田 杰,胡秋霞,马孝义.基于高斯分布的改进C-V模型植物病斑彩色图像分割[J].农业工程学报,2013,29(16):166-173

基于高斯分布的改进C-V模型植物病斑彩色图像分割

Color image segmentation of plant lesion using improved C-V model based on Gaussian distribution

投稿时间： 2013-01-09 最后修改时间： 2013-07-15

中文关键词：农作物,图像处理,模型,高斯混合模型,C-V模型

英文关键词:crops image processing models Gaussian mixture model C-V model level set

基金项目:国家科技支撑项目（2012BAD08B01）；国家自然科学基金项目（61003151）

作者	单位
田 杰	1. 西北农林科技大学机械与电子工程学院，杨凌 7121002. 西北农林科技大学信息工程学院，杨凌 712100
胡秋霞	1. 西北农林科技大学机械与电子工程学院，杨凌 7121002. 西北农林科技大学信息工程学院，杨凌 712100
马孝义	3. 西北农林科技大学水利与建筑工程学院，杨凌 712100

中文摘要:

为了使C-V模型能够准确快速分割植物病斑图像，该文引入高斯混合模型来构建C-V模型，针对基于加权颜色信息的C-V模型处理时间长，R、G、B通道能量系数难确定等问题，结合高斯混合模型和C-V模型对病叶图像进行分割。先选中病斑区域中一点，以其3×3邻域像素均值作为C-V模型中曲线的内部能量均值；利用高斯混合模型对病斑图像建模，并采用高斯混合模型先验概率初始化C-V模型的水平集函数；最后分别以图像R、G、B通道中目标和背景像素均值的比例作为3个通道的权值，演化水平集函数的分割曲线。试验结果表明，该方法能够有效地分割出植物病斑，并在分割性能上优于基于加权颜色信息的C-V模型及传统C-V模型。本文的研究结果可为植物病斑分割提供参考。

英文摘要:

Abstract: In order to make the C-V model segment plant lesion images more accurate and display quicker, the Gaussian mix model was introduced to set up an improved C-V model in this paper. In view of the drawbacks of long processing time and determining the R, G, B channel energy coefficients artificially for the weighted color information-based C-V model, an improved C-V model based on a Gaussian mix model was proposed in this paper and applied to plant lesion image segmentation. At first, a point in the lesion area was selected and the averages over its 3×3 neighbor was taken as the internal energy in the C-V model. Then the Gaussian mix model was used to model the image, and the sign distance function was initialized by prior probability. Finally, the ratios of the averages on the foreground and background from R, G, B channels were used as the weights of these three channels respectively, and the level set function was iterated to obtain the segmentation contour. To verify the improved C-V model for plant lesion color image segmentation, the traditional C-V model and the weighted color information-based C-V model were used as counterpart algorithms in term of quantitative evaluation of image segmentation, respectively. The experimental results were the averages over ten experiments. In every experiment, two important things had to be decided: one was that the selected point must fall into larger lesion areas, the other was that the Gaussian mix model was calculated by the EM method. The experimental results and analysis on capsicum lesion image and cucumber lesion image mainly lay in the following three aspects. First, for the noised slightly capsicum lesion images, the undetected ratio and the over detected ratio of segmentation for the proposed method were 0.02 lower and 0.01 higher than that of the weighted color information-based C-V model, respectively. For the larger pixels cucumber lesion images, the undetected ratio was about equal to and the over detected ratio was 1.7 lower than that of the weighted color information-based C-V model. The traditional C-V model had the minimum undetected ratio and the maximum over detected ratio. The running time of the proposed method in segmenting capsicum and cucumber lesion images was less than that of the weighted color information-based C-V model and that of the traditional C-V model. Secondly, by making use of the ratios of the averages on foreground and background from R, G, B channels as the weights of these three channels respectively, not only was the contrast between lesion area and background area stressed, but also the randomness to artificially compute the weights through many trials in weighted color information-based C-V model was reduced. Thirdly, the proportion of the target pixels in the entire image was utilized as the final weights of image energy, which decreased the possibility of over-segmentation. Above all, the proposed method in this paper obtained better performance than the weighted color information-based C-V model and the traditional C-V model. Therefore, the algorithm based on C-V and Gaussian mix model provides an effective means to separate the lesions in an image.

查看全文 下载PDF阅读器

关闭