Active Contours Detection—Snake Algorithm—For Amoeba Detection

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***Resumen*—In the field of pattern recognition there's an interest when it comes to object recognition or texture in 3 dimensions, where the third dimension is time. The snakes[1] algorithm is a method which allows us to detect objects based on pattern recognition features such as the energy. In this experiment we'll test the snakes algorithm implemetnted within `scikit-image`[2].**

I. Introduction

In several study fields, the most important thing when trying to solve a classification problem from video, sometimes is needed to detect the interest object. In this experiment, our ROI is an Amoeba which is moving along the window.

For this, the snakes algorithm[1] the method that will help the recognition task.

II. Methods

For this experiment, the first step is to get the image data, the it'll be preprocessed enhancing the image to get better results. The enhancement will be done via **histogram normalization**, **otsu tresholding** and a **gaussian filter**—this one, during the snake algorithm—. Another option, yet abandoned was **inverting** the gray levels of the image, but it gave more unstable results.

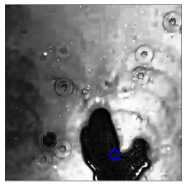
Several values combinations were tested for the coefficients α, β and γ, **control point numbers** and **gaussian** σ.

III. Results

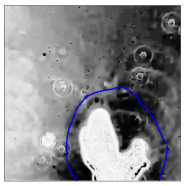
As it can be seen in figure 1, the most interesting behaviour of this algorithm can be found when a binarization is used. Aldo, the inversion resulted in rapidly collapsed polynoms.

Figura 1: Results

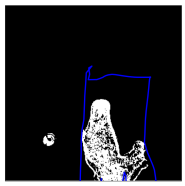
(a) Original Image



(b) Enhanced Image Inverted



(c) Enhanced Image



(d) Binarized image

IV. Discussion

Here is a point to discuss mainly about the parameters used for the best results obtained, and is that there are tons of different combinations, and due time constraints, we could not test all of them. Also, snakes are a good algorithm but it's not perfect, several tests reflected rapidly collapsed polynoms or practically insensitive polynoms. It's also important that this approach requires initial conditions which are needed for accuracy, but, even point number can be a totally tricky parameter depending on the problem.

V. Conclusions

This experiment demosntrates the capabilities of contour detectin of snakes, but, it's needed to point out that the main issue is finding the correct hyperparamenters and initial conditions for the algorithm to behave correctly.

Another point is that even the smallest details can alter completely the final polygon behaviour. This aims every researcher interested in using this methtod to be aware of this image quality, focusing on contrast.

References

Referencias

[1] M. Kass, A. Witkin, and D. Terzopoulos, "Snakes: Active contour models," *International Journal of Computer Vision*, vol. 1, no. 4, p. 321–331, Jan. 1988. [Online]. Available: http://dx.doi.org/10.1007/BF00133570

[2] Scikit-Image Contributors, "Active contours," https://scikit-image.org/docs/stable/auto_examples/edges/plot_active_contours.html, 2025.