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基于机器视觉和近红外光谱技术的杏干品质无损检测

Nondestructive detection of dried apricots quality based on machine vision and near-infrared diffuse reflectance spectroscopy technology

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中文关键词：机器视觉,检测,近红外光谱,含糖量,biPLS,杏干

英文关键词:computer vision detection near infrared spectroscopy sugar content biPLS dried apricots

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中文摘要:

干果品质直接影响其市场销售。该研究以杏干为对象探讨用机器视觉和近红外光谱技术快速无损检测干果内外品质的方法。拍摄杏干4个不同位置的彩色图像，用基于区域骨架化的填充法分割杏干，提取每种角度下的面积。从100个正常杏干样本中随机挑选75个为校正集，25个为预测集，用多元线性回归对杏干的实际质量和4个面的面积建模，得到校正集和预测集相关系数分别为0.9374和0.9307，杏干质量分级的准确率为90%。提出用基于平均灰度的区域增长法提取杏干缺陷，缺陷检测的准确率为84.5%。采用SNV对杏干近红外光谱进行预处理，然后分别采用偏最小二乘法（PLS）、向后区间偏最小二乘法（biPLS）及联合区间偏最小二乘法（siPLS）建立杏干糖度预测模型。结果表明，当全光谱范围被划分为22个子区间，优选出区间[17、2、3、9、20、13、7、18、15、11、6]，主因子数为10时建立的biPLS糖度模型性能最好。其校正集相关系数和校正均方根误差分别为0.8983和1.23，预测集相关系数和预测均方根误差分别为0.8814和1.46。研究表明，机器视觉结合近红外光谱技术能对杏干内外品质进行综合检测，也可为其他干果的品质检测提供借鉴。

英文摘要:

Quality is the most important factor for marketing of dried fruits. The machine vision and near infrared spectroscopy were explored to detect the external and internal quality of dried apricots nondestructively. Color images of dried apricots in four different locations were captured, the filling algorithm based on the regional skeleton was used for segmentation of dried apricots on those images and then area of dried apricot was calculated. Among 100 normal samples, 75 samples were randomly selected as calibrating set, 25 samples were used as forecast set. Evaluation model based on co-relationship between actual weight and pixels of dried apricots was developed via multiple linear regressions, the correlation coefficient of calibrating set and forecast set were 0.9374 and 0.9307 respectively, and the weights detection accuracy was 90%. Regional growth based on average gray value was put forward to extract surface defects of dried apricots, defects detection accuracy was 84.5%. SNV method was used to pretreat the near infrared spectrum of dried apricots. Then the partial least squares (PLS), back interval partial least squares (biPLS) and synergy interval partial least square (siPLS) were used to establish the prediction models of sugar content, respectively. Experimental results showed that the optimal biPLS model was obtained with 22 intervals divided and the optimal combinations of intervals [17、2、3、9、20、13、7、18、15、11、6] and its factor number being 10. The optimal biPLS model was achieved with correlation coefficient of 0.8983 and root mean square error of cross validation of 1.23 for calibration set and correlation coefficient of 0.8814 and the root mean square error of 1.46 for prediction set. The results indicate that machine vision and near infrared technology can be a good method to synthetically detect the internal and external quality of dried apricot.

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