

ISBI 2015 Longitudinal MS Lesion Segmentation Challenge

Training Data Set Description (Feb 11, 2015)

Organization

This data set consists of longitudinal imaging data from 5 subjects. The top-level directory consists of directories named according to subject. Within each subject directory are three directories: 1) “orig” – containing the original MR images, 2) “preprocessed” – containing the images after co-registration, brain extraction, and non-uniformity correction, and 3) “masks” – which contain binary images representing lesion locations. The file names are structured as follows:

subject_timepoint_contrast(_pp).nii

subject – “training01”, “training02”, “training03”, “training04”, or “training05” in this data set

timepoint – 2 digit representation of the timepoint

contrast – “flair” stands for T2-weighted FLAIR, “mprage” stands for T1-weighted MPRAGE, “t2” stands for T2-weighted, “pd” stands for proton density weighted, “mask1” is the lesion mask from rater 1, and “mask2” is the lesion mask from rater 2.

For preprocessed images, “pp” is added as a suffix to the filename before the file extension.

Original Images

Data were acquired on a 3T Philips MRI scanner as part of an IRB approved research study conducted by the Johns Hopkins MS Center. Subjects “training01”-“training03” were diagnosed with relapsing-remitting MS at the onset of the study. Subject “training04” was diagnosed with clinical isolated syndrome and “training05” with primary progressive MS. Only pre-contrast images are available for this challenge. Acquisition time intervals were approximately 1 year. FLAIR images (TR=11s, TE=68ms, TI=2800ms) were 0.83x0.83mm in plane with either 4.4 or 2.2mm slice thickness (mostly the latter but some early timepoint images may have the larger slice thickness). T1-weighted MPRAGE images (TR=10ms, TE=6ms, Flip angle=8 degrees, TI=835ms) were approximately 1.1mm resolution isotropic. Dual echo proton density weighted and T2-weighted images (TR=4.2s, TE=12/80ms) were 0.83mm in plane with a slice thickness of 2.2mm. Images were converted from PAR/REC files to NIFTI using dcm2nii [1].

Preprocessed images

Original images were processed with the following pipeline:

- 1) Baseline MPRAGE was rigidly registered to MNI space using the MIPAV’s optimized automatic registration [2] with a normalized mutual information cost function.
- 2) Other baseline images were rigidly registered to the baseline MPRAGE using MIPAV with a normalized mutual information cost function.
- 3) Non-baseline images were co-registered to the baseline using MIPAV with a normalized mutual information cost function to the baseline MPRAGE.
- 4) Baseline MPRAGE images underwent brain extraction using SPECTRE [3] and dura stripping as implemented in TOADS-CRUISE [3].
- 5) The mask from Step 4 was applied to all other images for the same subject.
- 6) N4ITK [4] was applied to all images.

Lesion masks

T2 lesions were manually delineated using the MIPAV software package [2] by two independent raters. Delineations were created as paint masks on the pre-processed FLAIR images but other contrasts were referred to where necessary. Raters were blinded to the chronological ordering of each scan but were allowed to view the different timepoints and their delineations to ensure consistency.

Evaluation

We will be providing software to compute various metrics between a given longitudinal lesion segmentation and a reference segmentation. Metrics will include commonly used measures for quantifying individual differences as well as longitudinal metrics to evaluate differences in tracking lesion evolution. These metrics will be weighted and combined to generate a final score for each algorithm. The final scoring system is still under development at this time.

[1] <http://www.mccauslandcenter.sc.edu/mricro/mricron/>

[2] <http://mipav.cit.nih.gov/>

[3] <http://www.nitrc.org/projects/toads-cruise/>

[4] <http://stnava.github.io/ANTs/>