Facial features removal

Recent studies have created awareness that facial features can be reconstructed from high-resolution MRI. Therefore, data sharing in neuroimaging requires special attention to protect participants' privacy. Facial features removal (FFR) could alleviate these concerns. We assessed the impact of three FFR methods on subsequent automated image analysis to obtain clinically relevant outcome measurements in three clinical groups.

METHODS: FFR was performed using QuickShear, FaceMasking, and Defacing. In 110 subjects of Alzheimer's Disease Neuroimaging Initiative, normalized brain volumes (NBV) were measured by SIENAX. In 70 multiple sclerosis patients of the MAGNIMS Study Group, lesion volumes (WMLV) were measured by lesion prediction algorithm in lesion segmentation toolbox. In 84 glioblastoma patients of the PICTURE Study Group, tumor volumes (GBV) were measured by BraTumIA. Failed analyses on FFR-processed images were recorded. Only cases in which all image analyses completed successfully were analyzed. Differences between outcomes obtained from FFR-processed and full images were assessed, by quantifying the intra-class correlation coefficient (ICC) for absolute agreement and by testing for systematic differences using paired t tests.

RESULTS: Automated analysis methods failed in 0-19% of cases in FFR-processed images versus 0-2% of cases in full images. ICC for absolute agreement ranged from 0.312 (GBV after FaceMasking) to 0.998 (WMLV after Defacing). FaceMasking yielded higher NBV ($p = 0.003$) and WMLV ($p \leq 0.001$). GBV was lower after QuickShear and Defacing (both $p < 0.001$).

CONCLUSIONS: All three outcome measures were affected differently by FFR, including failure of analysis methods and both “random” variation and systematic differences. Further study is warranted to ensure high-quality neuroimaging research while protecting participants' privacy [1)].

1)
de Sitter A, Visser M, Brouwer I, Cover KS, van Schijndel RA, Eijgelaar RS, Müller DMJ, Ropele S, Kappos L, Rovira Á, Filippi M, Enzinger C, Frederiksen J, Ciccarelli O, Guttmann CRG, Wattjes MP, Witte MG, de Witt Hamer PC, Barkhof F, Vrenken H; MAGNIMS Study Group and Alzheimer’s Disease Neuroimaging Initiative. Facing privacy in neuroimaging: removing facial features degrades performance of image analysis methods. Eur Radiol. 2019 Nov 5. doi: 10.1007/s00330-019-06459-3. [Epub ahead of print] PubMed PMID: 31691120.