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基于双轮廓同步跟踪的果树枝干提取及三维重建

Fruit tree extraction based on simultaneous tracking of two edges for 3D

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中文关键词: 机器视觉 模型 线性回归 三维重建 轮廓跟踪 二叉树结构 曲率约束

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中文摘要:

自适应果实振动收获是利用机器视觉技术识别果树的几何参数，从而分析其动力学特性并用来自动调整振动设备的参数，达到高
的无叶山核桃树为研究对象，根据果实自适应振动收获方式的需要，研究了一种基于双轮廓同步跟踪提取果树枝干并利用双目视觉
适应阈值分割算法和轮廓跟踪技术提取果树枝干区域，细化后得到枝干骨架并用二叉树结构描述。然后根据极线约束和拓扑结构建
树树枝形状的连续性，在三维重建过程中引入了曲率约束，从而提高了重建的效果。最后利用植物学的营养管道输送模型，结合线
显示，重建的三维果树枝干形态与真实果树在视觉上很接近，估计的半径与测量半径之间的相对误差小于9%。该研究可为果树动力
从而为果实的自适应振动收获技术提供参考。

英文摘要:

Abstract: In order to develop adaptive equipment for the mechanical harvest of fruit, a 3D model of a fruit tree was required for analyzing
tuning vibratory parameters. A Chinese hickory tree without leaves was selected for this study. The objective of this paper was to extract tru
reconstruction based on a stereo vision with two images. All tree branches in an image were divided into two parts, up-side branches and do
to their different background. The up-side branches can be easily segmented by an auto-threshold binarization algorithm. The down-side br
tracking of the two edges. The branch in image can be treated as a series of scanning beams defined by two end points with a certain width.
to find an optimal path from the seed scanning beam to the root scanning. At each tracking step, nm candidate scanning beams with certain
constraints, and only n scanning beams with lowest cost were reserved for next tracking step. After successfully tracking, a branch can be e
from the optimal path. Thinning the branch, a binary tree was employed to describe the topology structure of the tree. In view of the continu
intersection points and bifurcate points of the skeleton were repaired heuristically. Under the topology and epipolar constraints, branch cor
easily. Likewise, for a pair of corresponding branches, points in one branch can be found by their corresponding ones in another branch by
accuracy of a reconstructed 3D model of trunk, curve-based reconstruction with curvature constraint instead of point-based reconstruction
of the Pipe Model of botany, the radius of a real branch was regressed as a linear equation with the variable of its length. Finally, an example
by Pro/E software was shown. The result demonstrated that the reconstructed 3D tree is realistic visually. However, some branches were no
others. To solve these problems, more images with different views of the tree are needed and a data-fusing algorithm should be provided to
branch, a comparison of the estimated radiuses between the 3D reconstruction and the measurement was made, and the relative derivation v
imprecise assumption that the real cross section of branch was not an absolute circle.

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