

Method for assessing quality of lesion volume and brain atrophy measurements

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OBJECTIVE

Lesion volume and atrophy changes are important quantitative imaging biomarkers of respective inflammatory and neurodegenerative processes, characteristic for patients with multiple sclerosis (MS). These biomarkers may be extracted from brain magnetic resonance (MR) images using various analysis methods, which generally yield different biomarker values, also depending on MR image quality. Using a novel reference-free regression framework we address the questions of how accurate and precise is each of the measurement methods, without the need of reference measurements

We propose a reference-free framework to compare accuracy and precision of measurement methods

TOTAL LESION LOAD

N=22, 4 segmentation methods, consensus registration available as a gold standard for validation

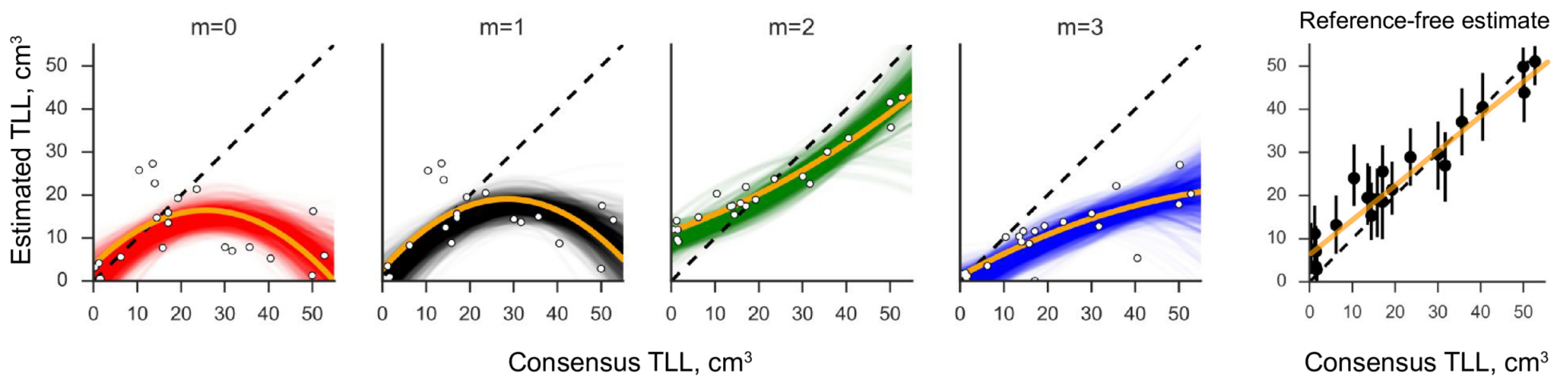


Table 1. Reference-free estimates [least squares estimates] of precision and accuracy of four lesion segmentation methods

m	σ , cm ³	RMSE, cm ³
Untrained (m=0)	6.6 [7.0]	19.6 [18.2]
Untrained (m=1)	5.8 [6.2]	20.0 [20.1]
Trained (m=2)	1.1 [2.2]	6.5 [7.8]
Commercial (m=3)	4.9 [4.3]	16.0 [15.3]

Reference-free estimates for lesion volume are in good agreement with gold standard (consensus segmentation)

ATROPHY CHANGES

N=26, 4 measurement methods

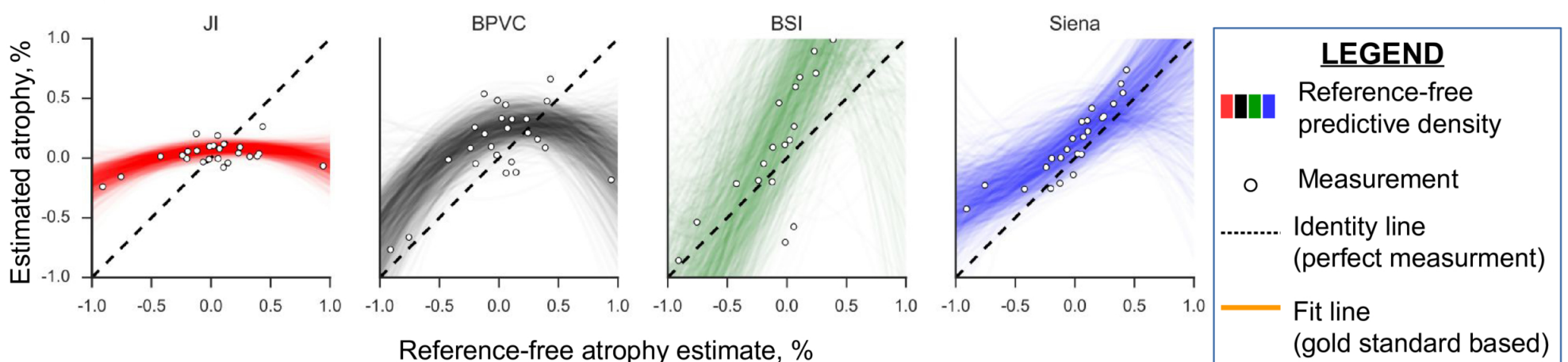


Table 2. Reference-free estimates of precision and accuracy of four atrophy measurement methods

m	σ , %	RMSE, %
Jl	0.09	0.36
BPVC	0.90	1.05
BSI	0.25	0.24
Siena	0.45	0.46

Reference-free estimates for atrophy changes measurement methods are in good agreement with previous research reports

CONCLUSION

The reference-free regression framework is a promising tool that may be widely applicable for identification of optimal biomarker extraction methods in various domains.

It works!