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近红外高光谱成像技术检测粮仓米象活虫

Detection of live Sitophilus oryzae (L.) in stored wheat by near-infrared hyperspectral imaging

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英文关键词:near-infrared spectroscopy image processing computer vision hyperspectral imaging stored-grain insects detection

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中文摘要:

为了准确地统计出仓储害虫的密度，需对储粮活虫和死虫进行有效地判别。该文研究开发一个900～1?700?nm的近红外高光谱成像系统来检测仓储小麦活虫。用液氮低温猝死法杀死米象，在其死亡后0～7?d进行高光谱图像采集。随着粮虫死亡时间的延长，粮虫相对光谱反射率逐渐增大，到死后第5天时粮虫的光谱曲线基本趋于稳定。应用相邻波长指数法对1?320～1?680?nm之间的110个波长的高光谱图像进行分析，提取出最优波长为1?417.2?nm。提出双区域连通阈值面积比的区域生长法粮虫活虫判别方法，即当粮虫的双区域连通阈值面积比大于0.5时，应判别为活虫。结果表明，自粮虫死亡后的第2.0天开始，储粮活虫与死虫的训练样本和检验样本全部被正确识别，为实现储粮活虫的计算机视觉实时检测与分类提供依据。

英文摘要:

It is necessary to distinguish between the live and the dead insects effectively for counting the density of the storage insects accurately. A 900-1700nm near-infrared hyperspectral imaging system was developed to detect live insects in stored wheat. The Sitophilus oryzae was killed by using low-temperature sudden death method with liquid nitrogen, and then the hyperspectral images were acquired over the period of time 0-7 day after the death of insects. The relative spectral reflectance of the insects increased gradually with the duration of the death time. Then the spectral curve of the insects became stable on the fifth day after the death. 110 hyperspectral images whose wavelength was from 1320 to 1680 nm were analyzed by the neighbor wavelength index, and the optimal characteristic wavelength to distinguish the live and the dead was 1417.2 nm. The region-growing method for identifying the live insects was proposed based on the area ratio of the two thresholds for connecting regions. And the insect should be judged to be alive if the area ratio was higher than 0.5. The results showed that the training samples and the testing samples of the live and the dead insects were all correctly identified since the second day after the death. This research provides a basis for the real-time detection and classification of stored-gain live insects based on computer vision technology.

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