

基于多光谱图像及组合特征分析的茶叶等级区分 Classification of Tea Grades by Multi-spectral Images and Combined Features

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关键词: 茶叶等级 多光谱成像 形状特征 纹理特征 组合特征

摘要: 提出了一种采用多光谱成像的机器视觉技术对4个等级的西湖龙井茶进行区分的方法。首先采用3CCD多光谱摄像机同时获取茶叶在540、670和800nm波谱处的波长图像, 然后对预处理后的图像进行图像特征提取, 选取了18个形状特征和15个纹理特征。基于这2组特征分别对4个等级的茶叶进行主成分聚类分析, 得到的两幅主成分空间的聚类图都不能对4个等级茶叶进行有效的区分。为了得到高效的区分模型, 本研究对形状特征和纹理特征进行组合, 聚类分析的结果优于原先的分析结果。随后, 采用多类逐步判别分析法对形状特征、纹理特征和组合特征(形状+纹理)这3组特征分别进行特征优化, 并建立了对应各组特征的等级区分模型, 经过比较发现基于组合特征的区分模型的效果仍为最佳, 对于预测集样本的区分正确率为85%。本研究还发现对于等级区分最重要的两个特征依次为波长800nm通道图像的相关性、波长800nm通道图像的二阶角矩。A method for classification of Xi-hu-long-jing tea in four grades was introduced based on machine vision of multi-spectral imaging technique. Firstly, three monochrome images at 540, 670 and 800 nm wavelengths were simultaneously obtained based on 3CCD multi-spectral camera, then image features including 18 shape features and 15 texture features were extracted based on image processing technology. These two groups of features were adopted for cluster analysis with principal component analysis of the four grades tea. However the result was not satisfactory. In order to obtain a more effective separation model, the two groups of features were combined, and the cluster analysis was conducted again based on the combined features. The result was better than the former. After optimization of these three groups of features, three classification models were developed by means of multiple stepwise discriminant analysis (MSDA). It was found that model based on the combined features had the best performance with accuracy of 85% for prediction of unknown samples. The most important two features for classification were correlation and energy of 800 nm wavelength monochrome image.

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