



شبكة المعلومات الجامعية

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ





شبكة المعلومات الجامعية



شبكة المعلومات الجامعية

التوثيق الالكتروني والميكرو فيلم

# جامعة عين شمس

التوثيق الالكتروني والميكروفيلم

## قسم

نقسم بـالله العظيم أن المادة التي تم توثيقها وتسجيلها  
على هذه الأفلام قد أعدت دون أية تغيرات



## يجب أن

تحفظ هذه الأفلام بعيداً عن الغبار

في درجة حرارة من 15 – 20 مئوية ورطوبة نسبية من 20-40 %

To be kept away from dust in dry cool place of  
15 – 25c and relative humidity 20-40 %



شبكة المعلومات الجامعية



# بعض الوثائق الأصلية تالفة



شبكة المعلومات الجامعية



بالرسالة صفحات

لم ترد بالأصل



B 9497

# **AUTOMATIC CARTOON COLORING SYSTEM**

By

**Eng. Mohammad Gamal Eldeen Ahmad Mandour**

A Thesis Submitted to the  
Faculty of Engineering at Cairo University  
in Partial Fulfillment of the  
Requirements for the Degree of  
**MASTER OF SCIENCE**  
in

**SYSTEMS AND BIOMEDICAL ENGINEERING**

**FACULTY OF ENGINEERING, CAIRO UNIVERSITY**  
**GIZA, EGYPT**  
**February 2001**



# AUTOMATIC CARTOON COLORING SYSTEM

By

Eng. Mohammad Gamal Eldeen Ahmad Mandour

A Thesis Submitted to the  
Faculty of Engineering at Cairo University  
in Partial Fulfillment of the  
Requirements for the Degree of  
MASTER OF SCIENCE  
in

SYSTEMS AND BIOMEDICAL ENGINEERING

Under the Supervision of

Prof. Abdalla S. A. Mohamed  
Professor

Systems & Biomedical Engineering Dept.  
Faculty of Engineering, Cairo University

Dr. Ahmed M. R. El-Bialy  
Assistant Professor

Systems & Biomedical Engineering Dept.  
Faculty of Engineering, Cairo University

Prof. Mohamed S. El-Shereif  
Professor

Systems & Computers Department  
Electronics Research Institute

  
FACULTY OF ENGINEERING, CAIRO UNIVERSITY  
GIZA, EGYPT  
February 2001





# AUTOMATIC CARTOON COLORING SYSTEM

By

Eng. Mohammad Gamal Eldeen Ahmad Mandour

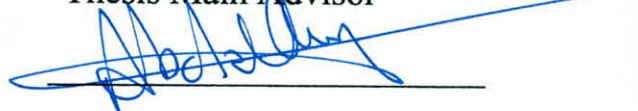
A Thesis Submitted to the  
Faculty of Engineering at Cairo University  
in Partial Fulfillment of the  
Requirements for the Degree of  
MASTER OF SCIENCE  
in

SYSTEMS AND BIOMEDICAL ENGINEERING

Approved by the  
Examining Committee

Prof. Abdalla M. S. Ahmed  
Systems & Biomedical Engineering Department  
Faculty of Engineering, Cairo University

Thesis Main Advisor



Prof. Mohamed Emad M. Rasmy  
Systems & Biomedical Engineering Department  
Faculty of Engineering, Cairo University

Member



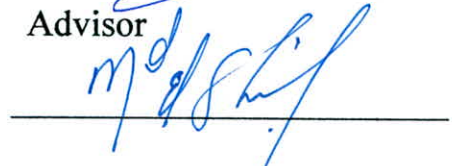
Prof. Abdul-Monem A. Wahdan  
Computers Engineering Department  
Faculty of Engineering, Ain Shams University

Member



Prof. Mohamed S. El-Shereif  
Systems & Computers Department  
Electronics Research Institute

Advisor



FACULTY OF ENGINEERING, CAIRO UNIVERSITY  
GIZA, EGYPT  
February 2001



# Table Of Contents

<b>List Of Tables</b>	<b>vii</b>
<b>List Of Figures</b>	<b>ix</b>
<b>Acknowledgement</b>	<b>xiii</b>
<b>Dedication</b>	<b>xiv</b>
<b>Abstract</b>	<b>xv</b>
<b>1- Introduction</b>	<b>1</b>
1-1- Introduction	1
1-2- Production Steps	2
1-3- Chapter Summary	10
1-4- Thesis Organization	10
<b>2- Literature Review</b>	<b>11</b>
2-1- Introduction	11
2-2- Existing Systems	11
2-3- Methods and algorithms	13
2-4- Chapter Summary	21
<b>3- Problem Description</b>	<b>23</b>
3-1- Introduction	23
3-2- System Inputs	23
3-3- System Outputs	24
3-4- Problem Analysis	24
3-4-1- Area Labeling	26
3-4-2- Feature Extraction	30
3-4-2-1- Minimum Enclosing Rectangle	30
3-4-2-2- Size	31
3-4-2-3- Center of Gravity	32
3-4-2-4- Moments	33

3-4-3- Calculating Distance	37
3-4-4- Link Break and Relink (LBR)	40
3-4-5- Linking with Genetic Algorithm	44
<b>3-5- Chapter Summary</b>	<b>49</b>
<b>4- Results and Discussion</b>	<b>51</b>
4-1- Introduction	51
4-2- Sample data	51
4-3- Results of Image Segmentation	57
4-3-1- Results of Area Labeling	57
4-3-2- Segmentation of a single pixel	58
4-4- Results of Feature Extraction	59
4-5- Calculating Intervector distance	73
4-6- Resolving multiple links	74
4-6-1- Solving using LBR	77
4-6-2- Linking using Genetic Algorithm	84
4-6-2-1- Selecting a size for population	84
4-6-2-2- LGA Results	86
4-7- System Limitations	88
4-8- System Performance Measure	95
4-8-1- Types of errors	95
4-8-2- Coloring Results	95
4-9- Results Summary	117
4-10- Chapter Summary	120
<b>5- Conclusions</b>	<b>121</b>
<b>6- References</b>	<b>123</b>
<b>A- Appendix A</b>	<b>127</b>
<b>B- Appendix B</b>	<b>131</b>
B-1- The BMP File Format	131
B-1-1- The BMP File Header	132
B-1-2- The BMP Bitmap Header	132



B-1-3- The Optional Palette	133
B-1-4- The BMP Image Data	134
B-1-5- The BMP Compression Formats	134
<b>C- Appendix C</b>	<b>137</b>
<b>C-1- Genetic Algorithms</b>	<b>137</b>
C-1-1- Traditional optimization and search methods	137
C-1-2- What do we mean by Optimization?	138
C-1-3- Difference between genetic algorithms and other traditional methods	138
C-1-4- Genetic algorithm operators	138
C-1-5- Genetic terminology	139
C-1-6- Similarity Templates (Schemata)	140
C-1-7- The fundamental theorem of genetic algorithm (schema theorem)	141
C-1-8- Components required to apply a genetic algorithm to any particular problem	143
<b>D- Appendix D</b>	<b>145</b>
<b>D-1- Data Samples</b>	<b>145</b>
D-1-1- Simple geometric shapes, Code SS-1	146
D-1-2- Front view of a walking figure, Code SM-1	147
D-1-3- Rear view of a walking figure, Code SM-2	148
D-1-4- Front view of a running figure, Code SH-1	150
D-1-5- Player on a bar, Code SH-2	152
D-1-6- Golf player, Code SH-3	154
D-1-7- Character representing wondering action, Code MM-1	158
D-1-8- Repetitive layer for "Bakkar" walking, Code MM-2	159
D-1-9- "Bakkar" holding and his goat "Rashida", Code HM-1	163
D-1-10- "Bakkar" and his friend on a horse moving his head and tail, Code HS-1	167



