Tree Ageing Using MATLAB: Literature review

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Abstract: This project describes the design and implementation of an interactive image analysis system for dendrochronology, tree ring structure. Image processing is the highest level of the evolution of imaging techniques. New qualities are brought to imaging system by digital computers and processors. Image processing has various application fields. Such application is tree ring analysis. It determine the living period of tree and all the factors affecting the tree. Image analyses transform the tree ring into digital data using processing software. This process includes resizing, density slicing, measuring, scaling and stacking. Software are available for analyzing the factor of various tree ring patterns.

Keywords: Tree trunk, rings, Image processing, Tree age, computer vision

1. INTRODUCTION

Image Processing deals with images which are two-dimensional entities (such as scanned office documents, x-ray films, satellite pictures, etc) captured electronically through a scanner or camera system that digitizes the spatially continuous coordinates to a sequence of 0’s and 1’s. A digital image is a mapping from the real three-dimensional world to a set of two-dimensional discrete points. Each of these spatially distinct points, hold a number that denotes grey level or color for it, and can be conveniently fed to a digital computer for processing. Here, processing essentially means algorithmic enhancement, manipulation, or analysis (also understanding or recognition) of the digital image data. Every image processing technique or algorithm takes an input, an image or a sequence of images and produces an output, which may be a modified image and/or a description of the input image.[1]

Edge detection forms the key component in a computer vision-based tree-ring analysis system for use in dendrochronology. The nature and diversity of tree-ring patterns make it necessary to employ human intervention and intelligence in tree-ring boundary identification. Any attempt to completely automate the process would mandate unacceptable levels of computation and could cause the system to become unpredictable when handling tree-ring samples with anomalies. A number of edge detection algorithms have been developed for various applications, but not all of them are amenable to analyst interaction. Dendrochronology is the science of dating events and variations in environment in former periods by comparative study of growth rings in trees and aged wood. Each year a tree adds a layer of wood to its trunk and branches, thus creating the annual rings that are seen when viewing a cross-section. Earlywood develops during the rainy season when there is abundant water for cellular growth. Latewood develops during the drier season and consists of densely packed cells that cause the ring to appear darker compared to the earlywood. Thus a typical cross-section of a tree trunk exhibits alternating annular regions of earlywood and latewood. The growth ring is the annular region consisting of the earlywood and the subsequent latewood, moving away from the wood center. [2]

Fig.1. Tree Trunk

2. Literature Review

The digital close range photogrammetry (DCRP) approach has been used for tree’s age estimation from its photographs with image analysis. Age of a tree can be determined using diameter or from the circumference, then convert it into diameter of a tree. The aim of this study is to determine the age of a tree by measuring tree diameter using close range photogrammetry technique. Conventional method was used to estimate the age of a tree by determining diameter at breast height (DBH) by using a measuring tape. Three jelutong trees with a different size were used in this study. Finding of the results shows the 3D representation of three sample trees with their circumference and diameter measurement compared to the conventional reading. From the analysis it was found that the different between conventional and DCRP method on tree age estimation on tree [1].

Rafael C. Gonzalez’et al.[2] Image segmentation is the fundamental approach of digital image processing. Among all the segmentation methods, Otsu method is one of the most successful methods for image thresholding because of its simple calculation.
Otsu is an automatic threshold selection region based segmentation method. The paper gives a brief detail information on Otsu algorithms [2].

Er.Nirpjeet kaur”et al [3] Many edge detection approaches have been proposed in the literature but in most cases, the basic approach is to search for abrupt change in color, intensity or other properties. Unfortunately, in many cases, images are corrupted with different types of noise which might cause sharp changes in some of these properties. In this paper, we propose a new method for edge detection which uses k-means clustering, and where different properties of image pixels were used as features. We analyze the quality of the different clusterings obtained using different k values in order to choose the best number of clusters. The advantage of this approach is that it shows higher noise resistance compared to existing approaches [3].

Zhong Qu”et al [4] Image segmentation is an important preprocessing operation in image recognition and computer vision. This paper proposes an adaptive K-means image segmentation method, which generates accurate segmentation results with simple operation and avoids the interactive input of K value. This method transforms the color space of images into LAB color space firstly. And the value of luminance components is set to a particular value, in order to reduce the effect of light on image segmentation. Then, the equivalent relation between K values and the number of connected domains after setting threshold is used to segment the image adaptively. After morphological processing, maximum connected domain extraction and matching with the original image, the final segmentation results are obtained. Experiments proof that the method proposed in this paper is not only simple but also accurate and effective [4].

W.X.Kang”et al [5] The study of tree-rings is a common task in dendrology. Usually the rings deliver information about the age of the tree, historic climate conditions and forest densities. Many different techniques exist to perform the tree-ring detection, but they commonly are semi-automatic. The main idea of this work is to propose an automatic process for the tree-ring detection and compare it with a manual detection made by an expert in dendrology. The proposed technique is based on a variant of the Generalized Hough Transform created using a very simple growing model of the tree. The automatic algorithm shows tolerance to textured and very noisy images, giving a good tree-ring recognition in most of the cases. In particular, it correctly detects the 80% of the tree-rings in our sample database [5].

Z.Ningbo”et al [6] Image processing is the highest level of the evolution of imaging techniques. New qualities are brought to imaging systems by digital computers and processors. Image processing has various application fields. Such application is tree ring analysis. It determines the living period of trees and all the factors affecting the tree. Image analyses transform the tree ring into digital data using processing software. This process includes resizing, density slicing, measuring (distances and angles), scaling, and stacking. Software are available for analysing the factors of various trees ring patterns. This paper study about the software used image processing for analysing dendrochronology [6].

L.Dongju”et al [7] Processing of cross sectional view of a wood that predicts the age and its weather impact by using convolution theorem and SVM classifier. The cross sectional view of a wood (X-Ray image) is extracted from the tree and it is given as an input. Image is processed and converted into gray scale image in order to remove the noise which present in the cross sectional view of an image. The extracted image is converted into vector. Vector contains many tree ring structure, distance between two tree ring structures is predicted using distance calculation. Input image is matched with the trained image. Image stored in the database is classified using SVM classifier based on the distance between two tree ring structures. If the input image matches with trained image, it will retrieve age, weather impact and outer layer thickness of the wood. The distance between two tree ring structure is used to classify and analyze age, weather impact and outer layer thickness of the wood by using SVM classifier. In the existing system two layered laminated wood is taken and processed. The laminated wood is pre-processed and it leads to wastage so the quality of wood cannot be predicted accurately [7].

3. Proposed work

Image Processing deals with images which are two-dimensional entities (such as scanned office documents, x-ray films, satellite pictures, etc) captured electronically through a scanner or camera system that digitizes the spatially continuous coordinates to a sequence of 0’s and 1’s. A digital image is a mapping from the real three-dimensional world to a set of two-dimensional discrete points. Each of these spatially distinct points, hold a number that denotes grey level or color for it, and can be conveniently fed to a digital computer for processing. Here, processing essentially means algorithmic enhancement, manipulation, or analysis (also understanding or recognition) of the digital image data. Every image processing technique or algorithm takes an input, an image or a sequence of images and produces an output, which may be a modified image and/or a description of the input image. Image processing has various application fields. Such application is tree ring analysis. It determines the living period of trees and all the factors affecting the tree. The age of tree is determined by whorl around the tree, core of the tree rings and radiocarbon dating. The thickness of the tree-ring depends on various factors such as:

- The age related growth trend due to normal physiological aging processes.
- The climate that occurred during that year.
- The occurrence of disturbance factors within the forest stand (for example, a blow down of trees).

The occurrence of disturbance factors from outside the forest stand (for example, an insect outbreak that defoliates the trees, causing growth reduction).
The measurement of tree rings would allow us to understand the past climate and help us to predict drought and flood over a period of years, which would provide economic advantages for the agriculture.

Three major steps for tree ring analysis include:

- Preprocessing
- Finding the Center
- Generating Profiles

This approach allows the development of a robust system that can emulate the complex human vision analysis of tree samples which often tend to have unpredictable features and finalize the age of tree.

Factors for the thickness of the tree-rings:

- Physiological aging processes
- Climate
- Disturbance factors
  - Within forest
  - Outside the forest

The pattern of tree – ring is analysed by the following methods:

- Whorl around the tree
- Core of the tree rings
- Radiocarbon dating.

A whorl is the circular growth of branches in the same spot around the tree trunk. As the tree gets older.

Fig.2. Flowchart
Conclusion

The measurement of tree rings would allow us to understand the past climate and help us to predict drought and flood over a period of years, which would provide economic advantages for the agriculture. The science of tree ring dating known as dendrochronology, provides techniques for the precise dating of trees. In order to effectively use the information contained in the tree-rings, there is an impending need to establish a robust method to measure the tree rings. Many computational models are available for analyzing the factors of various trees ring patterns. But there is not an efficient model for finding the age of tree and the climatic condition using the factors. Development of a robust system that can emulate the complex human vision analysis of tree samples which often tend to have unpredictable features and finalize the age of tree is necessary.

References

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