

عنوان مقاله:

A Novel Automated Method for Analyzing Semen Microscopy Images: Curvelet Paradigm as a Solution for Improving Sperm Detection

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خلاصه مقاله:

Introduction: Credible research shows that in many cases, infertility is caused by problems with men's sperm. Therefore, an accurate sperm analysis is a necessity to solve the problem of infertile couples. However, the first step in this analysis is to separate the sperm from the semen, which may not be accurate due to the poor contrast of the captured microscopy images. Material and Methods: Curvelet transform has been introduced in recent years as an effective tool for object detection in the image processing domain. The most significant advantage of this transform is that it maps the raw image to a new space in which the features are sparser and parallelly more directional. Based on this fact, in this study, this approach is used to more effectively detect sperm in microscopic images. However, intelligent adjustment of the parameters of this mapping plays an important role in strengthening the weaker edges, and therefore in this article, a new method for optimizing the mapping parameters in order to achieve better separation of sperms from the background of the semen image is also proposed and examined. Results: The comparison of the results obtained from examining the proposed method versus the results of the state of art methods was performed by using the two main criteria including sperm detection rate and false detection rate (i.e., false positives). This comparison clearly indicated the effectiveness of the proposed idea in distinguishing sperms from semen background. When the basis of performance evaluation is based on not detecting even a single false particle, it is observed that the correct sperm detection rate in the proposed method is between ۴ and ۱۷ percent higher than alternative methods. However, the false detection parameter itself shows an improvement of ۳۳% to ۳% in the proposed method compared to the weakest to the best among alternatives. Conclusion: Investigating the ROC curve which has been obtained from several examinations showed the effectiveness of the proposed idea over its alternatives either in correct detection of sperms or elimination of false objects. Therefore, the obtained results may lead us to the conclusion that the curvelet transform may be utilized as an effective solution for detecting sperms in low contrast microscopic images of human semen.

کلمات کلیدی:

Microscopy Images, Sperm detection, Curvelet Framework Nonlinear Mapping Function

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