

سامية محمد مصطفى



شبكة المعلومات الجامعية

بسم الله الرحمن الرحيم



سامية محمد مصطفى



شبكة المعلومات الجامعية



شبكة المعلومات الجامعية التوثيق الالكتروني والميكروفيلم



سامية محمد مصطفى



شبكة المعلومات الجامعية

جامعة عين شمس

التوثيق الإلكتروني والميكروفيلم

قسم

نقسم بالله العظيم أن المادة التي تم توثيقها وتسجيلها
علي هذه الأقراص المدمجة قد أعدت دون أية تغيرات



يجب أن

تحفظ هذه الأقراص المدمجة بعيدا عن الغبار



سامية محمد مصطفى



شبكة المعلومات الجامعية



بعض الوثائق الأصلية تالفة



سامية محمد مصطفى



شبكة المعلومات الجامعية



بالرسالة صفحات لم ترد بالأصل



**ALEXANDRIA UNIVERSITY
FACULTY OF ENGINEERING**

***RECOGNITION OF PARTIALLY
OCCLUDED OBJECTS***

*A thesis submitted to the
Department of Computer Science and Automatic Control
in partial fulfillment of the requirements
for the degree of
Master of Science*

*By :
Sherin mosstafa youssef*

*Supervised By :
Prof. Dr. Mohamed A. Ismail
Prof. Dr. Amin A. Shokry*

Alexandria , 1995

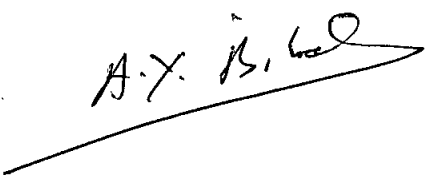
B
12300

✓ We certify that we have read this thesis and that in our opinion it is fully adequate, in scope and quality, as a dissertation for the degree of Master of Science.

Exam Committee :

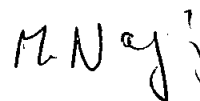
1. Prof. Dr. Abd El-Monem Belal

Dept. of Electrical Engineering,
Cairo University.



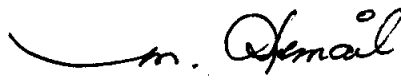
2. Prof Dr. Magdi Nagi

Dept. of Computer Science and Automatic Control,
Alexandria University.



3. Prof. Dr. Mohamed A. Ismail

Dept. of Computer Science and Automatic Control,
Alexandria University.



4. Prof. Dr. Amin Ahmed Shokry

Dept. of Computer Science and Automatic Control,
Alexandria University.



For the faculty council :

Prof Dr. Adel Lotfy Mohamedein

Vice Dean for Graduate Studies and Research,
Faculty of Engineering, Alexandria University.

Acknowledgment

Thanks to God helping me finish this thesis.

My deepest gratitude and appreciation are due to Prof. Dr. Mohamed A. Ismail for his major part in preparation of this work. Thanks for his persistent direction and constructive guidance throughout this work. His continuous guidance and meticulous supervision are deeply appreciated.

I would like to express my deepest gratitude to Prof. Dr. Amin Shokry for his valuable help and fruitful assistance.

Finally, I take the advantage of this occasion to recognize and acknowledge the continuous help accorded to me by my family. I should also thank all the members of the department for their faithful suggestion and recognizable help.

Abstract

The aim of this work is to demonstrate how to enhance the capability of the computer vision to recognize partially occluded parts.

In the thesis, we show how local features are used for object identification. Local features such as corners, holes, lines, curve segments,...etc. depends only on a subset of an object so it is possible to deal with the problem of recognizing occluded objects in the case where some of the local features are visible.

First, a survey of computer vision process is introduced with an emphasis on the related topics, this is followed by discussion of the problems of occlusion. Next, three techniques have been presented, the first uses the holes in the objects as a local feature for radial template matching. The second, uses the Curvature Guided Polygonal Approximation to represent objects in isolated and occluded scene depends on the existence of critical points of high curvature. Third, contour matching for those objects who do not posse critical points or in cases where such critical points are hidden.

In the simulation stage, algorithms and modifications have been implemented and results are summarized. The system is tested on a real set of handtools and mechanical parts. Different techniques are compared with respect to the ability of detection of occluded objects with boundary separated into isolated clusters, relative sensitivity to noise, the ability of recognize objects of different scales (sizes) and rotation, complexity and computational load.

Table of contents

	Page
<u>Chapter 1 : Introduction</u>	1
1.1. General background	1
1.2. The benefits of using machine vision in industry	7
1.3. Literature survey	8
1.4. Objective	10
1.5. Outline of the the thesis	11
<u>Chapter 2 : Low level image processing</u>	16
2.1. Introduction	16
2.2. Industrial machine vision system hierarchy	16
2.2.1. Image Acquisition	17
2.2.2. Processing	17
2.2.3. Segmentation	19
2.2.4. Description	20
2.2.5. Recognition	20
2.3. Basic Relationships Between Pixels	20
2.3.1. Neighbors of a pixel	20
2.3.2. Connectivity	21
2.4. Imaging Geometry	23
2.4.1. Translation	23
2.4.2. Scaling	25
2.4.3. Rotation.	25
2.5. The Detection of Discontinuities.	26
2.5.1. Point Detection.	28
2.5.2. Line Detection.	29
2.5.3. Edge Detection.	30
2.5.3.1. Basic formulation.	30

2.5.3.2. Gradient operators.	32
2.5.3.3. Laplacian operator.	35
2.5.3.4. Homogeneity Edge Detection.	36
2.5.3.5. The difference Edge Detector.	38
2.5.3.6. Using other convolution masks.	41
2.6. Edge Thinning algorithm.	44
2.6.1. Binary region thinning.	45
2.6.2. Graylevel Edge Thinning	47
2.7. Contour following.	49
2.8. Objects Representation.	51
2.8.1. Representation Scheme.	53
2.8.1.1. Freeman's Chain codes.	53
2.8.1.2. Polygonal Approximations.	56
2.8.1.3. Signatures.	61
<u>Chapter 3 : Region based recognition.</u>	63
3.1. Introduction.	63
3.2. Training the system.	65
3.3. Object recognition.	69
3.3.1. Image acquisition.	69
3.3.2. Preprocessing.	70
3.3.3. Labeling.	72
3.3.4. Feature Recognition.	73
3.3.4.1. The Area test.	76
3.3.4.2. The Ratio test.	76
3.3.4.3. The Continuity test.	77
3.3.5. Template Matching.	80
3.3.6. Object Recognition and Reconstruction.	83

<u>Chapter 4 : Using polygons to recognize and locate</u>	112
<u>partially occluded objects.</u>	
4.1. Introduction.	112
4.1.1. The problem.	112
4.1.2. Assumptions.	113
4.1.3. The Issues.	114
4.1.4. Literature and Approach.	116
4.1.5. Using polygons.	118
4.1.5.1. Matching polygon fragments.	118
4.2. Feature Extraction and Matching.	119
4.2.1. Polygon Approximation.	119
4.2.2. Polygon Fragments.	120
4.2.3. Corner Vertex Extraction.	122
4.2.4. Matching polygon fragments.	123
4.3. Hypothesis Generation.	125
4.3.1. Introduction.	125
4.3.2. Mutual Compatibility Between Two Matches.	126
4.3.2.1. Coordinate Transform Comparison.	127
4.3.3. Evaluation and Location of the Hypothesis.	129
4.3.4. Experimental Results.	129
4.4. Hypothesis Verification.	144
 <u>Chapter 5 : Classification of Partially Occluded</u>	 152
<u>Objects using 3-point matching and Distance Transformation.</u>	
5.1. Introduction.	152
5.2. Localization of dominant points.	155
5.3. Extraction of dominant points using 3-point matching.	160
5.4. Similarity measure using distance transform.	170
5.5. The results.	178

<u>Chapter 6 : Curve Matching.</u>	204
6.1. Introduction.	204
6.2. Definition of the problem.	207
6.3. Data acquisition and smoothing.	208
6.4. Conversion of curves into characteristic strings.	209
6.5. The string matching algorithms.	212
6.6. Recovering the transformation and verification.	214
6.7. Complexity.	215
6.8. Experimental results.	218
 <u>Chapter 7 : System testing and comparisons between different techniques.</u>	 220
7.1. Introduction.	220
7.2. Testing methodology.	220
7.3. Comparison of different techniques.	221
7.3.1. The ability of detection of occluded objects with boundary separated into isolated clusters.	221
7.3.2. Relative sensitivity to noise.	222
7.3.3. The ability of recognizing objects of different scales and rotation.	223
7.3.4. Complexity.	224
7.3.5. Dependability on local features.	227
7.3.6. Computational load and accuracy.	228
7.4. Conclusions.	229
7.5. Suggestions for future work.	237

Appendices

Appendix A **238**

A.1. Algorithm init_label.

A.2. Algorithm label.

A.3. Algorithm RunLenLabel.

A.4. Algorithm AreaCalculate.

A.5. Algorithm of Recognition .

A.6. Algorithm for calculating radial templates.

References. **255**

CHAPTER 1