FUZZY C-MEANS CLUSTERING ALGORITHM WITH LEVEL SET FOR MRI CEREBRAL TISSUE SEGMENTATION

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I cordially dedicate this thesis to the biggest treasures of my life, my parents, my brothers and my sisters who gave me their love and also for their endless support and encouragement.

Dad and wife,
I love you for every second of my life

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ABSTRACT

The brain is the most complex organ in the human body, and it consists of four regions namely, gray matter, white matter, cerebrospinal fluid and background. It is widely accepted as an imaging modality for detecting a variety of conditions of the brain such as tumours, bleeding, swelling, infections, or problems associated with blood vessels. Brain images mostly contain noise, inhomogeneity and sometimes deviation. Therefore, accurate segmentation of brain images is a very difficult task. This thesis presents a new approach of Magnetic Resonance Imaging (MRI) brain tissue segmentation, which consists of three main phases: (1) Noise removal using median filter, (2) Tissue clustering based on the fuzzy c-means, and (3) Tissue segmentation using the fuzzy level set method, which finally separates white matter from gray matter. The results show that the segmentation's accuracy rates of 98% is achieved when tested on 100 samples of MRI brain images atlas dataset.

ABSTRAK

Otak adalah organ yang paling kompleks dalam badan manusia, dan ia terdiri daripada empat kawasan iaitu bahan kelabu, bahan putih, cecair serebrospina dan latar belakang. Ianya diterima secara meluas sebagai modaliti pengimejan untuk mengesan pelbagai keadaan otak seperti tumor, pendarahan, bengkak, jangkitan, atau masalah yang berkaitan dengan saluran darah. Imej otak kebanyakannya mengandungi hingar, ketidakseragaman dan kadang-kadang pemesongan. Oleh itu, tugas mensegmentasikan imej otak dengan tepat adalah amat sukar. Tesis ini membentangkan satu pendekatan baru bagi segmentasi tisu otak MRI yang terdiri daripada tiga fasa utama: (1) Penyingkiran hingar menggunakan penapis median, (2) Pengkelompokan tisu berasaskan *fuzzy c-means*, dan (3) segmentasi tisu menggunakan *fuzzy level set*, yang akhirnya memisahkan bahan putih daripada bahan kelabu. Hasil kajian menunjukkan bahawa kadar ketepatan segmentasi sebanyak 98% dicapai apabila diuji ke atas 100 sampel daripada dataset imej otak MRI.