

实蝇科果实蝇属昆虫数字图像自动识别系统的构建和测试

张蕾, 陈小琳, 侯新文, 刘成林, 樊利民, 汪兴鉴

Construction and testing of Automated Fruit Fly Identification System-Bactrocera Macquart (Diptera: Tephritidae)

ZHANG Lei, CHEN Xiao-Lin*, HOU Xin-Wen, LIU Cheng-Lin, FAN Li-Min, WANG Xing-Jian

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摘要

针对双翅目实蝇科果实蝇属昆虫的自动识别, 本文提出利用翅及中胸背板图像的局部二进制模式 (local binary pattern, LBP) 特征, 采用Adaboost算法, 设计和开发“实蝇科果实蝇属昆虫数字图像自动识别系统”(Automated Fruit fly Identification System-Bactrocera, AFIS-B)。该系统包括图像采集、图像裁剪、预处理、特征提取、分类器设计、识别和显示, 共7个模块。研究结果表明: LBP特征可以有效鉴别实蝇科果实蝇属昆虫; 在对实蝇科果实蝇属8个种的测试中, 该系统表现出较高的准确性和稳定性, 平均识别率可达80%以上。此外, 还对果实蝇属昆虫翅膀及中胸背板图像在光照不均匀、姿态扭曲、样本受损及样本量大小等不同条件下的识别率进行了试验测试。结果表明, 该系统对测试样本的光照不均匀、姿态扭曲和样本受损都表现出良好的鲁棒性, 正确识别率与训练集样本各个种数量在一定条件下明显正相关, 与训练集样本物种总量负相关。该项研究为实蝇科有害昆虫自动识别系统的构建及实际应用提供了理论、方法及基础数据的支撑, 亦可为其他昆虫自动识别系统的研究和构建提供有益借鉴。

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Abstract:

Based on Local Binary Pattern (LBP) features of wing and scutum images and the improved Adaboost algorithm, we developed “Automated Fruit Fly Identification System-Bactrocera, AFIS-B” for automatic identification of *Bactrocera Macquart* (Diptera: Tephritidae). The system consists of seven modules, which includes image acquisition, image cropping, image preprocessing, feature extraction, classifier design, taxa identification and outcome display. The results showed that LBP features are effective to the automatic identification of fruit flies. The AFIS-B system has good accuracy and robustness by identifying 8 *Bactrocera* spp., and the average recognition rate is more than 80%. We also did preliminary experiments under different conditions, such as inhomogeneous illumination, distorted posture, specimen partly damaged and different sample sizes. The results showed that the system has good robustness for the first three conditions, and the recognition rate usually positively relate to numbers of training sets for each species and negatively relate to the total species numbers. This research provides the theoretical, method and data foundation for the construction and practice of automated identification system of fruit fly, and it also gives a reference to the research and construction of other insects automated identification systems.

Key words:

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地址: 北京市朝阳区北辰西路1号院5号中国科学院动物研究所 邮编: 100101

电话: 010-64807173 传真: 010-64807099 E-mail: kcxb@ioz.ac.cn 网址: <http://www.insect.org.cn>

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