Joint Intensity Fusion

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Abstract

Consensus techniques have demonstrated remarkable utility in various medical imaging segmentation tasks. Joint label fusion (JLF) employs spatially normalized atlas sets—gray-scale intensity images with corresponding segmentation labels—to segment unlabeled images using various weighting schemes. The technique of [1, 2] avoids informational redundancy in the atlas voting scheme by considering the atlas set as a whole versus individually in determining the optimal weights. In this work we extend this methodology to the estimation of intensity information in multi-modal image data sets, which we denote as *joint intensity fusion (JIF)*. JIF has several potential applications including removal of imaging artifacts (e.g., motion), removal of pathologies (e.g., tumour, lesions), imputation of missing modality data, and template enhancement. Evaluation is performed on a variety of data ...need more here. We provide an open-source implementation in the the well-known Advanced Normalization Tools (ANTs) software package which subsumes the functionality reported in [2] in addition to offering further enhancements such as multi-threading and a non-negative least-squares calculation of the atlas weights.

Keywords: ANTs, atlases, denoising, motion correction, non-negative least squares.

Introduction

"Wisdom-of-crowds" [3] approaches to medical image segmentation have proven remarkably successful. Recent international competitions such as the brain labeling challenge associated with the MICCAI 2012 Workshop on Multi-Atlas Labeling and the 2013 MICCAI Challenge Workshop on Segmentation: Algorithms, Theory and Applications have demonstrated the superiority of these consensus-based approaches when coupled with high-performing image spatial normalization algorithms.

Early techniques such as single atlas label assignment [4] and majority voting [5]

Methods

Results

Discussion

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