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FAST AND AUTOMATIC BRAIN EXTRACTION BY GEODESIC PASSIVE CONTOURS (BEGPC)

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Abstract. *Brain extraction is pre-processing step for quantitative analysis of biomedical images. Precision at brain extraction is not solved by current techniques especially on T2 MRI towards top of the brain where challenging non-brain tissues appear like coastal band and there is a trade-off between precision and speed. Moreover, full automaticity obligates failure at challenging images by preventing user intervention. This novel technique (BEGPC) is simple, fast and full automatic which utilizes geodesic passive contours (GPC) and imitates edge-sensitiveness ability of an expert. Edges are caught at correct GPC by utilizing morphology of brain. Segments of nearby geodesics exclude non-brain tissues at enhancement stage. It has better precision than existing techniques whereas it gets ahead much at challenging images without sacrificing full automation. Performance of BEGPC is verified on axial and coronal T2 MRI of 40 patients by comparing with manual drawings of radiologists and with known techniques like BET in literature. It has an average correct boundary rate over 90%, similarity over 99% on normal images and performs %10 better than BET at challenging ones.*
Keywords: Brain extraction, Geodesic passive contours, MRI, Medical image processing, Automatic

1. **Introduction.** Brain extraction is an important initial step of following segmentation algorithms and quantitative analysis of brain tissues. It runs before measuring propagation of diseases and other neuroimaging applications [1]. For example, the amount of medicine injected to patient for visualization and anesthesia is determined according to volume of brain and BSC (Brain Surface Contour) plays a vital role there. The more precise the extraction is, the less the cumulative error is in further steps of neuroimaging applications.

Brain has to be precisely extracted first so that segmentation algorithms for CSF (cerebro-spinal fluid), GM (Gray Matter) and WM (White Matter) tissues show a better performance. Then, atrophy (volume loss) detection is done by measuring sulcal and ventricular changes based on tissue segmentation. However, each patient has different brain surface area (BSA). Thus, area and lengths of particular organs and tissues in brain like lateral ventricles and sulci may mislead research results which are carried out on many patients. Patient with big skull size and BSA will have wider ventricular area than other patients although they all have the same age and no significant infarct, Alzheimer disease,