

國立清華大學

碩士論文

自動光學檢測系統的演算法改良

An Algorithm improve on AOI System

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I'm glad to thank...

摘要

在工業檢測的場合中，自動化影像辨識 (AOI) 技術日漸成為一個重要的應用，而現成的影像處理軟體通常有授權費過高，且準確度與分析速度並不符合產線的預算與需求，對此問題，我們希望可以找到一個低成本的解決方案，同時滿足產線對於分析速度的需求。本研究所實作出的產品檢驗流程可以粗略分為兩步驟，第一步驟為樣板設定，此步驟會紀錄標準的產品特徵；第二步驟為樣本檢驗，此步驟會將樣本與第一步驟所記錄下的樣本進行比對，並判斷此背光鍵盤是否有瑕疵或故障。本論文主要討論自動化光學檢測系統及分析演算法的設計架構與分析過程中的演算法比較並加以改良。並在最後將嘗試過的各種方法以產線實際運作的標準下進行比較。

Abstract

In the industrial production site, Automatic-Optics-Inspection (AOI) techniques has become an important application. Since the existing image processing software is not cost effective due to high licence fee, and doesn't meet the requirement of both speed and accuracy.

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Chapter 1

Introduction

1.1 Motivation

In production line, the quality check process is the final and the most important step before the products roll out. Having automatic inspection platform on the production line could speed up the production speed and reduce the chance that product with defect getting on the shelf. Which is important for all manufacturers. Since the previous solution is obsoleted. It doesn't performs well on lettering defect detection and couldn't identify the color of LED back-light of the keyboard. In this thesis, we will introduce the construction and implementation of an AOI(Automatic Optics Inspection) system that is special designed to do the LED self illuminated keyboards.

1.2 Goal

Design an AOI(Automatic Optics Inspection) system is have ability to detect the *lettering defect* and *LED multifunction* from *given image* or from *camera*. Need to be *accurate, scalable* and both *time & cost effective* in order to meet the requirement of production line.

1.3 Organization

The organization of the paper is as follows. In Chapter 2, we introduce some background knowledge related works, previous solution & our testing platform structure. In Chapter 3, we will give a detailed description of our testing work-flows and inspection algorithm design. In Chapter 4, we will further introduce the difference on performance of each key points detection methods and their pros & cons. Finally, we conclude this thesis in Chapter 5.

1.3.1 Main Contribution of This Dissertation

Provide a updated baseline platform

Independence of Subproblems

Speed up

Chapter 2

Preliminaries

In this section, previous works of OMR are mentioned. Preprocessing (binarization, staff profiling, staff detection, and staff removal) and recognition (symbol segmentation, symbol classification) are included.

2.1 Binarization

In recognition of printed scores, the color information, namely R/G/B or R/G/B/A vectors, is not useful. Instead, only the intensity information is considered for recognition, so gray-scaled images are always used as the raw input. Furthermore, people always determine if each pixel is background (white) or foreground (black) in advance, and hence the binarization is included in most applications of OMR.

In Pinto's research [1], two kinds of binarization methods were introduced depending on whether the binarization threshold is locally adjustable. The simplest way is applying a constant threshold to all pixels in the image, which is called *global thresholding*. The global threshold can be obtained by finding a value that maximizes the variance [2] between foreground and background pixels, preserves the most edge information [3], or maximizes the similarity between the binarized image and the original image [4, 5]. However, it cannot be expected that the intensity in different small regions is constant over the document, and a constant threshold might not work at a different intensity level. In particular, near the boundary of a page in a book, the image might

show a gradient-like difference in terms of the average intensity as compared to the region far from the book spine (Fig. 2.1). To deal with such situations, the choice of the threshold should be determined by local information (nearby pixels) [6], which is called *local thresholding*. In general, global thresholding is easier to be implemented, while local thresholding is more adaptive and robust.

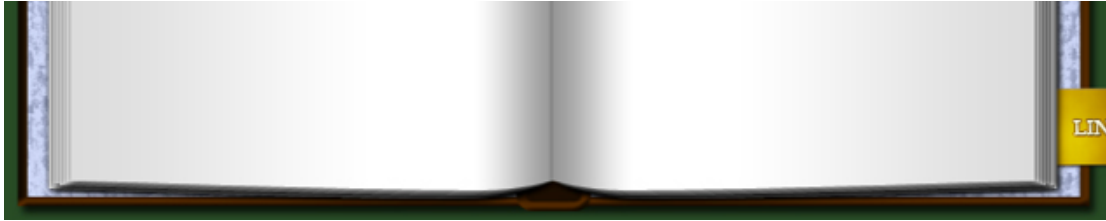


Figure 2.1: Example of the gray-scale image near the book spine.

2.2 Staff Detection and Removal

Dalitz et al. [7] introduced a systematic way for testing the staff removal algorithms. A dataset was generated from a set of ideal score images with the deformation methods listed in Table. 2.1. The deformation algorithms and the CVC-MUSCIMA dataset are made openly available by Forns et al. [8].

Deformation	Type	Parameter Description
Curvature	deterministic	height/width ratio of sine curve
Typeset Emulation	both	gap width, maximal height and variance of vertical shift
Line Interruptions	random	interruption frequency, maximal width and variance of gap width
Thickness Variation	random	Markov chain stationary distribution and inertia factor
<i>y</i> -variation	random	Markov chain stationary distribution and inertia factor
White Speckles	random	speckle frequency, random walk length and smoothing factor

Table 2.1: Deformation Methods.

Chapter 3

Methods

Chapter 4

Comparision Between Other Mehtods

Chapter 5

Conclusion & Future Works

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