

FINGER COUNTER WITH OPENCV

Brief description

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Steps

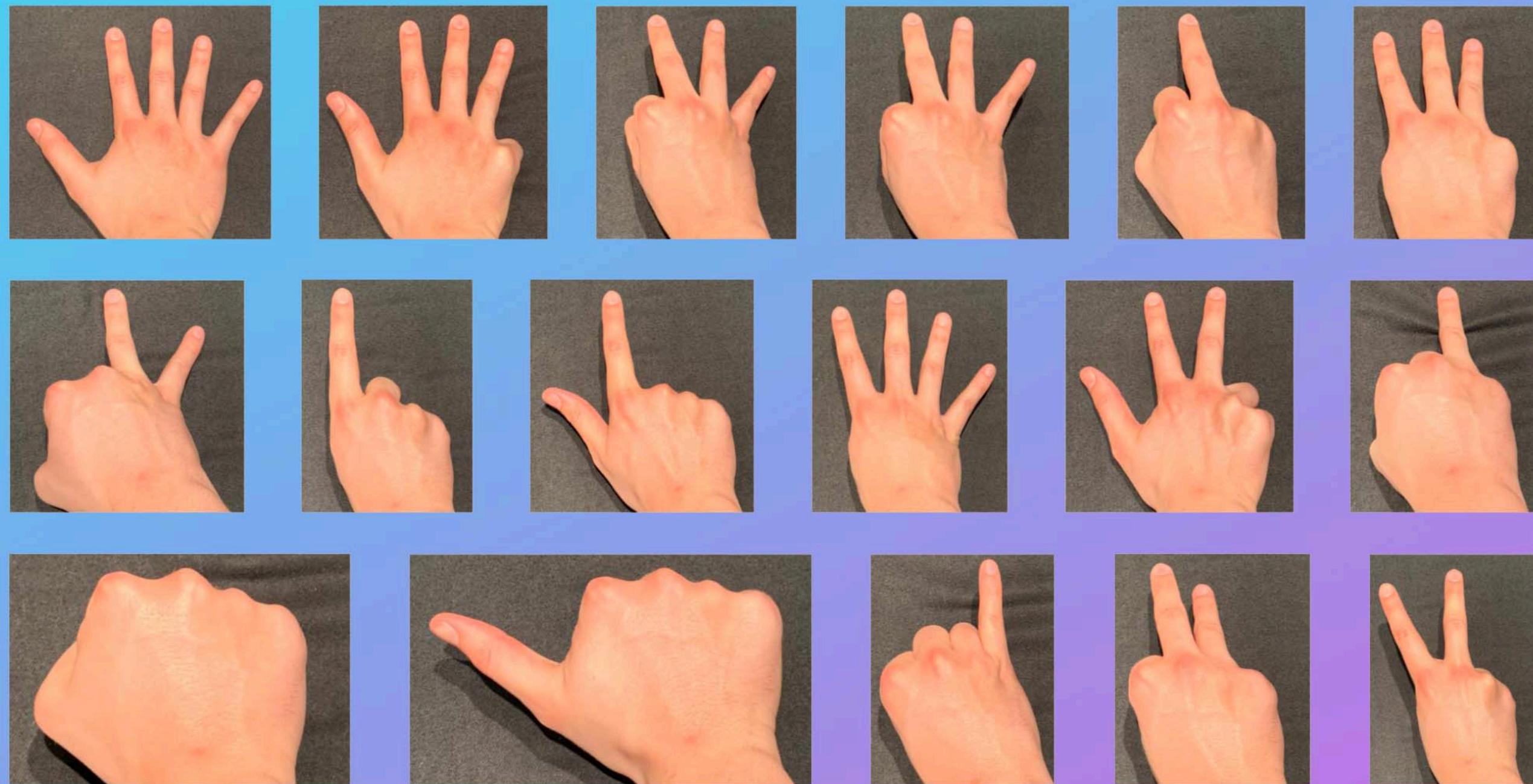
Short steps to maintain the problem

- Data collection
- Study of a hand detection algorithm
- Study of a finger counting algorithm from a hand area
- Packaging of algorithms in simple python modules
- Analysis of final results

Simple Dataset

Uniform, simple and specific

Images of cautious hands in more varied configurations (positions and backgrounds) while remaining fairly simple



Background Dataset

With specific background

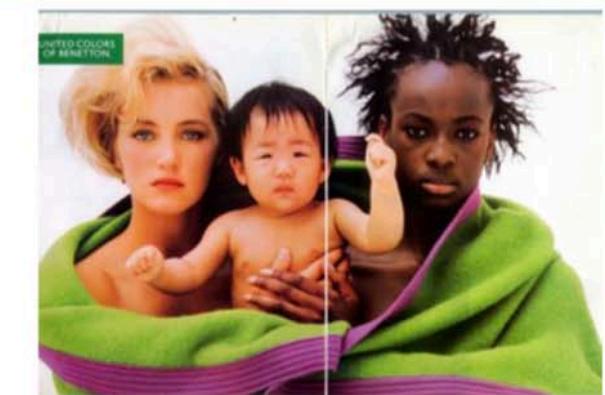
Images showing Caucasian individuals and no longer only hands with different positions and backgrounds so as to test the discriminating character of our filter



Colored skin Dataset

Different ethnic hands

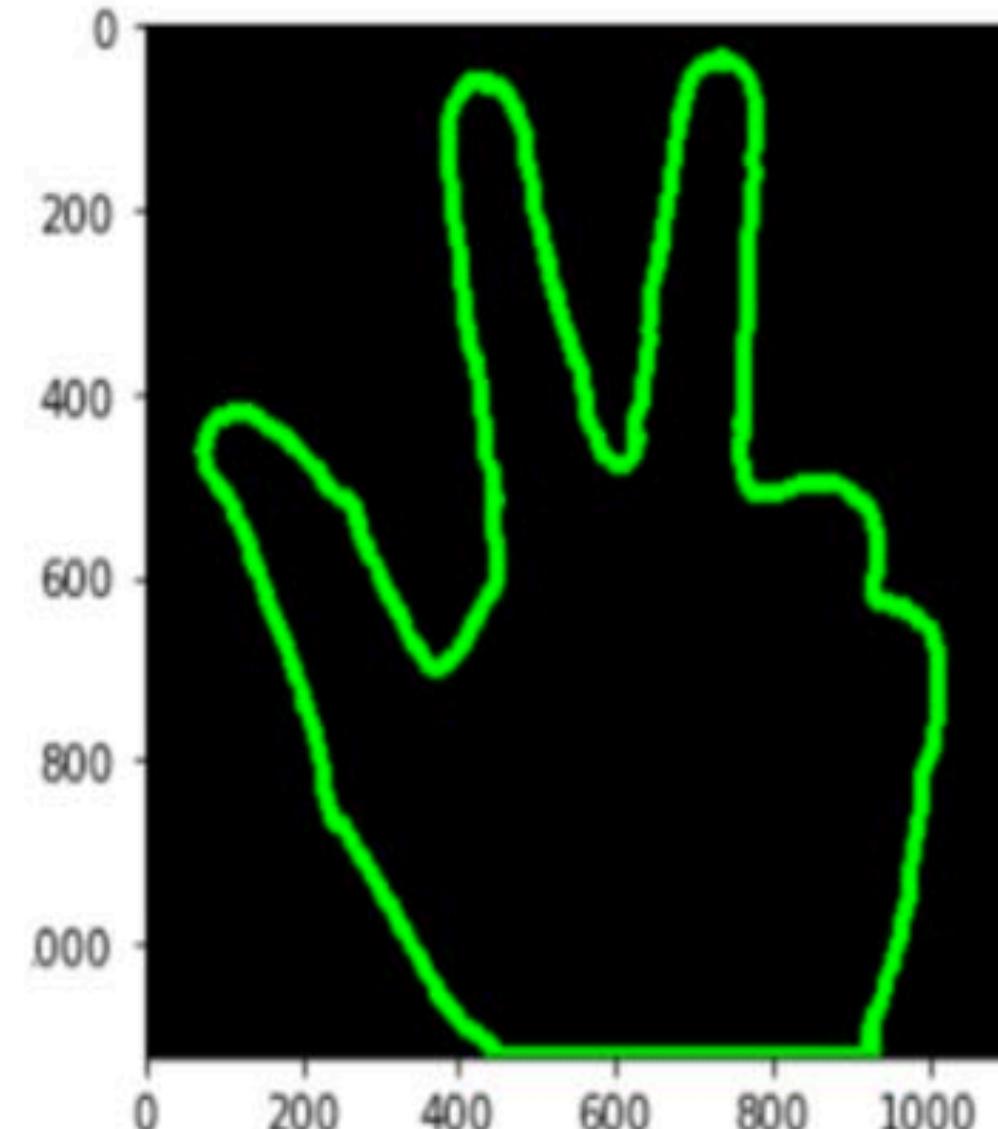
Images showing individuals of more varied ethnic origins (with a particular accent on hands but not only) in order to test the generalizability of our filter



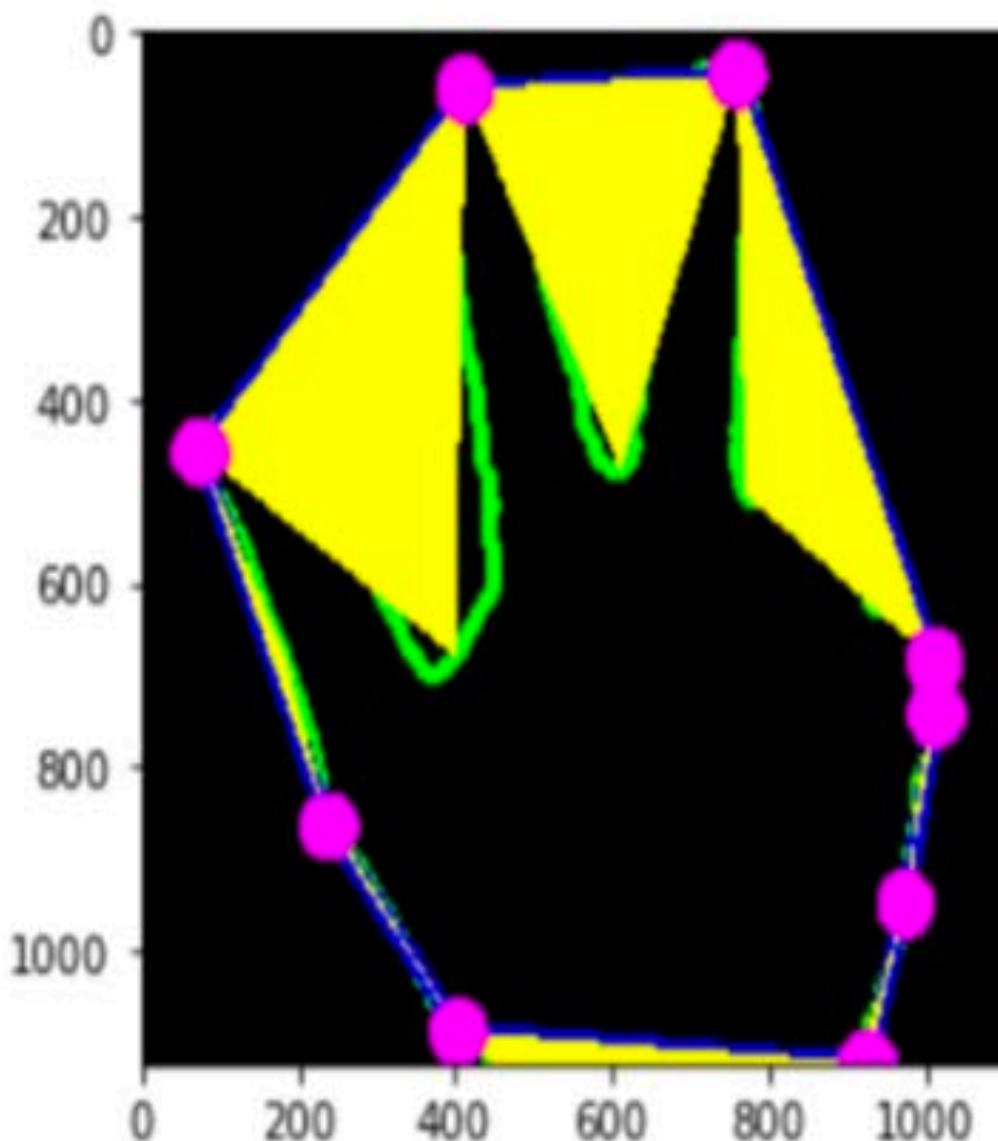
Methodology

- First it is a question of listing the contours associated with each hand.
- Next, we calculate the convex envelope encompassing each hand with a minimal polygon.
- Then calculation of maximum convective faults between the convex envelope and the outline of the hand.
- Finally, we analyze each convexity defect in order to deduce information about the number of fingers it represents. We will see later that several adjustments and choices have to be made so that the results of this simple algorithm are satisfactory for a majority of cases.

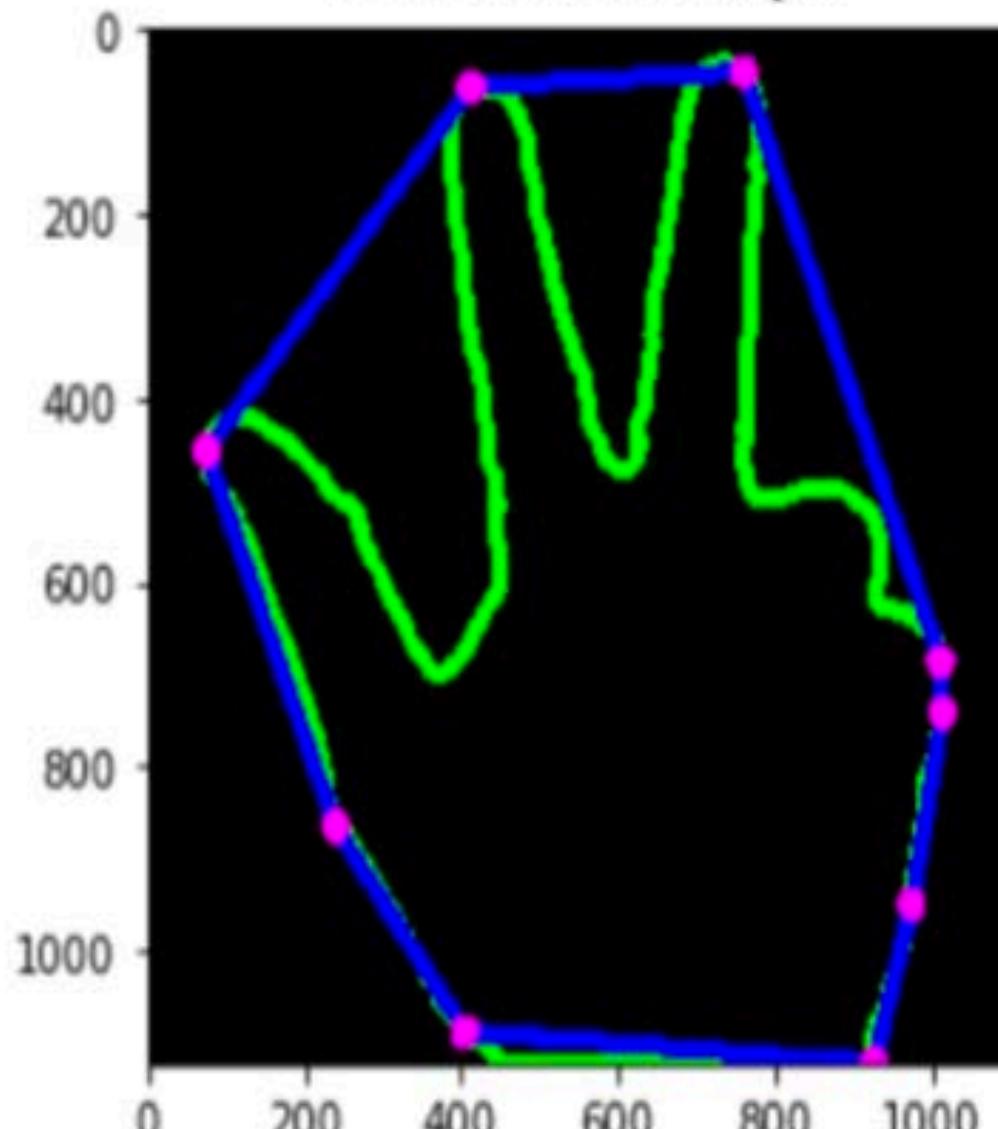
1 - Detection of the countours



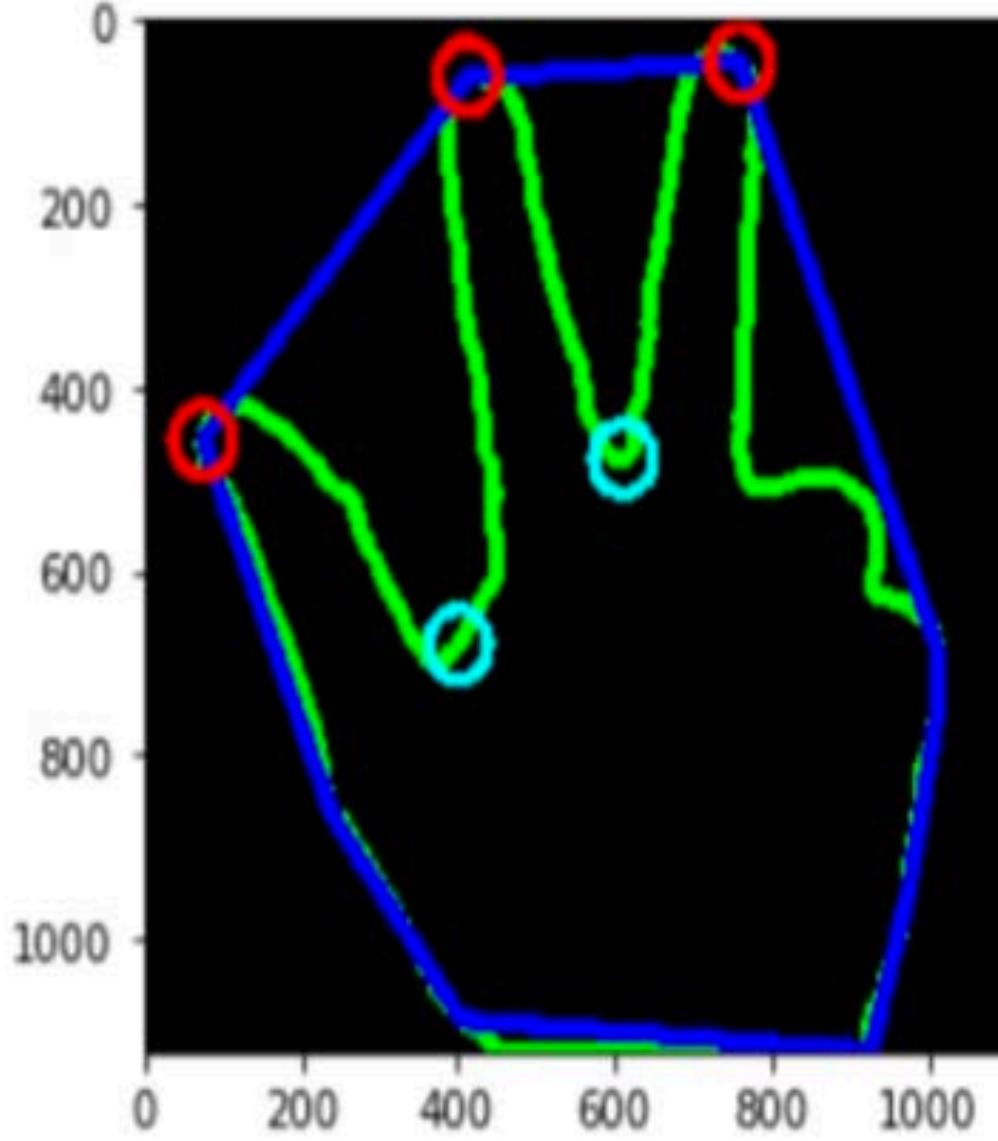
3 -Analysis of maximum convexite faults



2 - Calculation of the minimum convex envelope



4 - Detection number of digits



Color spaces testing

- RGB seems poorly suited except to focus on very specific skin tones
- HSV already seems more promising by offering fairly consistent areas between all the images.
- LAB is the most promising at this stage. It seems in fact to offer a fairly clear and constant delimitation along the axis a (green / red) around 150
- YCrCb has interesting delimitations, however these do not seem to be constant from one image to another.



Main cause of errors

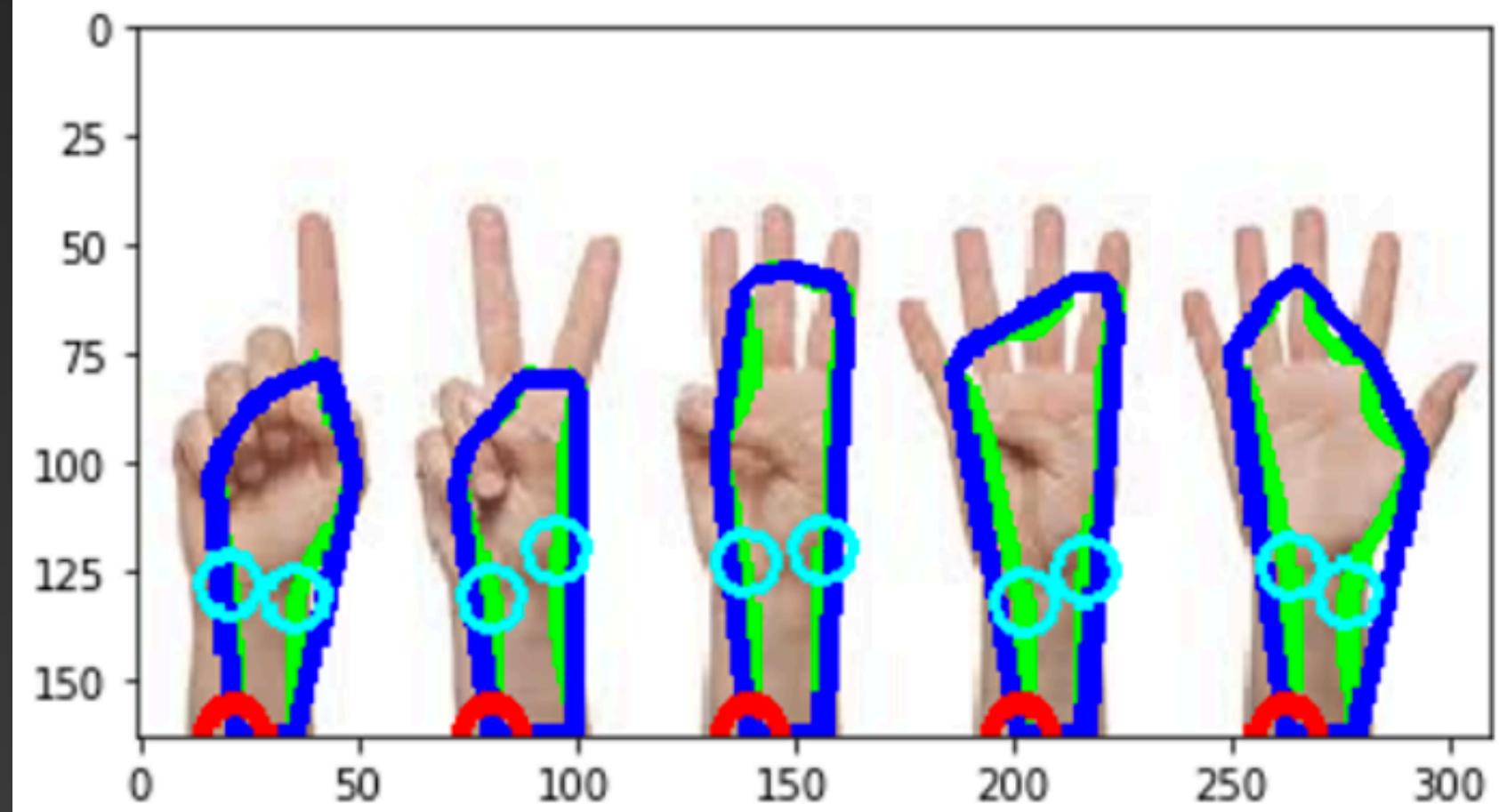
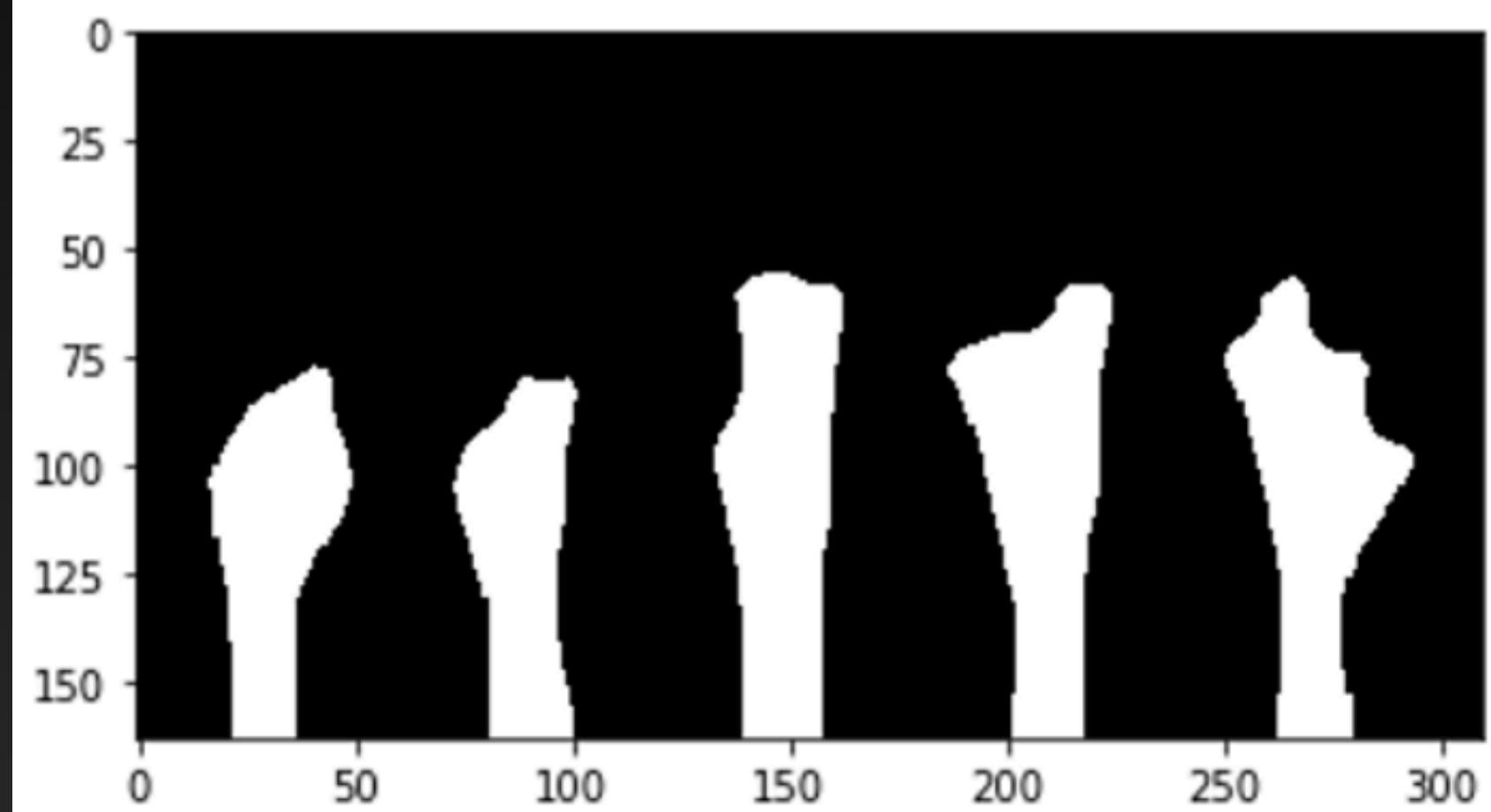
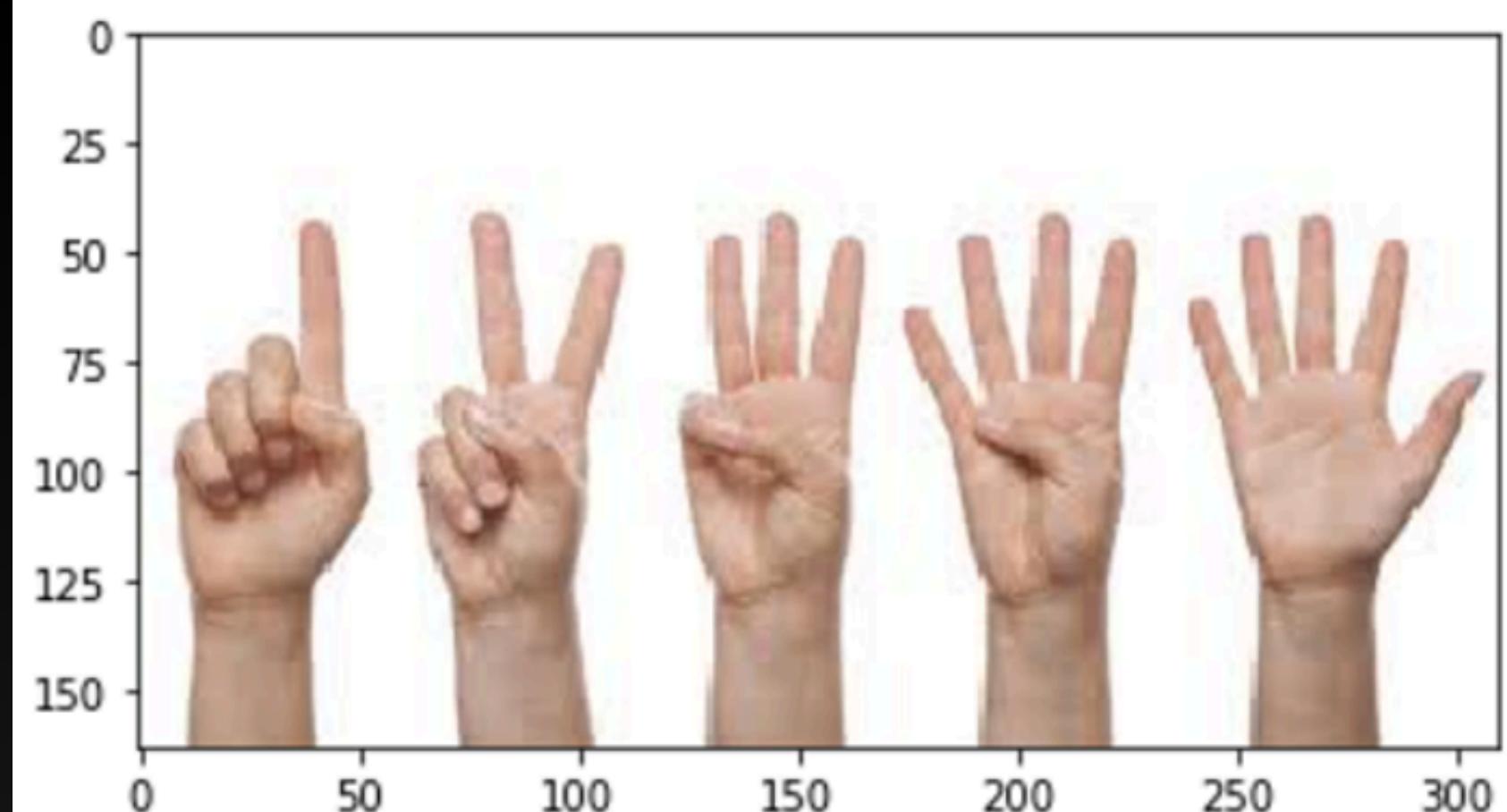
- Overexposure of the images: the exposed areas which are totally white are excluded by the filters due to their component in green and blue
- Elements with shades close to the skin (beige, salmon, etc.) which are not excluded.



Conclusion

The finger count will only work correctly when the entry mask responds well to the following perimeters:

- Entrance masks contain only hands
- Hands are well separated from each other
- The detection of each hand is fine enough to precisely detect the contour of the fingers



Future goals

- Live recognition of sign language
- Hand sign calculator
- Sign controller (use hands and fingers instead of trackpad)