Novel image enhancement method based on an artificial life model

Alex F. de Araujo, João Manuel R. S. Tavares

Faculty of Engineering, University of Porto (FEUP) / Institute of Machanical Engineering and Industrial Management (INEGI),
R. Dr Roberto Frias s/n, 4200-465 - Porto, PORTUGAL
fa.alex@gmail.com, tavares@fe.up.pt

Abstract

Processes of image acquisition, transmission and compression can degrade the images, affecting, for example, the quality of the features extracted from the imaged objects. Techniques of image enhancement have been developed to increase the contrast between the existent objects, emphasizing their more significant features and representing the images in a more appropriate way for the computational analysis. Researchers have been used computational models based on artificial life to perform tasks of image processing with very promising results. This models are inspired in the biological processes that characterize the living organisms and can be integrated into computational algorithms to overcoming the problems found in many image processing and analysis tasks, such as the ones due to low image contrast and complexity of the objects. The most known of such algorithms adopt techniques based on physics and geometry in order to build a "living" deformable model with a "primitive brain" that can take decisions in searches for the best states. Natural selection, evolution, locomotion and learning are biological processes can be used to inspire the design of artificial life models.

The objective of this work is to present a novel image enhancement method that integrates a model based on artificial life which takes into account the control and perception centers of the organism, inspiring on the organism's behavior when selecting its aliment in a specific environment. This model is based on the observation that, usually, when an herbivore organism feeds, it moves in its environment, guided by the information that its cognitive system provides about the aliment in the neighborhood, selecting the possible aliments and defining a "priority order" for them. As such, the difference between inferior and superior aliments in the environment tends to be stressed, as is desired in operations of image enhancement.

The results obtained using the method based on the adopted artificial life model allow to confirm its competence, especially to enhance the quality of damaged images.

Key words: Image Pre-processing, Image Enhancement, Medical Image

References

[1] T. McInerney, G. Hamarneh, M. Shenton, D. Terzopoulos. (2002) "Deformable organisms for automatic medical image analysis", Medical Image Analysis, Vol. 6:3, p. 251-266.
[2] G. Hamarneh, C. McIntosh, T. McInerney, D. Terzopoulos. (2009) "Deformable Organisms: An Artificial Life Framework for Automated Medical Image Analysis". *Book: Computational Intelligence In Medical Imaging: Techniques and Applications - Chapter 15*, p. 433-474.
[3] D. Terzopoulos. (1999). "Artificial life for computer graphics". *Communications of the ACM*, Vol. 42:8, p. 32-42.