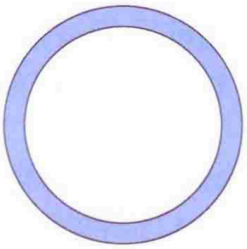
课后作业

9.52 某家高技术制造工厂与当地政府签订了一份合同，合同内容是制造右图所示的高精度垫圈。合同要求使用图像系统来检测所有垫圈的形状。在合同正文中，形状检测是指检测垫圈内边缘和外边缘的偏差。你可以做如下假设：（1）存在一幅能够满足要求的垫圈“金”图像（对这一问题而言，“金”图像是指一幅完美的图像）；（2）系统所用成像和定位部件的精度高到足以允许你忽略数字化和定位引起的误差。为了规定系统的视觉检查部分，假设工厂聘你为顾问。请根据形态学/逻辑运算提出一种检测方案。



Problem 9.37

As given in the problem statement, interest lies in deviations from the round in the inner and outer boundaries of the washers. It is stated also that we can ignore errors due to digitizing and positioning. This means that the imaging system has enough resolution so that objectionable artifacts will not be introduced as a result of digitization. The mechanical accuracy similarly tells us that no appreciable errors will be introduced as a result of positioning. This is important if we want to do matching without having to register the images.

The first step in the solution is the specification of an illumination approach. Because we are interested in boundary defects, the method of choice is a backlighting system that will produce a binary image. We are assured from the problem statement that the illumination system has enough resolution so that we can ignore defects due to digitizing.

The next step is to specify a comparison scheme. The simplest way to match binary images is to AND one image with the complement of the other. Here, we match the input binary image with the complement of the golden image (this is more efficient than computing the complement of each input image and comparing it to the golden image). If the images are identical (and perfectly registered) the result of the AND operation will be all 0s. Otherwise, there will be 1s in the areas where the two images do not match. Note that this requires that the images be of the same size and be registered, thus the assumption of the mechanical accuracy given in the problem statement.

As noted, differences in the images will appear as regions of 1s in the AND image. These we group into regions (connected components) by using the algorithm given in Section 9.5.3. Once all connected components have been ex-

tracted, we can compare them against specified criteria for acceptance or rejection of a given washer. The simplest criterion is to set a limit on the number and size (number of pixels) of connected components. The most stringent criterion is 0 connected components. This means a perfect match. The next level for "relaxing" acceptance is one connected component of size 1, and so on. More sophisticated criteria might involve measures like the shape of connected components and the relative locations with respect to each other. These types of descriptors are studied in Chapter 11.

实验内容 2024.12.06

1. 基于图像形态学处理算法提取下面血管图像的中心线，并将提取的中心线以红色重 叠显示在原图中。注意:若读取到计算机中的血管图像不是二值图像，通过灰度变换算 法(阈值处理)将其转换成二值图像。