

EFFICIENT VISUALIZATION AND ANALYSIS OF FLUORESCENTLY LABELLED SUBCELLULAR STRUCTURES OF LIVING YEAST CELLS

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Recent advances in fluorescence labelling and in imaging technologies for biomedical applications result in an increasing number of experimental approaches to investigate subcellular structures in living cells. This trend is mirrored by the ongoing development of tools designed for visualization and quantitative/statistical analysis of microscopic image data from different sources.

The yeast *Saccharomyces cerevisiae* provides an excellent model organism for biomedical research and has also become very attractive for microscopic analysis, despite its small size of 5-10 μm : the short generation time of 90-120 min allows visualization of multiple rounds of division of cells immobilized under the microscope. Furthermore, since many cells can be observed and imaged at once, the quantitative, statistical analysis of image data is very reliable, and permits monitoring of minor alteration of cellular structures induced by e.g. nutritional or environmental conditions, or drugs.

Here, we present two novel procedures and sample applications for efficient visualization and statistical analysis of fluorescently (multi)labelled subcellular structures in living yeast cells. First, we show a threshold-based technique for semi-automatic registration of GFP-labelled, three-dimensional yeast structures. For this purpose, we take advantage of features of a modular software system (amira®), as well as of a novel highly efficient image reconstruction algorithm for counting yeast cells in differential interference contrast (DIC) images. Second, we introduce a custom-made software add-on for amira® visualization platforms, called '4D Assistant', which facilitates and accelerates the extraction of useful information from complex multi-channel 4D data sets. The tool was applied for simultaneous visualization of the migration of endoplasmic reticulum and mitochondria during cellular growth and division. Both techniques are not only highly useful for yeast specific applications but also applicable to other biological systems.