

**JADAVPUR UNIVERSITY**

**MASTER DEGREE THESIS**

**BRAIN MR IMAGE SEGMENTATION USING TYPE 2 FUZZY LOGIC**

A thesis is submitted in partial fulfilment of the requirements for the degree of

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**Department of Computer Science and Engineering**

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**Certificate of Recommendation**

This is to certify that Swaroop Acharjee (Registration No:, Roll No: ) has completed his dissertation entitled “**Brain MR Image segmentation using Type-2 fuzzy logic**”, under the supervision and guidance of Prof. (Dr.) Jamuna Kanta Sing, Department of Computer Science and Engineering, Jadavpur University, Kolkata and is being presented for the partial fulfillment of the degree of Master of Engineering in Computer Science and Engineering, Jadavpur University, Kolkata – 700032 during the academic year of 2020-21.

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**Certificate of Approval\***

The foregoing thesis is hereby approved as a creditable study of Master of Engineering in Computer Science and Engineering and presented in a manner satisfactory to warrant its acceptance as a prerequisite to the degree for which it has been submitted. It is understood that by this approval the undersigned do not necessarily endorse or approve any statement made, opinion expressed or conclusion therein but approve this thesis only for the purpose for which it is submitted.

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I hereby declare that this thesis contains literature survey and original research work by the undersigned candidate, as a part of his Master of Engineering in Computer Science and Engineering.

All the information is this document has been obtained and presented in accordance with academic rules and ethical conduct.

I also declare that, as required by these rules and conduct, I have fully cited and referenced all material and results that are not original to this work.

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**Contents Page No.**

Abstract

Chapter 1: Introduction

1.1 Clinical Brain MR Image Segmentation

1.2 Approach and application

Chapter 2: Literature Survey

2.1 Types of Brain MR Image Segmentation Methods

2.1.1 Fuzzy Logic Based Statistical Methods

2.1.2 Convolution Neural Networks (CNNs)

2.1.3 Fuzzy Clustering methods based on Entropy

Chapter 3: Background

3.1 Type-1 Fuzzy Systems

3.2 Type-2 Fuzzy Systems

3.3 Science behind the MR Imaging of Brain

3.4 Representation of Brain MR Images

3.5 BrainWeb Database

Chapter 4: Proposed Methodology

4.1 Overview

4.2 Workflow of the Algorithm

4.3 Description of the Algorithm

Chapter 5: Complexity Analysis

5.1 Time Complexity

5.1.1 Time Complexity of Global Membership value

5.1.2 Time Complexity of Local Membership value

5.1.3 Time Complexity of Type-2 Fuzzy Membership value

5.1.4 Overall Time Complexity

5.2 Space Complexity

5.2.1 Space Complexity of Global Membership value

5.2.2 Space Complexity of Local Membership value

5.2.3 Space Complexity of Type-2 Membership value

5.2.4 Space Complexity of Final Membership value

Chapter 6: Experimental Results

6.1 Implementation Overview

6.2 Classification Metrics

6.2.1 Misclassification Error (MSE)

6.2.2 Average Segmentation Accuracy (Avg SA)

6.2.3 Dice Coefficient (DSC)

6.2.4 Partition Coefficient (Vpc)

6.2.5 Partition Entropy (Vpe)

6.3 Quantitative Analysis Results

6.3.1 Misclassification Error (MSE)

6.3.2 Dice Similarity Coefficient (DSC)

6.3.3 Segmentation accuracies

6.3.4 Partition Coefficient (Vpc)

6.3.5 Partition Entropy (Vpe)

6.4 Qualitative Analysis Results

Chapter 6: Conclusion and Future Scope

References

**List of Figures**

2.1 Pictorial Representation of the clustering algorithms

3.1 Pictorial representation of a Crisp Set

3.2 Pictorial representation of a Type-1 Fuzzy Set

3.3 Graphical Representation of a Type-2 Fuzzy Set

6.1 Plot for Misclassification Errors

6.2 Plot for Dice Similarity Coefficient

6.3 Comparison plot for Segmentation accuracies across tissue region and average segmentation accuracy

6.4 Comparison plot for Partition Coefficient (Vpc) and Partition Entropy (Vpe)

6.5 Comparison of the Segmented Images

**ABSTRACT**

In this thesis, we have proposed an algorithm to segment Brain MR Image 3D volume using Type-2 Fuzzy logic. For each voxel in the 3D Brain MR image, three membership values are defined. Global Membership function measures the amount of uncertainty in the term of global entropy using fuzzifier weighted global membership function. The local membership function measures the spatially constrained likelihood-based local entropy using a fuzzifier weighted local membership function. A type-2 fuzzy interval set is computed for each of the voxel using the global and local membership values. The Type-2 fuzzy interval set is then defuzzified and normalized to obtain the Type-2 membership value. The cluster prototypes are calculated using these values. The final membership value for each of the voxel is calculated after integrating these global, local, and Type-2 membership values using three weighted parameters. These three weighted parameters are selected empirically. The algorithm is assessed qualitatively and quantitatively on eighteen 3D volumes of simulated clinical brain MR image data obtained from BrainWeb (SBD) having various combinations and levels of noise and IIH. The simulated results reveal that the proposed algorithm performs decently when evaluated in terms of Misclassification Error Percentage, segmentation accuracy for different tissue regions, average segmentation accuracy for the whole image volume, dice similarity coefficient, partition coefficient, and partition entropy.