Digital Pathological Image Analysis and Cell Segmentation

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Abstract

This project proposes the use of Digital Signal Processing (DSP) for real-time capture and analysis of pathological slide images to improve accuracy and efficiency. Analyzing cell density statistics and average cell nuclei diameters of a slide image is useful to determine the abnormality of slide sample. Being tedious as it is in counting/measuring hundreds to thousands of cells in one sample slide under a microscope, the manual result, typically can be achieved by a pathologist, is often limited by human eye precision/efficiency. Millions of biopsy samples obtained daily around the world, from minor skin lesions to major tumors, are anxiously waiting to be screened/examined. As a high-level, interactive environment for data visualization/analysis/computation, MATLAB® is utilized currently to perform automatic image analysis and segmentation of brain cells on a computer. By comparing cell concentration and cell nuclei sizes between cancerous and normal image groups, MATLAB® can be programmed to distinguish normal brain cells from questionable ones. In general, pathological image analysis using a computer-based application could demonstrate great precision and efficiency for screening large quantities of cells on one or numerous sample slides. Currently, MATLAB® image analysis works on captured/digitized slide images and takes a minute per image to automatically pre-screen abnormalities that require further human expert analysis. With future real-time/parallel/machine-intelligent improvements, we hope that DSP can help physicians/pathologists/patients everywhere to get immediate diagnosis for effective/timely treatment, and can show accuracy within acceptable levels that are comparable to human pathologists in dealing with cell-overlapping and non-cell objects existing in slide images.