光子学报 2010, 39(5) 923-928 DOI: 10.3788/gzxb20103905.0923 ISSN: 1004-4213 CN: 61-1235/O4

论文

基于互信息改进型脉冲耦合神经网络多值图像分割

刘勃[1,2],许录平[1],马义德[3],苏哲[1]

(1 西安电子科技大学 电子工程学院, 西安 710071)
(2 天水师范学院 物理与信息科学学院,甘肃 天水 741001)
(3 兰州大学 信息科学与工程学院, 兰州 730000)

摘要：

为了自动地进行图像的多值分割,从原始图像与分割图像之间的相互关系出发,以最大互信息为优化分割目标,以互信息熵差作为一种新的分类类数判据,在对传统脉冲耦合神经网络模型改进的基础上,提出了一种基于最大互信息改进型脉冲耦合神经网络图像多值分割算法.理论分析和实验结果表明,该方法能够自动确定最佳分割迭代次数及最佳分割灰度类数,对分割图像具有良好的特征划分能力,且在分割类数较少的情况下,能较好地保持图像细节、纹理及边缘等信息,对不同图像分割准确度高,具有较强的适用性.

关键词： 图像分割 脉冲耦合神经网络 互信息 最大互信息准则

Multi-threshold Image Segmentation Using Improved Pulse Coupled Neural Networks Based on Mutual Information

LIU Qing[1,2],XU Lu-ping[1],MA Yi-de[3],SU Zhe[1]

(1 School of Electronic Engineering,Xidian University,Xi'an 710071,China)
(2 School of Physics and Information Science|Tianshui Normal University,Tianshui 741001,China)
(3 School of Information Science |and |Engineering|Lanzhou University,Lanzhou 730000,China)

Abstract:

In order to process multi-threshold image segmentation automatically,the traditional pulse coupled neural networks model is improved.A new algorithm of multi-threshold image segmentation using improved PCNN based on the maximization of mutual information is put forward according to the relationship between original image and segmented image,which is based on the optimization object of maximal of mutual information and a new measurement criterion for determining the number of clusters in an image called difference of mutual information.Theoretical analysis and simulation results indicate that the new method can automatically determine the optimal cyclic iterative times and the optimal number of gray-scale clusters,has a favorable capability to carve up characteristics and maintain the edges,texture and details of images,has higher precision in different image segmentation and can be more adaptability.

Keywords: Image segmentation PCNN Mutual information Maximum criterion of mutual information

收稿日期 2008-09-23 修回日期 2008-12-01 网络版发布日期 2010-05-25

DOI: 10.3788/gzxb20103905.0923

基金项目:

国家高技术研究发展计划（2007AA12Z323）、国家自然科学基金（60772139、60572011）和天水师范学院“青蓝”人才工程基金（0708-10）资助

通讯作者: 刘勃

作者简介:

参考文献：

［1］LIN Ya-zhong,CHEN Wu-fan,YANG Feng,et al.New approach for image segmentation based on generalized fuzzy Gibbs random fields［J］.Chinese Journal of Computers,2003,26(11):1464-1469.

林亚忠,陈武凡,杨丰,等 基于广义模糊吉布斯随机场图像分割的新算法［J］.计算机学报,2003,26(11):1464-1469.
［2］LU Xiao-dong,ZHOU Jun,ZHOU Feng-qi.Image segmentation and parameters estimation based on fuzz Markov random field with possibility theory［J］.Infraredand Laser Engineerin,2007,36(5):733-737.
卢晓东,周军,周凤岐.基于可能性 FMRF的红外图像分割算法及其参量估计［J］.红外与激光工程,2007,36(5):733-737.
［3］ZHANG Wei,JIANG Hong,REN Zhang.An adaptive multi threshold image-segmentation algorithm［J］.Techniques of Automation and Applications,2007,26(8):71-74.
张伟,蒋宏,任章.自适应多阈值图像分割算法［J］.自动化技术与应用,2007,26(8):71-74.
［4］PEI Ji-hong,XIE Wei-xin.Adaptive multithresholds image segmentation based on potential function clustering［J］.Chinese Journal of Computers,1999,22(7):758-762.
裴继红,谢维信.势函数聚类自适应多阈值图像分割［J］.计算机学报,1999,22(7):758-762.
［5］LI Hui-hui,GUO Lei,LIU Han.A region-based remote sensing image fusion method［J］.Acta Photonica Sinic,2005,34(12):1901-1905.
李晖晖,郭雷,刘航.基于区域分割的遥感图像融合方法［J］.光子学报,2005,34(12):1901-1905.
［6］ECKHORN R,REITBOECK H J,ARNDTETAL M.Feature linking via synchronization among distributed assemblies:simulation of results from cat cortex［J］.Neural Computation,1990,2(3):293-307.
［7］JOHNSON J L,PADGETT M L.PCNN models and applications［J］.IEEE,Trans,Neural Networks,1999,10(3):480-498.
［8］CHEN J U N,ISMRILTRA K,WADA M I.Moving object extraction using multi-tiered pulse-coupled neural network［C］.Proceedings of 2004 SICE Annual Conference,2004,3:2843-2848.
［9］LIU Qing,MA Yi-de.QIAN Zhi-bai.Automated image segmentation using improved PCNN model based on cross-entropy［J］.Journal of Image and Graphics,2005,10(5):579-584.
刘勋,马义德,钱志柏.一种基于交叉熵的改进型PCNN图像自动分割新方法［J］.中国图象图形学报,2005,10(5):579-584.
［10］LIU Qing,MA Yi-de.A new algorithm for noise reducing of image based on PCNN time matrix［J］.Journal of Electronics and Information Technology,2008,30(8):1869-1873.
刘勋,马义德.一种基于PCNN赋时矩阵的图像去噪新算法［J］.电子与信息学报,2008,30(8):1869-1873.
［11］LIU Qing,MA Yi-de,ZHANG Shao-gang,et al.Image target recognition using pulse coupled neural networks time matrix［C］.Beijing:Publishing House of Beijing University of Aeronautics and Astronautics,2007:96-99.
［12］VIOLA P,WELLS W M.Alignment by maximization of mutual information［C］.Proceedings of the 5th International Conference on Computer Vision［A］.Cambridge,MA,1995-06:16-23.
［13］RANGARAJAN A,CHUI H,DUNCAN J S.Rigid point feature registrationusing mutual information［J］.Medical Image Analysis,1999,3(4):425-440.
［14］YANG Jin-bao,LIU Chang-chun,HU Shun-bo,et al.Mean divergence measures for medical image registration［J］.Acta Photonica Sinic,2008,37(5):1046-1051.
［15］RIGAU J,FEIXAS M,SBERT M,et al.Medical image segmentation based on mutual information maximization［C］.Proceedings of MICCAI'04,2004:135-142.
［16］LU Qing-Wen,CHEN Wu-Fan.Image segmentation based on mutual information［J］.Chinese Journal of Computers,2006,29(2):296-301.
吕庆文,陈武凡.基于互信息量的图像分割［J］.计算机学报,2006,29(2):296-301.
［17］MA Yi-de,DAI Ro-lan,LI Lian.Image segmentation of embryonic plant cell using pulse-coupled neural networks［J］.Chinese Science Bulletin,2002,47(2):167-172.
［18］STUDHOLME C,HILL D L G,HAWKES D J.An overlap invariant entropy measure of 3-D medical image alignment［J］.Pattern Recognition,1999,32(1):71-86.

本刊中的类似文章

1．李哲;苏秀琴;杨小君;张广华.一种基于强边缘块的时域多分辨率图像分割算法[J]. 光子学报, 2005,34(9): 1408-1410
2．陈志新;唐志列;廖常俊;刘颂豪.实际量子密钥分配扩展BB84协议窃听下的安全性分析[J]. 光子学报, 2006,35(1): 126-129
3．蒋海军 刘文 刘朝晖 .基于回形窗的弱小多目标图像分割方法[J]. 光子学报, 2007,36(11): 2168-2171
4．周军妮; 曹剑中; 刘波; 田雁; 杨小军; 李变侠; 杜云飞.一种基于局部最小代价分水岭变换的图像分割新方法[J]. 光子学报, 2005,34(1): 142-145
5．梁继民;王昌明;殷廷瑞;吕宁.基于投影的X光图像分割区域数量判定[J]. 光子学报, 2004,33(12): 1518-1521
6．陈志新;唐志列;魏正军;刘景锋;廖常俊;刘颂豪.QKD系统在Breidbart基窃听下BB84协议的信息量研究[J]. 光子学报, 2004,33(12): 1469-1472
7．杨金宝 刘常春 胡顺波 顾建军.基于均值距离测度的医学图像配准[J]. 光子学报, 2008,37(5): 1046-1051
8．徐建程 许乔 柴立群.基于互信息的干涉成像采样系统性能分析[J]. 光子学报, 2008,37(8): 1608-1611
9．柳稼航 杨建峰 方涛.彩色遥感影像阴影颜色特性分析[J]. 光子学报, 2009,38(2): 441-447
10．赵立龙,方志良,顾泽苍.基于人眼视觉的对不良照明图像的二值化方法[J]. 光子学报, 2009,38(5): 1301-1305
11．罗胜,郑蓓蓉,叶忻泉.基于EM和GMM相结合的自适应灰度图像分割算法[J]. 光子学报, 2009,38(6): 1581-

1585
12. 张道兵 刘波 王宏琦.基于平行活动围道模型的高分辨率遥感影像城区主干道路段提取[J]. 光子学报, 2007,36(7): 1345-1350
13. 李正周 彭素静 王允 刘国金.基于均值偏移的灰度图像分割方法[J]. 光子学报, 2007,36(Sup1): 286-289
14. 田玉敏 王昊 .镜头边界检测的动态窗口技术[J]. 光子学报, 2007,36(10): 1949-1953
15. 倪超 李奇 夏良正 .基于广义混沌混合PSO的快速红外图像分割算法[J]. 光子学报, 2007,36(10): 1954-1959

文章评论 (请注意:本站实行文责自负, 请不要发表与学术无关的内容!评论内容不代表本站观点.)

反馈人		邮箱地址	
反馈标题		验证码	5171
反馈内			