 Improve user experience. Show the user a window dialog, where the task is explained. How can the user collect positive samples (left click of the mouse), and how he can collect negative samples (right click of the mouse). Show a counter of the positive/negative samples collected. When reached a minimum of n_1 positive samples and n_2 negative samples, allow the user to exit the program pressing the button *esc*.

Feature 3 Use your own creativity!

Feature	Priority	Time
1	3	8
2	2	4
3	1	?

Legend

- *Priority* $\in (1, 2, 3)$, where 3 is the highest priority, and 1 the lowest
- *Time*: expressed in hours

Again I decided to give more importance to the feature: being able to identify many different fruits can allow us to impress the manager of the supermarket, and he will buy our software. Once we moved the money from the supermarket's pocket into our pocket, we can make the user happier, explaining him all the different combinations of bottoms.

Timeline

	Mon	Tue	Wed	Thu	Fri
Filippo	5H T1F1 3H T1F2	5H T1F1 3H T1F2	2H T1F1 2H T1F2 4H T1F3	1H T1F3 4H T2F1 3H T2F2	6H T2F1 2H T2F2

Legend

- H, time in hours

	Mon	Tue	Wed	Thu	Fri
Filippo	5H T1F1 2H T1F2 1H T1F3	5H T2F1 1H T2F2 2H ?	other	other	other
Ana	5H T1F1 2HT1F2 1H T1F3	4H T2F2 2H ?	other	other	other
Marc	4H T1F2 4HT1F3	5H T2F1 1H T2F2 1H ?	other	other	other

- TiFj, Task i (1 or 2), feature j, where the tasks follow the details explained above.

For every task I would assign more or less 20% more time than expected, since I made the time assumptions very hones (without including already this margin). In general I don't focus one person on a single task for the entire day, but rather assign different tasks. When we are working as a team, I split each task among at least 2 people, but trying to avoid to work all together at the same task. On Tuesday, since the team performed very well, I leave to Ana and Marc a couple of spare hours, and the opportunity of releasing their creativity!

Open Questions

1. *What do you look for when choosing someone to work with?*
   The first qualities I would look for, when choosing someone to work with, are the technical competences relative to the field of work, and the willingness to learn. Regarding the soft skills, I would seek for someone with strong team oriented attitudes, willing to open himself to discussion and with a flexible, open-minded approach to problems. Furthermore I would consider important the capacity of planning and organizing systematically the work.

2. *What do you consider your biggest strengths? How do you see applying them in Eyeware?*
   I am used to work hard to reach my goals, and to invest all the energies in my activities. I don't give up in front of difficulties, trying to overcome them. In Eyeware I would for sure commit myself very much in the everyday work, and I would accomplish all tasks assigned to me, no matter of how long or how effort I have to put on them. I get the work done. I think I have an entrepreneurial mindset, and I would like to contribute to the development of ideas, projects and strategies within the company.

3. *What do you consider to be your biggest weaknesses? How would you go about addressing them?*
   In my limited, but nevertheless significant, leadership experience, I learned that I am not comfortable in taking decisions that are not approved by

the all group; I think that more self confidence and more experience will help me under this point. I would add, as personal weakness, that I need calm and time to work, not too much stress or pressure. Start working in a very dynamic and high demanding environment will help me getting used to more stressful situations and to work under pressure.

4. *Did you previously work together with a product manager? How can you describe your interaction? Did you have conflicts? How did you go about solving them?*
   Short answer: never worked with a product manager.

5. *How does a perfect work day look like for you?*
   I picture my perfect work day starting with a coffee (espresso) with the colleagues, sharing our thoughts, passions, and experiences. During the work, tormented by a difficult problem, I would share it with my neighbor, listen to his advices and feedbacks; together we would come up with a brilliant solution! I would add a new cool feature to the product, something that would make me really proud! Before leaving the office, I would note down all the achievements of the day, and all the goals for the day after. Finally, I would knock off work, and have some relax.

6. *How does a horrible work day look for you? :)* To me, a horrible work day, looks like myself alone in the office, working on some task that don't make me learn anything, and that I know won't be of any real benefit. Food cooked the day before at home, and eaten in the office, making the desk a bit dirty. At the end of the day, I have the impression that my work was useless, and I don't know what I will be doing tomorrow. I go out and rain.

7. *If you had unlimited money what would you do? Would you still work with us? :D*
   Maybe I already have unlimited money, and I am applying for Eyeware! A part from the jokes, if I had unlimited capitals, to be honest, I would not work for you, I would INVEST in you!