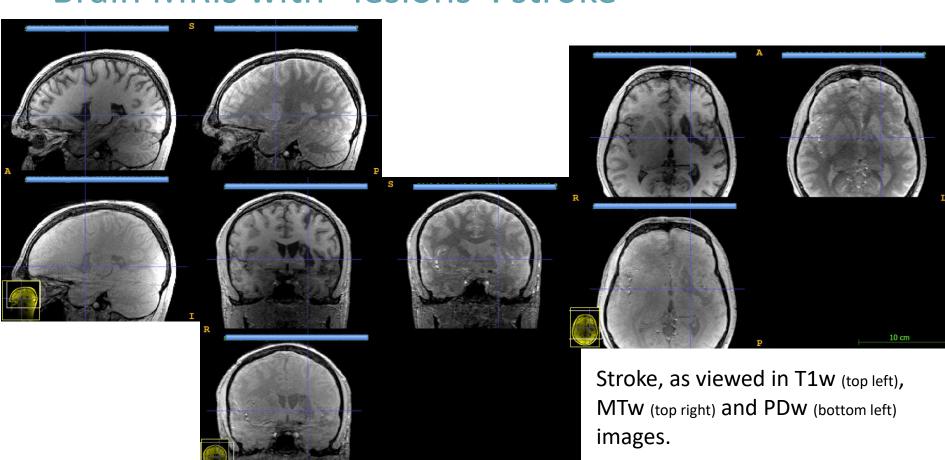


Lesioned brain images: Segmentation and normalization



Brain MRIs with "lesions": stroke

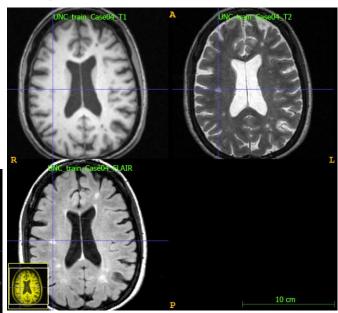




Brain MRIs with "lesions": multiple sclerosis







Multiple sclerosis, as viewed in T1w (top left), T2w (top right) and FLAIR (bottom left) images.

Normalization and segmentation?

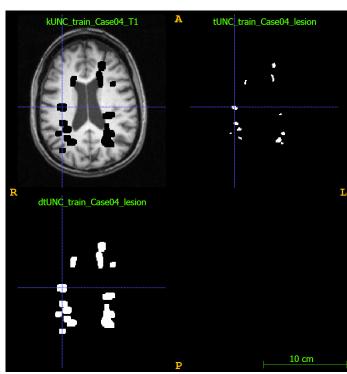


"Cost Function Masking"

- easy to apply
- provides normalization of healthy tissues

BUT

- Segmentation only in not-masked part
- if large lesion(s), global effect of normalization?
- need a mask of lesion area(s)



Multiple sclerosis: T1w (top left), lesion mask (top right) and dilated lesion mask (bottom left) images.

Lesion mask generation, manual vs automatic



Manual

- Time consuming & subjective
- Inter-rater variability and error prone

Automatic

- Faster & reproducible
- But how?
 - Specific sequences
 - Specific applications
 - Specific tools (ML, adaptative thresholding,...)

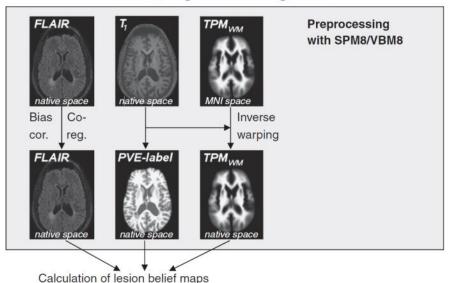
Lesion mask generation

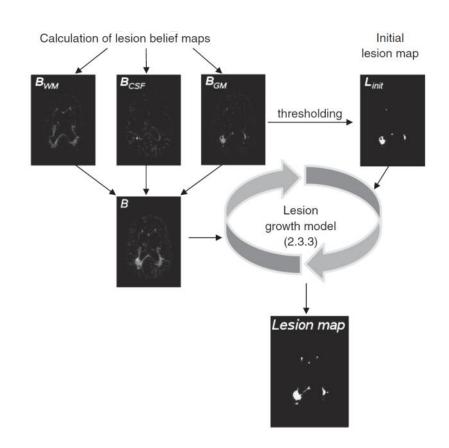


Automatic mask generation based on T1w and FLAIR images (Schmidt et al. 2012)

→ Lesion mask in subject space.

Lesion Segmentation Algorithm







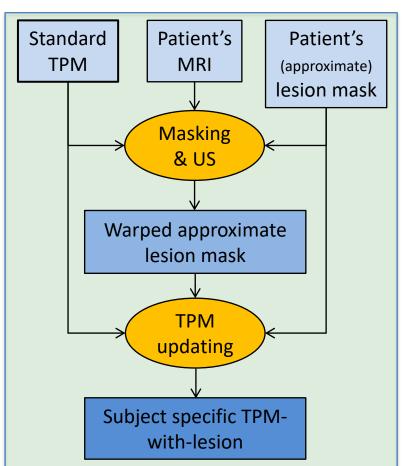


US-with-Lesion extend

- 1. TPM with lesion tissue class
- 2. apply US with new extTPM

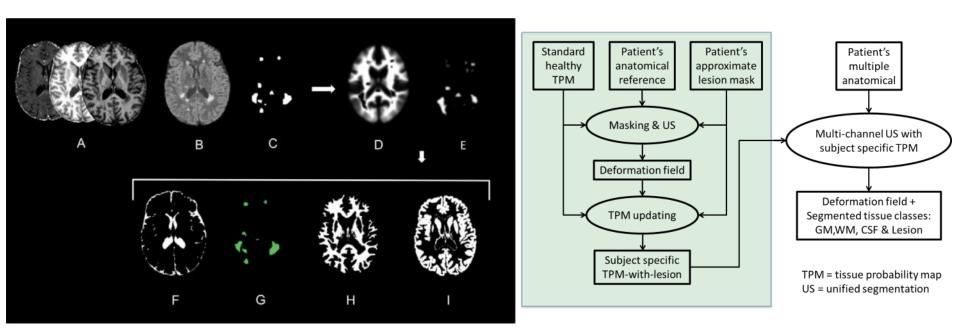
Key points:

- needs a prior lesion mask
- accounts for lesion + healthy tissues by extending TPMs
- provides normalization and segmentation



USwL for MS image segmentation & warping



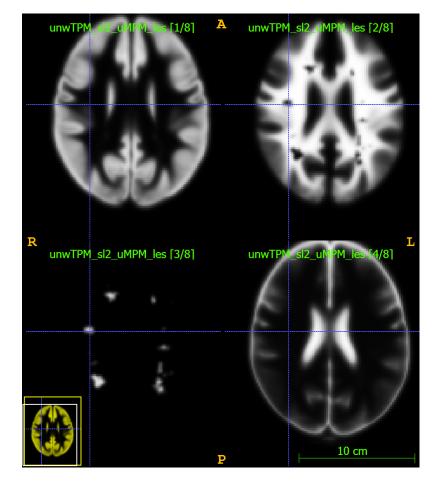


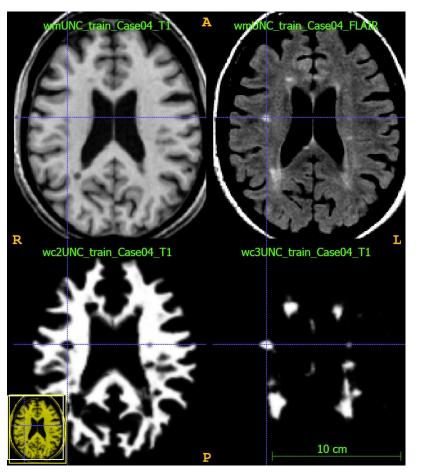
Key features of "Unified Segmentation with Lesion"

- 1. More principled segmentation and normalisation approach for lesioned brain
- Increased sensitivity, from multichannel qMRI segmentation, wrt. FLAIR hyper-intensity lesion detection

US-with-Lesion results







References



- M. Brett et al. (2001), 'Spatial normalization of brain images with focal lesions using cost function masking', NeuroImage, 14:486–500.
- P. Schmidt et al. (2012), 'An automated tool for detection of FLAIR-hyperintense white-matter lesions in Multiple Sclerosis', NeuroImage, 59(4): 3774–3783.
- Phillips et al. (217), https://github.com/CyclotronResearchCentre/USwLesion



Thank you for your attention!



Normalization and segmentation?

