

WHITE MATTER SEGMENTATION OF BRAIN MRI DURING INFANCY

Michèle Péporté¹, Dana E. Ilea¹, Eilish Twomey², and Paul F. Whelan¹

¹ Centre for Image Processing and Analysis, Dublin City University, Ireland

² Department of Radiology, Children's University Hospital, Dublin, Ireland

michele.peporte2@mail.dcu.ie

Abstract

The objective of this study is the development of an automatic segmentation framework to measure the volume changes in white matter tissue from premature infant MRI data. Due to the early stage of the developing brain which results in a high water content in brain tissue, several major computational challenges arise including artefacts, intensity variations and partial volume effect.

The first component of the framework is the development of a novel brain extraction method [1] [2]. Due to the overlapping of intensity values across different brain tissues, a primary challenge is the removal of non-brain tissue such as skull, fluid, fat and body parts.

The second component involves the intensity inhomogeneities called bias field and has a significant effect on the segmentation. The intensity variations described as a low-frequency multiplicative artefact is a result of the inhomogeneity in the magnetic field during the MRI acquisition.

The last component is a novel probabilistic model which segments and measures the white matter volume. The key element is the classification of the partial volume voxels which is achieved by an expectation-maximization algorithm combined with a probabilistic segmentation scheme. Examples of each step of this framework are presented in Fig. 1.

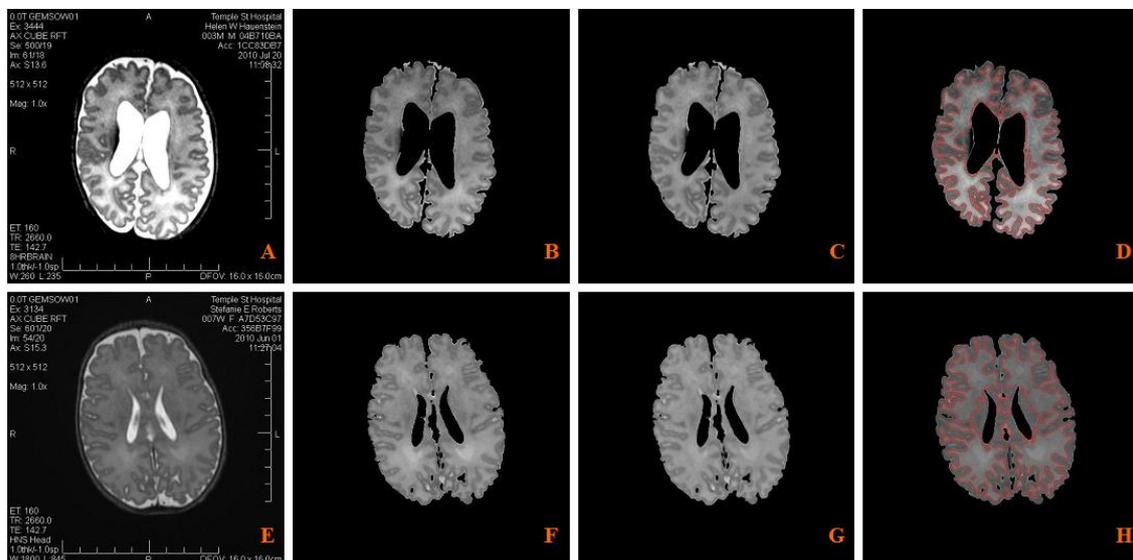


Figure 1: Some results of the three steps of the framework are presented; (A) and (E) are original images of two different premature infants, (B) and (F) show the results of the brain extraction algorithm, (C) and (G) demonstrate the correction of the corrupted bias field; (D) and (H) demonstrate final results in which the contours of the white matter are marked in red.

References:

- [1] Péporté M, Ilea D, Twomey E, and Whelan P, 2011. A Hybrid Approach to Brain Extraction from Premature Infant MRI, Scandinavian Conference on Image Analysis (SCIA 2011), LNCS, 6688:719-730
- [2] Péporté M, Ilea D, Twomey E, and Whelan P, 2011. A Morphological Approach for Infant Brain Segmentation in MRI Data, Irish Machine Vision and Image Processing Conference (IMVIP 2011), IEEE, . 125-126