ICBM-NY – A highly detailed volume conductor model for EEG source localization and TCS targeting

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Abstract

Individual head models for EEG source imaging and tCS targeting are expensive.

Instead, we propose a highly detailed FEM of the ICBM152 head, named as ICBM-NY.

We approximate 4 individual heads and measure localization and targeting errors.

Our model compares favorably to individual and individualized models.

All data are made available online. (http://neuralengr.com/nyhead/)

Method

ICBM152 v2009b: brain

ICBM152 v6: non-brain

CR-TPM: lower part

→ ICBM-NY

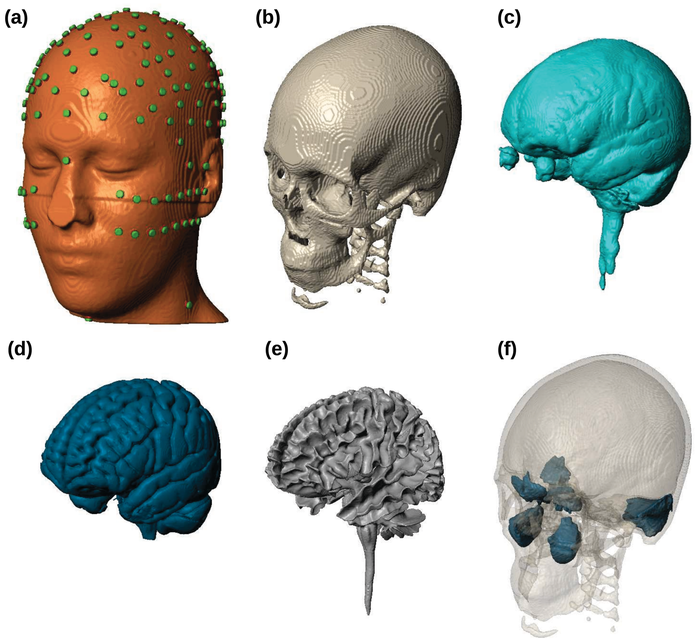
Whole-head FOV;
6 tissues;
0.5 mm^3 resolution;

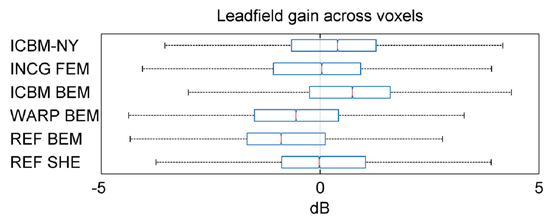
231 electrodes (10-05) placed → (FEM solved) → 230 lead field

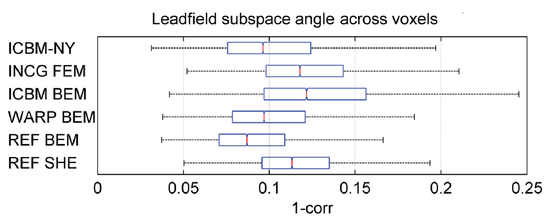
Evaluated on FEMs of 4 individuals built following the same procedures

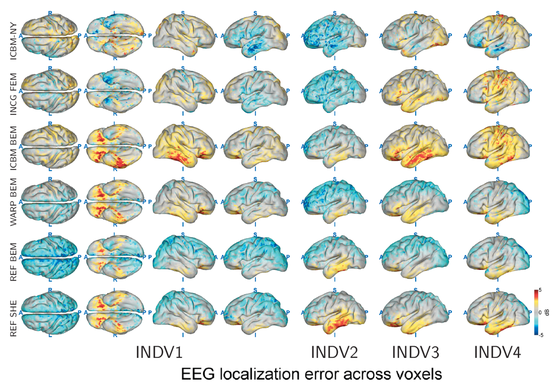
Competitors: Incongruent FEM; Reference BEM; Reference SHE; ICBM152 BEM; Warped ICBM152 BEM

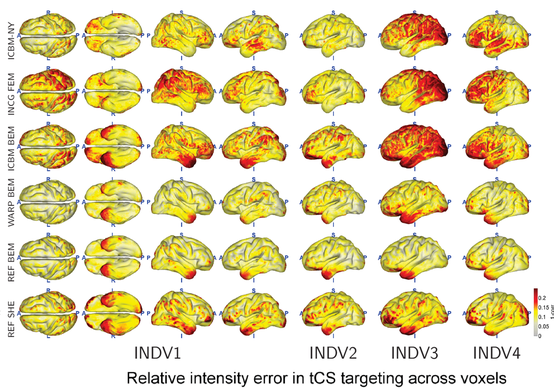
Results

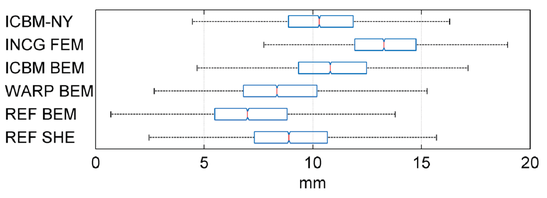


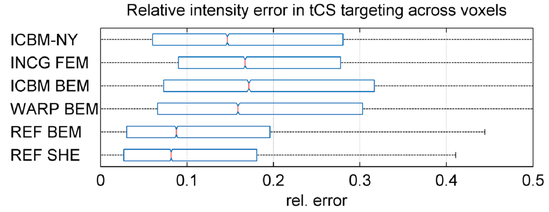


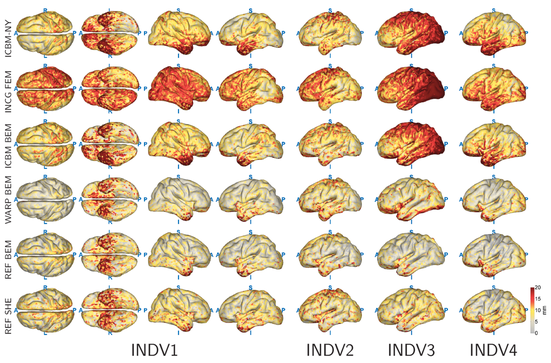


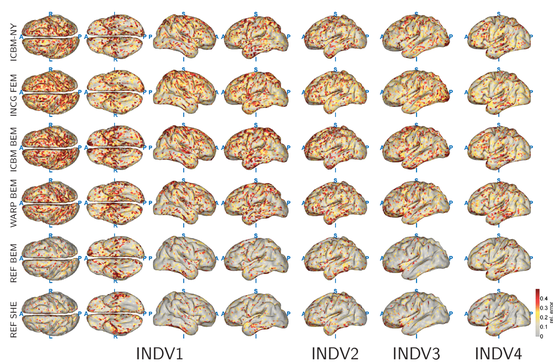


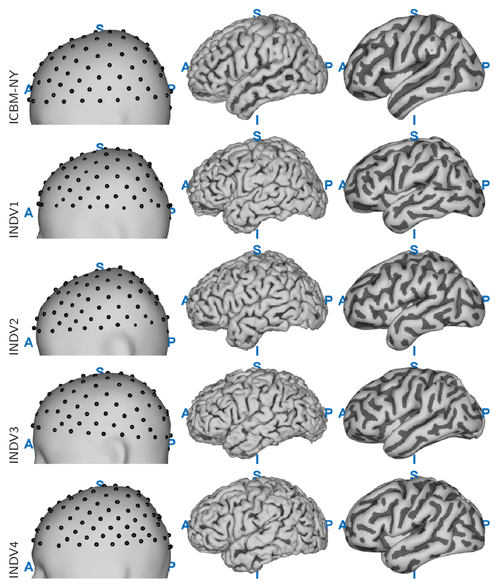


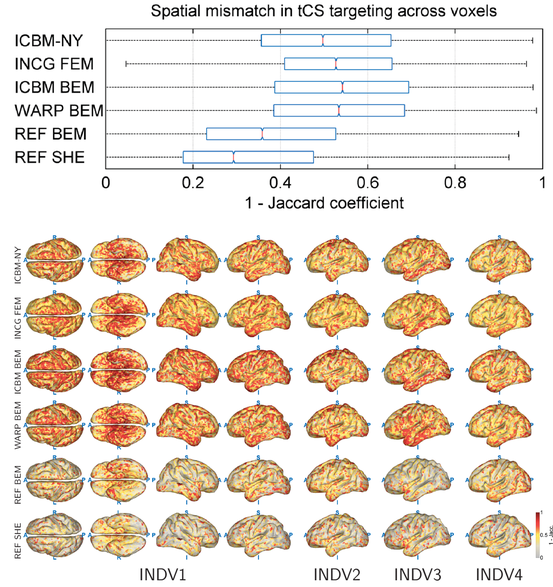


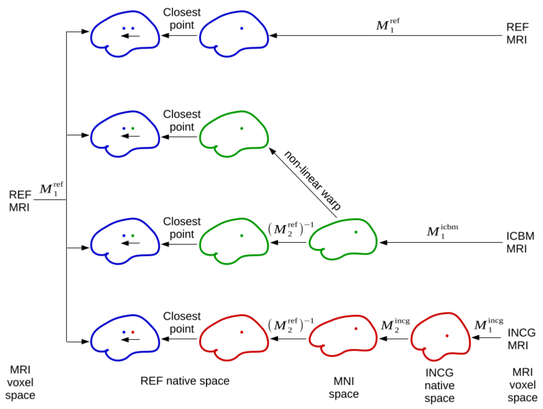












Discussion

Most accurate general-purpose electrical volume conductor model possible today;

Outperforms arbitrary reference head models, and ICBM152 BEM;

One should use the New York Head for targeting and source localization whenever neither individual MRIs nor digitized electrode coordinates are available;

Optimizing/Localizing the field along the normal direction: the most physiologically meaningful orientation (radial at gyri and tangential at sulci): no bias in the evaluation;

Only Caucasian males used for evaluation;

Point-like electrodes are not realistic in the context of TCS, but analysis shows only 4% difference;

No anisotropic modeling for WM/skull, due to lack of DTI data for ICBM152;

Free download at
neuralengr.com/nyhead/

Reference:

Yu Huang, Lucas C. Parra, Stefan Haufe, *The New York Head—A precise standardized volume conductor model for EEG source localization and tES targeting*, NeuroImage, 2015. doi:10.1016/j.neuroimage.2015.12.019

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