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ABSTRACT

Segmentation of images is a vital part of medical image processing, and MRI (Magnetic Resonance Imaging) is already recognized as a very important tool for clinical diagnosis. In this thesis, comparisons between different segmentation algorithms are carried out, specifically on brain MRI images. Initial parts of the thesis provide the background to the project, and an introduction to the basic principles of MRI, respectively, followed by parameter definitions and MRI image artifacts. The next part briefly covers various image pre-processing techniques which are required, and this is followed with a review of the major segmentation techniques which are available, including thresholding, region growing, clustering, and K-Means clustering. The concept of fuzzy logic is also introduced here, and the chapter concludes with a discussion of fuzzy logic based segmentation algorithms such as Fuzzy C-Means (FCM) and Improved Fuzzy C-Means (IFCM) clustering algorithms. The following part provides details concerning the source, type and parameters of the data (images) used for this thesis. Evaluation and inter-comparisons between a number of different segmentation algorithms are given in near concluding part, finally, conclusions and suggestions for future research are provided in last part.

Qualitative comparisons on real images and quantitative comparisons on simulated images were performed. Both qualitative and quantitative comparisons demonstrated that fuzzy logic based segmentation algorithms are superior in comparison with classical segmentation algorithms. Edge-based segmentation algorithms demonstrated the poorest performance of all; K-means and IFCM clustering algorithms performed better, and FCM demonstrated the best performance of all. However, it should be noted that IFCM was not properly evaluated due to time restrictions in code generation, testing and evaluation.

CONTENTS

Chapter 1

INTRODUCTION.....	01
1.1 BACKGROUND.....	01
1.2 AIMS.....	02
1.3 THESIS ORGANIZATION.....	03

Chapter 2

MAGNETIC RESONANCE IMAGING.....	04
2.1 HISTORY OF MRI.....	04
2.2 BASIC PRINCIPLES OF MRI.....	05
2.2.1 Introduction.....	05
2.2.2 Radio frequency field and MR signal.....	08
2.2.3 Relaxation processes.....	10
2.2.4 Magnetic resonance imaging.....	11
2.2.4.a Slice selection.....	11
2.2.4.b Frequency encoding.....	11
2.2.4.c Phase encoding.....	11
2.2.4.d Image formation.....	12
2.3 MRI PARAMETERS.....	12
2.4 MRI PULSE SEQUENCES.....	13
2.5 MRI ARTIFACTS.....	14

Chapter 3

MR IMAGE PREPROCESSING.....	20
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Chapter 4

MR IMAGE SEGMENTATION.....	22
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4.1	INTRODUCTION.....	22
4.1.1	Thresholding.....	22
4.1.2	Region growing.....	23
4.1.3	Edge-based segmentation.....	25
4.1.4	Clustering.....	25
4.2	K-MEANS CLUSTERING ALGORITHM.....	27
4.3	FUZZY LOGIC.....	28
4.3.1	Introduction.....	27
4.3.2	Membership function.....	29
4.3.3	Applications.....	30
4.4	FUZZY C-MEANS CLUSTERING ALGORITHM.....	30
4.5	THEORETICAL COMPARISON BETWEEN FUZZY C-MEANS CLUSTERING ALGORITHM AND ITS EXTENSIONS.....	33
4.6	IMPROVED FUZZY C-MEANS CLUSTERING ALGORITHM.....	34

Chapter 5

DATA COLLECTION.....	37	
5.1	DATA SOURCE.....	37
5.2	DATA TYPE.....	37
5.3	DATA PARAMETERS.....	38

Chapter 6

RESULTS AND COMPARISONS.....	39
6.1 RESULTS FOR SIMULATED IMAGES.....	40
6.1.1 Edge-based segmentation.....	40
6.1.2 K-means clustering segmentation.....	44
6.1.3 FCM clustering segmentation.....	47
6.1.4 IFCM clustering segmentation.....	53
6.2 RESULTS FOR REAL IMAGE.....	56
6.3 COMPARISONS.....	60
6.3.1 Qualitative comparison.....	60
6.3.2 Quantitative comparison.....	61

Chapter 7

CONCLUSIONS AND FUTURE WORK.....	64
7.1 CONCLUSIONS.....	64
7.2 FUTURE WORK.....	66
REFERENCES.....	67
APPENDIX I: LIST OF FIGURES.....	74
APPENDIX II: LIST OF TABLES.....	77
APPENDIX III: GLOSSARY.....	78
APPENDIX IV: COMPUTING DETAILS.....	81
APPENDIX V: SUMMARY OF THE PROJECT WORK.....	82
APPENDIX VI: CONTENTS OF ACCOMPANYING CD.....	84