A Combined Expectation Maximization and Marker Controlled Watershed Driven Distance Regularized Level Sets for Nuclear Segmentation in Histopathological Images

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Abstract

Detection of significant biomarker has been a major issue in the pathological study of cancerous tissue. The microscopic observation of H&E stained histopathological slides involves the study of various tissue objects and their significant traits influencing the cancer grading. The change in shape and size of the nuclei objects (nuclear pleomorphism) contributes much significantly in grading the cancer. With the advent of various imaging studies over a digitized Histopathological image, Active contour based segmentation approaches are considered to be much potential scheme in detecting the nuclei within occlusions and extracting their irregular boundaries. In this research, a novel approach of driving the contours of distance regularized level sets using an improved watershed transformation, has been presented. An Expectation Maximization based morphologically precomputed shape prior is used to extract the foreground markers, which controls the watershed transformation. The result of watershed transformation is used compute the centroid of nuclei to serve the initialization of the contour and the proposed gradient to drive the same efficiently. The study performed over the Benign and Malignant tissue images from BreakHis dataset has shown the efficacy of the methodology in terms of
object detection accuracy and overlap resolution. The segmentation accuracy is compared to that of Geodesic active contours, based on the ground truth generated by expert pathologist.

References


Index Terms

Computer Science  Image Processing

Keywords

Nuclear pleomorphism, Centroid Detection, Watershed gradient, Contour Evolution