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Introduction:

Image Acquisition:

Methods:

The subjects were classified into two groups based on their lesion load (LL) as obtained by the expert. Group I consists of 29 subjects with LL less than or equal to 10 cc and group II consists of 28 subjects with LL greater than 10 cc. It is observed from these two groups, that false classifications are more prevalent in group I and some of these false classifications are consistent in most of the subjects and appear to be located at the same regions. Hence, these known false classifications were utilized to further improve the lesion classification. Segmented and expert validated images of each subject was deformed to the template using the inverse deformation fields, that were generated while co-aligning template with subject T1 images, following which false classifications on each subject was obtained by subtracting the deformed validated lesions from deformed segmented lesions in the template space. FCP map was created by taking the average of false classifications from all subjects. The FCP was then deformed to each subject using respective deformation fields. A threshold was applied to FCP to eliminate lower probabilities of occurrence of false classifications which was then applied to segmented images to further minimize the false classifications thus improving the lesion classifications. The threshold was set based on the observation on a cohort of subjects and was kept same for all subjects.

Results and Discussion:

Figure 1 shows a schematic diagram of the work flow for improving the lesion classifications using FCP map. Figure 2 shows T1, T2, FLAIR, automated segmented, expert validated, and improved segmented images. As can be observed from this figure, false classification on segmented image (arrow) was successfully removed by the application of FCP map. The dice similarity indices ($DSI = 2 * (\text{Seg} \cap \text{Ref}) / (\text{Seg} + \text{Ref})$; seg: obtained with automated technique and ref: validated lesions obtained by the expert) was calculated for all 57 subjects before and after the application of FCP. Average (\pm sd) similarity indices for all subjects, group I, and group II, when segmented images were compared with validated images were 0.791 (± 0.136), 0.699 (± 0.111), and 0.886 (± 0.082) respectively. These indices increased to 0.836 (± 0.106), 0.770 (± 0.094), and 0.904 (± 0.071) following the application of FCP. These improvements are significant on two-tailed paired t-test (fig. 3).

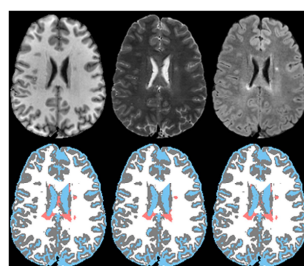


Fig. 2: 1st row: T1, T2, FLAIR; 2nd row: segmented, validated, improved images.

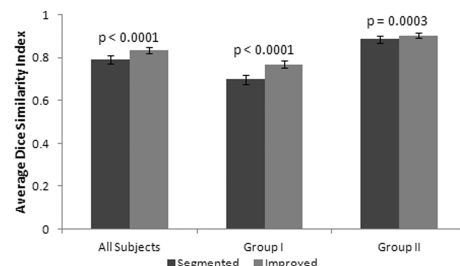


Fig. 3: Bar chart representing average DSI before and after the application of FCP map.

Conclusions:

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