VOLUME MEASUREMENTS AND VISUALIZATION IN BIOTECHNOLOGY

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Abstract: The aim of this work is to show the use of the MMach tool of morphological operators, implemented in the Khoros environment, in order to obtain measurements about volume, which in turn allow inference about mass in the *Penicillium chrysogenum* fungus through images of the mycelium of this culture. From a previous work, on hyphals length measure, it was possible to obtain measurements of length and area and therefore obtain the volume. Mathematical Morphology offers an integrated and powerful method for the treatment of different kinds of applications in image processing. This work consolidates and extends a quantitative analysis of measurements in mycelium, obtaining an estimate of length, area and volume of hyphas using euclidean metrics. Fungus visual analysis is also treated in this work by a raster to vector conversion process and the use of a graphics library rendering resource. A comparison between the traditional and computational methods is presented.

Keywords: Biotechnology, Image Processing, Visualization in Biotechnology.

1. Introduction

Mathematical morphology (MM) offers an integrated and powerful method for the treatment of different kinds of applications in image processing.

Roughly, morphological operations establish geometric relations and connectivity between pixels that are defined through integer values, which here are initially treated in gray level scale, and then reduced to two levels: black and white.

The basic concepts of this theory started with the work of spatial algebra of sets carried out by Minkowski [Minkowski03], and were initially applied to porous materials; it was only much later that they were effectively formalized by Jean Serra [Serra82].

More recent research [Tucker-Thomas92], [Lendelfeld et al.93] and [Kent et al.94], shows a set of techniques of image analysis applied to the characterization and differentiation of different phases of growth of fungus.

This work in particular is aimed at applying this theory to the identification and measurement of fungus (*Penicillium chrysogenum*), over which euclidean measurements were carried out using MM. An environment, with facilities for the execution and storage of microscopic images, was used. These images were treated in the Khoros environment using M Mach tools, obtaining estimates of the mycelium's volume. These estimates were compared with