Knowledge enhanced cellular visualization using 3D confocal images

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Introduction. Enhancement of fluorescent confocal imaging techniques allows the visualization of detail structure of cellular component by reconstruction a 3-dimensional (3-D) image from its 2-D x-y planes images [1, 2]. With confocal images, a quantitative analysis of the fluorescence signal can also be done [3, 4]. However, confocal imaging of cellular structure has more information behind the stacked image sequence. For instance, the biochemical processing of the cellular specimen and antibody labeling are an integrated part of the whole procedure. Those knowledge or information can be easily lost with the confocal images thus causing difficulty in subsequent analysis of cellular structure. We are developing a new mechanism to process 3D confocal data. Knowledge related to clinical and bio-chemical processing with the cellular structures is embedded into the 3D data set. From an integrated view, our 3D originated and knowledge based approach is able to provide better overall visualization and quantitative analysis for tasks like intracellular localization. **Methods**. An Olympus FluoView™ 500 confocal microscope is used for 3-D scanning of samples. A TeraRecon VolumePro graphics board is used for volume rendering and reconstruction of the 3D cellular structure. A Microsoft Access database is design to store and retrieve the extracted knowledge related to clinical and bio-chemical processing of the 3D cellular structure. Visual C++ and OpenGL are used as the software development platform. **Results and Summary**. Samples of calreticulin in mouse brain section are processed and scanned with the Olympus system. Detail processing information are embedded with the relevant image sections. In particular, the expression pattern of apolipoprotein (a), B and E of cervical cancer cell, HeLa, liver cancer cell, HepG2 and white blood cells are recorded. Figure 1 shows selected images of apo(a) expression in liver cancer cells HepG2. A comparison of its 3-D localization pattern of the protein within cellular compartments can be performed with the aid of our knowledge based 3D visualization system.

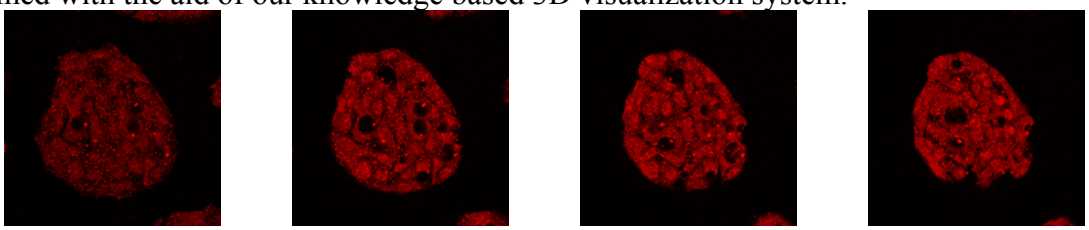

Figure 1. Apolipoprotein(a) stained with TRITC (red) of liver cancer cell, HepG2.

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