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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感謝…

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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 importent application. Since the existing image processing software is not cost effective due to high licence fee, and doesn't meet the requirment of both speed and accuracy.

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Chapter 1

Introduction

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. Witch is important for all manufacturers. In this thesis, we will introduce an AOI platform based on OpenCV 3.3.1 & EmguCV 2.4 special designed for self illuminated keyboard. And give a pros & cons analysis for our case.

1.1 Motivation

Automatic Optical Inspection (AOI) technique is now widely use in modern production lines. With these techniques applied, cost spent on quality check & chance of making mistake has significantly dropped. But the ready-made AOI solutions still cost much on license fee, take a lot of resource to running on production line. There is a demand to make an AOI platform special designed for our own need. 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

Accuracy

The accuracy issue of previous solution is now solved by updated alignment methods and defect detection methods.

Speed up

After solved the accuracy issue, we find out the bottle neck of the inspection work flow. Thus, by reduce the input area size, only focus on the area that worth time to do the inspection.

Provide a updated baseline platform for later upgrade

This project provided a base model for future AOI tools development.

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 Common Image Processing Techniques

2.2 Related Works

2.3 Previous Solution

2.4 Inspection Platform Structure

Chapter 3

Methods

3.1 Work Flows Intorduction

3.2 Learning Stage

3.2.1 Load Reference Images from Camera or File

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3.3 Examining Stage

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Comparision Between Other Mehtods

4.1 Different Feature Point Extration Methods

4.1.1 SIFT

4.1.2 SURF

4.1.3 BRISK

4.1.4 ORB

4.1.5 FREAK

4.2 Comparithen between each methods

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Chapter 5

Conclusions & Future Works

5.1 Conclusions

5.2 Future Works

5.2.1 Multicamera controls optimizatin

5.2.2 GPU is not utilized in this project

5.2.3 Smarter Algorithm

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