Abstract

The current research work aims to propose an improved clump splitting approach to classify breast cancer lesion based on extracting shape features. Identifying the number of benign and malignant nuclei in a given area of histopathological tissue is very important for the automated grading system. This process becomes difficult due to irregular size and shape of the nuclei leading to clump formation. Therefore, a major challenge lies in accurately separating these nuclei for further processing. Towards this end, there has been a well-focused research on accurate identification and extraction of nuclei based on concavity analysis. From exhaustive experimentations, it is observed that concavity based approaches pose several limitations: like identifying the concave point pair and selecting the valid split lines. Further, it is also observed from the literature that either region or edge based segmentation is the most commonly used method for segmenting nuclei. Experimental analysis showed that under or over-segmentation is the common problem with region-based methods. Since poor, unclear edges, noise and other artefacts are inevitable in histopathological images, the edge based method does not perform well. Therefore in this research work, a combination of both edge and region-based nuclei
segmentation is proposed. The performance measure of the proposed method is evaluated on a dataset consisting of 1820 histopathological images. Further, in comparison with the existing methods, the proposed method showed the improved accuracy of 86%. Also, it is clearly seen from the ROC curve that the non-linear SVM outperforms other classifying methods.

References

16. H. Irshad, A. Veillard, L. Roux, and D. Racoceanu, “Methods for nuclei detection,
segmentation, and classification in digital histopathology: a reviewcurrent status and future
18. X. Bai, C. Sun, and F. Zhou, “Splitting touching cells based on concave points and
19. W. X. Wang, “Binary image segmentation of aggregates based on polygonal
20. A. S. B. Samma, A. Z. Talib, and R. A. Salam, “Combining boundary and skeleton
information for convex and concave points detection,” in 2010 Seventh International Conference
833–836.
clumps of nuclei,” in Biomedical Imaging: From Nano to Macro, 2009. ISBI'09. IEEE
objects incorporating image intensity and using rectangular window-based concavity pointpair
of neuronal nuclei based on clump splitting and a two-step binarization of images,” Expert
27. H. Li, Z. Ji, and H. Yang, “Quantitative characterization of lamellar and equiaxed alpha
phases of α+β titanium alloy using a robust approach for touching features splitting,”
S. Tan, “Automatic area classification in peripheral blood smears,” IEEE Transactions on
30. O. Schmitt and M. Hasse, “Morphological multiscale decomposition of connected
regions with emphasis on cell clusters,” Computer Vision and Image Understanding, vol. 113,
no. 2, pp. 188–201, 2009.
31. S. Kothari, Q. Chaudry, and M. D. Wang, “Automated cell counting and cluster
segmentation using concavity detection and ellipse fitting techniques,” in Biomedical Imaging:
795–798.
32. E. Cosatto, M. Miller, H. P. Graf, and J. S. Meyer, “Grading nuclear pleomorphism on


Index Terms
Keywords

Histopathological Images, clumps, Shape features, nuclei extraction, Digital Pathology