

论文

同轴数字全息用于血吸虫尾蚴检测研究

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摘要:

由于水的表面易出现抖动或波动情况,而传统的显微镜成像需要精确的光学聚焦过程,因此不适于观察漂浮于水表面的血吸虫尾蚴.本文论述了用同轴数字全息检测血吸虫尾蚴的基本原理.通过对再现像进行小波分析发现,偏离焦点时的小波变换高频系数的幅值比聚焦时要小得多.针对这一特点,本文对小波变换清晰度评价函数进行了改进,将原来利用高频系数之和改为利用聚焦窗口中高频系数的最大幅值为清晰度评价依据.在模拟实验结果中清晰度评价函数极大值出现在再现距离与记录距离相等处,说明了该算法的准确性.建立了用于血吸虫尾蚴检测的实验装置,可方便获取普通显微图像及数字全息图.实验结果表明,本文提出的算法能实现实际情况下的数字全息自动聚焦,其再现像的分辨率与装有1倍显微镜头的数码显微镜分辨率相当,足以清晰地分辨出血吸虫尾蚴的尾部分叉特征.利用同轴数字全息技术可在水面与图像传感器之间的距离不确定的情况下实现对血吸虫尾蚴的检测.

关键词: 同轴数字全息 血吸虫尾蚴 再现像 自动聚焦 小波变换

Digital In-line Holography for Schistosoma Cercariae Detection

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Abstract:

The traditional microscope is not suitable to observe the schistosoma cercariae which usually floating on the water surface, because it needs an optical focusing process and the wobble or fluctuation of the water surface is difficult to avoid. The basic concept and procedure of digital in-line holography based on convolution are shown mainly for schistosoma cercariae detection. An auto-focus algorithm based on wavelet transform was improved. The max amplitude of high-frequency coefficients in the focal windows was used to evaluate the definition of the reconstructed image instead of the sum of high-frequency coefficients. The evaluation function was maximal only when the reconstructed distance equal to the recording distance in the simulated experiment, which shows the accuracy of the improved algorithm. The experimental device of digital in-line holography was designed for schistosoma cercariae detection. The experimental results show that the auto-focusing method based on wavelet transform can be used in digital holography, and the digital in-line holography can be used to detect schistosoma cercariae when the water surface is fluctuant. The reconstructed image resolution is equivalent to the resolution of digital microscope with 1X micro lens, and the bifurcated tail of schistosoma cercariae can be observed clearly.

Keywords: Digital in-line holography Schistosoma cercariae Reconstructed image Auto-focusing Wavelet transform

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参考文献:

[1] YANG Gui-feng, FU Huei-an. Study on ecology of Schistosoma japonicum cercariae and cercariae-checked and-killed method[J]. Chinese Journal of Schistosomiasis Control, 2008, 20(2): 152-155. 阳桂芬, 付慧岸. 日本血吸虫尾蚴生态及查灭蚴的研究[J]. 中国血吸虫病防治杂志, 2008, 20(2): 152-155.

[2] GUO Wei, ZHEN Lu-ying, GAO Yan-chun, et al. Progress of research on drugs of kill schistosoma cercariae[J]. Chinese Journal of Zoonoses, 2008, 24(7): 672-674. 郭维, 郑绿茵, 高艳春, 等. 杀灭血吸虫尾蚴药

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[3] MURATA S, YASUDA N. Potential of digital holography in particle measurement[J]. Optics and Laser Technology, 2000, 32(7-8): 567-574.

[4] PALACIOS F, RICARDO J, PALACIOS D, *et al.* 3D image reconstruction of transparent microscopic objects using digital holography[J]. Optics Communications, 2005, 248(1-3): 41-50.

[5] LU Qie-ni, GE Bao-zhen, GAO Yan, *et al.* Simultaneous measurement of size and velocity of alcohol spray with digital holography[J]. Acta Photonica Sinica, 2010, 39(2): 266-270. 吕且妮, 葛宝臻, 高岩, 等. 乙醇喷雾场粒子尺寸和速度的数字全息测量[J]. 光子学报, 2010, 39(2): 266-270.

[6] XU Yuan-qiang, WANG Yu-rong, DING Hai-sheng. Segmentation identification and independent focus for digital in-line holography of particle fields[J]. Acta Photonica Sinica, 2010, 39(3): 881-887. 徐元强, 王玉荣, 丁海生. 数字同轴全息颗粒场检测中的颗粒分割识别与独立聚焦[J]. 光子学报, 2010, 39(3): 881-887.

[7] WANG Hua-ying, WANG Da-yong, XIE Jian-jun. Reconst ruction of object wave front in digital holography microscopy[J]. Acta Photonica Sinica, 2007, 36(6): 1023-1027. 王华英, 王大勇, 谢建军. 显微数字全息中物光波前重建方法研究和比较[J]. 光子学报, 2007, 36(6): 1023-1027.

[8] SUN H, BENZIE P W, BURNS N, *et al.* Underwater digital holography for studies of marine plankton[J]. Philosophical Transactions of the Royal Society A, 2008, 366: 1789-1806.

[9] DYOMIN V V, OLSHUKOV A S, DZYUBA E V. Digital holographic video for studies of plankton dynamics[J]. Russian Physics Journal, 2011, 53(8): 857-866.

[10] ANTKOWIAK M. Extended focused imaging of a microparticle field with digital holographic microscopy[J]. Optics Letters, 2008, 33(14): 1626-1628.

[11] LIU Chang-geng, WANG Da-yong, ZHANG Yi-zhuo, *et al.* Derivatives-based autofocus algorithms for the digital holographic imaging[J]. Chinese Journal of Lasers, 2009, 36(11): 2989-2996. 刘长庚, 王大勇, 张亦卓, 等. 数字全息成像中基于导数的自动对焦算法[J]. 中国激光, 2009, 36(11): 2989-2996.

[12] WANG Feng-peng, ZHEN Xiang-zhi, ZHEN Xiang-hua, *et al.* Simulation analysis of digital in-line holography for schistosoma cercariae detection. 2011 International Conference on Electronics and Optoelectronics, 2011, V4-447-450.

[13] WANG Yi-wen, LIU Xian-li, XIE Hui. A wavelet-based focus measure and 3-D autofocus for microscope images [J]. Optics and Precision Engineering, 2006, 14(6): 1063-1069. 王义文, 刘献礼, 谢晖. 基于小波变换的显微图像清晰度评价函数及3-D自动调焦技术[J]. 光学精密工程, 2006, 14(6): 1063-1069.

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2. 安志勇 赵珊 王晓华 周利华. 基于多尺度Radon变换的图像检索[J]. 光子学报, 2007, 36(6): 1176-1180
3. 赵永强; 潘泉; 张洪才. 一种新的全色图像与光谱图像融合方法研究[J]. 光子学报, 2007, 36(1): 180-183
4. 刘新文; 王惠南; 钱志余. 小波变换对OCT图像的降噪处理[J]. 光子学报, 2006, 35(6): 935-939
5. 杨必武; 郭晓松; 赵敬民; 王玉森.

基于小波变换的视差图像全局几何配准新算法

[J]. 光子学报, 2007, 36(3): 574-576

6. 王文龙 韩保君 张红萍. 一种海空背景下红外小目标检测新算法[J]. 光子学报, 2009, 38(3): 725-728
7. 刘卜; 屈有山; 冯桂兰; 杨秀芳; 相里斌. 小波双线性插值迭代算法应用于光学遥感图像[J]. 光子学报, 2006, 35(3): 468-472
8. 常威威 郭雷 刘坤 . OMIS图像条带噪声消除方法研究[J]. 光子学报, 2007, 36(11): 2148-2152
9. 才德; 严瑛白; 金国藩. 光学小波包变换及其滤波器的研究[J]. 光子学报, 2006, 35(7): 1076-1079
10. 马静; 吴成柯; 李云松; 周有喜; 相里斌; 陈东. 干涉多光谱图像压缩编码新技术[J]. 光子学报, 2006, 35(10): 1579-1583
11. 宋凭; 刘波; 曹剑中; 张仲敏; 李荣. 提升小波变换与分形相结合的图像压缩[J]. 光子学报, 2006, 35(11): 1784-1787
12. 赵静; 夏良正. 基于连续小波变换的神经网络人脸识别研究[J]. 光子学报, 2005, 34(9): 1425-1430
13. 张亚妮; 苗润才. MPEG-4静态纹理BQ模式编码算法的改进[J]. 光子学报, 2005, 34(10): 1593-1596
14. 张道兵; 张继武; 许朝晖; 史舒娟. 基于小波变换的数字胸片自适应增强[J]. 光子学报, 2005, 34(2): 302-305
15. 熊宇虹; 温志渝; 陈刚; 黄俭; 徐溢. 基于小波变换和支持向量机的光谱多组分分析[J]. 光子学报, 2005, 34(10): 1514-1517

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