**Development of a data fusion model for detection of electronic components and generating of a life-cycle inventory PCB model**

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Submitted in partial fulfillment of the requirements

for the degree of

Master of Science in

Physical Engineering Science

at the

Technical University of Berlin

13.10.2014

# Introduction

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## Object recognition from 2D Images

Dg

## Recycling potential of electronic waste

Asd

# Recognition of electronic components

Erdt

## Data fusion model

Saf

## Image preprocessing

Asf

### Image rotation correction

Safd

### Scaling determination based on scaling symbol

To bypass the restriction of invariant features for object recognition, the scaling of the printed circuit board images were determined using a scaling symbol is shown in Figure 1. The whole scaling process is showen in . At first the image is down scaled to 2000x1500 pixel. Afterwards the image is converted from the RGB color model to the HSV color model and the brightness channel (value channel) is used to make a discrete cosine transform filtering.



Figure 1: Scale symbol

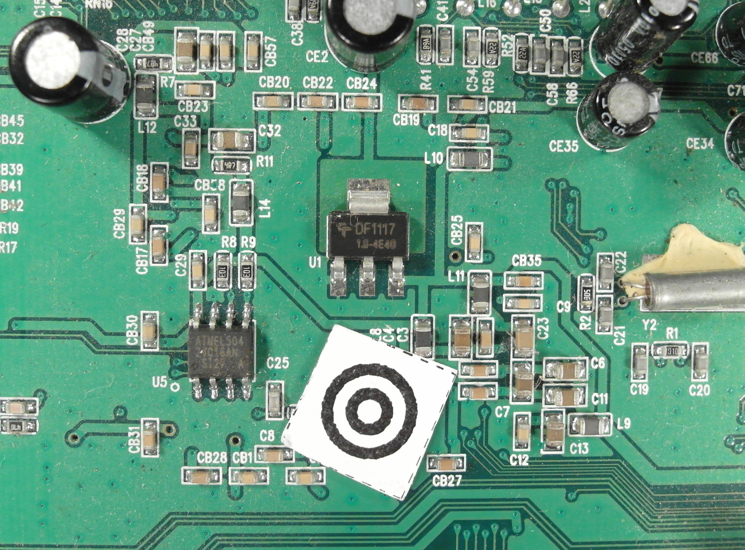


Figure : Scale symbol placed on the board

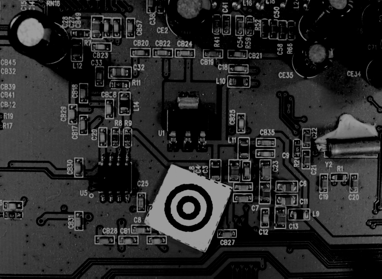


Figure : Cosine transform filtered image

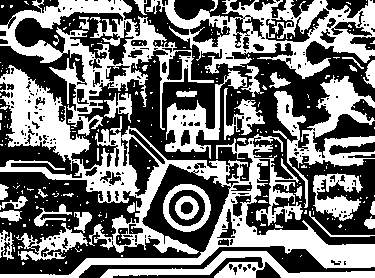


Figure : Otsu segmentation

## Electronic component detection

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### Electronic component detection based on color based background detection

Sdf

### Electronic component detection based on 3D range image

Sd

### Electronic component detection based on normalized correlation

Sasd

## Feature extraction algorithms for electronic components

Sad

### Fourier analyses for feature extraction

Asd

### Histogram based feature extraction

Sad

### Segment based feature extraction

Asd

### PCA based feature extraction in Laplacian of Gaussian filtered gray scaled image

Asfd

## Feature selection and feature fusion techniques for classification

Asd

# Classification

Asdf

## Random forest classifier

asd

## Support vector machine classifier

Asdf

# Decision fusion for component recognition

Asf

# Optical character recognition of electronic component marking

Dsf

## Introduction

Dsf

## Character segmentation

Dsf

## Optical character recognition with Tesseract and Cognex Vision Pro software

Asdf

## Electronic part label verification based on Octopart database

Dsf

# Experimental results

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## Dataset creation

Asf

### Image acquisition

Asf

## Classification results

Ef

## Optical character recognition results

Asd

# Life-cycle inventory analyses of printed circuit boards

Asdf

## Introduction

Safd

## Printed circuit board region classification based on electronic part recognition results

Sad

## GaBi-Software and LCI data availability of electronic components

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## ILCD format for LCA-data exchange

# Conclusion and prospects

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