Dynamic Monitoring of Forest Volumes by a Feature Extraction Method

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ABSTRACT

In this article, in order to improve tree volume calculation method, a measurement method based on tree information point feature extraction is proposed, the method based on image processing and binocular vision, according to the measurement result of information point change and tree growth model, achieve through the distance change of information point to study the tree volume change. The visual measurement method is compared with the traditional method, the feasibility and accuracy of the method are proven. From the results, tree volume changes through the information point feature extraction and the traditional breast diameter measurement is very similar, the maximal percentage increase is 2.570% and 2.546%, the minimum percentage increase is 0.092% and 0.068%, which shows that volume change is consistent with the results, confirmed the tree volume change scheme of visual measurement is feasible and the result is reliable, which can reduce the impact of environmental change in the manual measurement.

KEYWORDS
Baseline Distance, Feature Extraction, Image Processing, Volume

1. INTRODUCTION

With the rapid development of the modern information and technology, the degree of digital forestry and forestry informatization has been improved higher and higher, which yields a hot spot attracting the majority of the forestry technologists’ attention in the recent years. That is how to accurately calculate the tree volume change of the single tree based on the change rule of important tree measurement factors from the forest survey by the simple measuring methods and means. And the tree volume quantity data is mainly acquired by taking the factors such as diameter in breast high of trees and the height of trees and so on as the reference. And combine the different areas’ volume equations to get the tree volume of the local environment. Therefore, how to get the factors of the diameter in breast high of trees and the height of trees is the key to make the point of the tree volume. Feng et al. (2007) use the total station to make out the height of trees by the traditional theory that is the trigonometric leveling. However, in the forest zone, trunks shading each other, it’s hard to observe the treetop let alone measure the height of trees accurately. Wang and Gao (2006) as the like divides the stumpage into two parts, height under branch and crown height. They take the stereo reconstruction technology to get the height of trees and this method need to take pictures of the stumpage and then construct the model then calculate the height of trees. But, the date is so large.

This research is based on a measuring method of feature extraction. Mark 4 information points on the location of the trees’ breast height, and get the space information of the information points

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through the image processing and visual technology. Take the image data of the trees every ten days and then calculate the distance change among the 4 points of each image. Moreover, take the local volume table into account and get the change of the tree volume. Therefore, the dynamic monitoring research on the tree volume is done, which proves the feasibility and the applicability of the plan on account of the feature extraction calculation.

2. THEORETICAL BASIS

2.1. The Parallel Binocular Stereo Vision Principle

Figure 1 is the imaging schematic diagram of the simple parallel binocular 3D (Zhang, 2005; Zhang, 2013). B stands for the baseline of the 2 cameras.

The two cameras view the same feature P(xc, yc, zc) of the space object at the same time, and respectively obtain the image coordinates, (XL, Y) and (XR, Y), from the left image and the right image. Supposing both of the two cameras’ focal distance are f, then the following formula will be gotten by the triangular geometry relationship (Xiang, Ying, Jiang, 2012; Zhang, 2013):

\[
\begin{align*}
    x_e &= \frac{B \cdot X_L}{D} \\
    y_e &= \frac{B \cdot Y}{D} \\
    z_e &= \frac{B \cdot f}{D}
\end{align*}
\]

Figure 1. Binocular 3D imaging principle
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