

## Chapter 21

# Design of Vision Measurement Device for Seeding Robot based on Ant Colony Algorithm and Nonlinear Circuit System

**Liu Xiaojie**

*Jiangsu University of Technology, China*

**Zhu Hongjin**

*Jiangsu University of Technology, China*

**Fan Honghui**

*Jiangsu University of Technology, China*

**Zhang Min**

*Jiangsu University of Technology, China*

### ABSTRACT

*In order to solve the problem of low efficiency and accuracy in the control process of seeding robot, a vision measurement device based on ant colony algorithm and nonlinear circuit system is proposed in this paper. By scanning the trunks areas, border crossing points of the bottom of the tree and ground were detected, and these points were divided into two clusters on both sides based on neighbouring relationship. The simulation result is compared with artificial recognition in a two-orchard environment. The result shows that the proposed method is reliable, safe and can satisfy the moving request of seeding robot.*

## 1. INTRODUCTION

Robot vision system can get two-dimensional image for the environment by visual sensor, which will be analysed and explained by visual processor, and then be converted to symbols, through which the robot can recognize object, determine and determine its position. The first problem need to be solved by the intelligent robot when in practice is the perception to the external environment. Only after this could it complete the specific tasks. The visual sensor can get the most significant environmental information, so highly efficient and stable mobile robot vision system is an indispensable part of the robot. For the robot vision system, study is carried out about the image processing algorithms and the software and hardware designs, and a certain achievements are acquired. Visual information has accounted for an extremely great proportion in the human environment where dynamic visual information is its main constituent. The robot vision is a new direction in robotics area. Dynamic visual information based on the robot vision has become an important research direction. Detecting and tracking the moving object is a very important topic in the application field of vision, which has the widespread application in robotics domains. Because of exiting the phenomenon such as the illumination change, the background disturbance, the shadow, the camera vibration, the movement object covers and so on, there will be an enormous challenge to detect and track moving object correctly. Researches have been done to the visual image processing algorithms, including image pre-processing, image segmentation, moving target detection, etc. Comparing the advantages and disadvantages of the various methods through simulations, the better ways are chosen and realized by program. The pin-hole camera model is used for target positioning, which avoids a large number of matrix operations, and increases computing speed. For the deficiencies of the traditional threshold segmentation, the ant colony algorithm is applied on image segmentation, and a new method with variable threshold based on ant colony algorithm group is proposed for the colour image segmentation. The method effectively overcomes the problem of great impact of the external changing light on colour image segmentation, and has a self-adjustment function for the colour thresholds under different light environments, which increases the accuracy of image segmentation.

During the 1990s, the Italian scholar M. Dorigo, V. Maniezzo (Li et al., 2014; Chi, Zhu, Jiang, & Tian, 2013) proposed a heuristic evolutionary bionic algorithm based on population by simulation the collective behaviour of ant routing, and found the whole ant colony make use of pheromone to collaborate with each other to form a positive feedback that each ant follow the shortest path. In last two decades, Ant colony algorithm got extensive application in combinatorial optimization, function optimization, system identification, network route, robot path planning, data mining and cabling design of large scale integrated circuit. But many scholars realized the limitation of traditional ant colony algorithm to improve. The improvement of ant colony algorithm has two handles, one aspect is the improvement of itself, such as improvement mode of pheromone release, probability of selection m

The image segmentation is a key step between image processing and image analysis, and it plays an important role in the research of a robot vision system. Many types of image segmentation techniques have been proposed in the literature. They can be grouped into three main categories corresponding to three different definitions of regions: the methods in the first group, called pixel based segmentation methods, define a region as a set of pixels satisfying a class membership function. In this category are included the histogram based techniques (Vieira, Gerla, & Misra, 2013) and the segmentation by clustering algorithms (Wang et al., 2014). The methods in the second group, corresponding to the area based segmentation techniques, consider a region like a set of connected pixels satisfying a uniformity condition. The growing region techniques (Tan, Xiong, & Wen, 2012) and the split and merge algo-

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