Estimating Target Orientations

A Comparison of Beamformer Algorithms and their Performances in Estimating Orientations of Neural Sources

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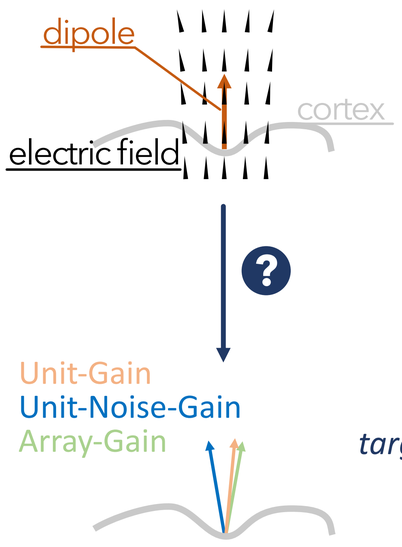
MOTIVATION

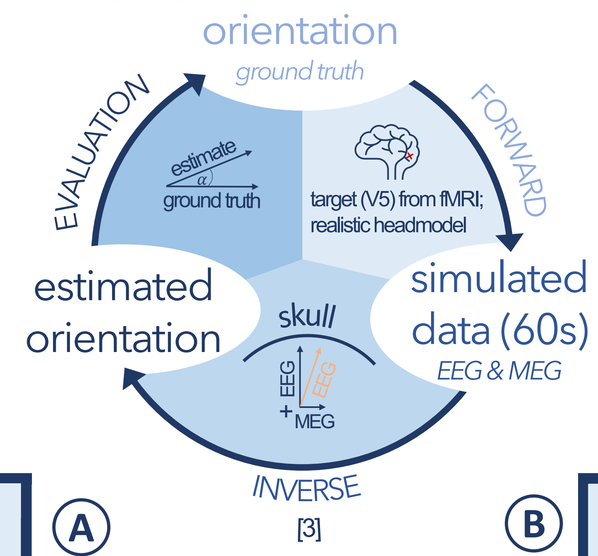


Goal: *individualized tDCS* [1,2]

Problem: *estimating target orientation*

Which beamformer algorithm leads to the best estimate of a given orientation?

METHODS



A random orientations

B fixed orientations

BEAMFORMERS [4]

UG: $\eta_{opt} = \upsilon_{\min}\{L^T C^{-1} L\}$

UNG: $\eta_{opt} = \upsilon_{\min}\{L^T C^{-2} L, L^T C^{-1} L\}$

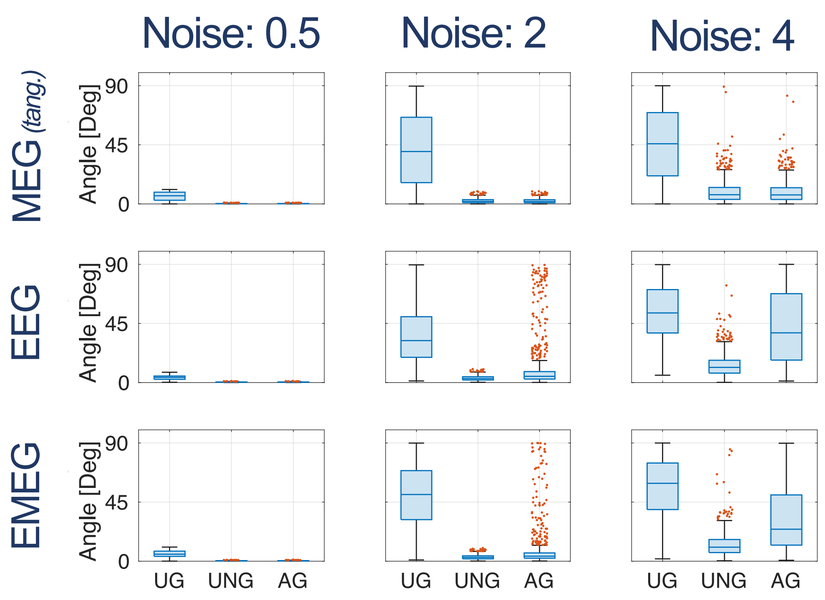
AG $\eta_{opt} = \upsilon_{\min}\{L^T C^{-1} L, L^T L\}$

with:

η_{opt}: *optimized orientation*
L: *Leadfield matrix*
C: *Covariance matrix*
υ_{min}: *eigenvector corresponding to lowest eigenvalue*

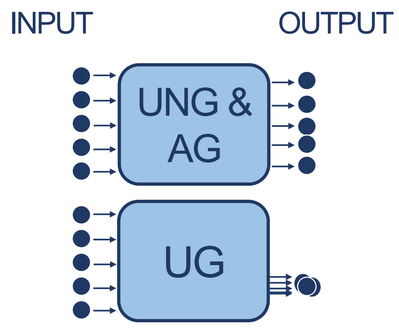
RESULTS

A Performance for **random** orientations



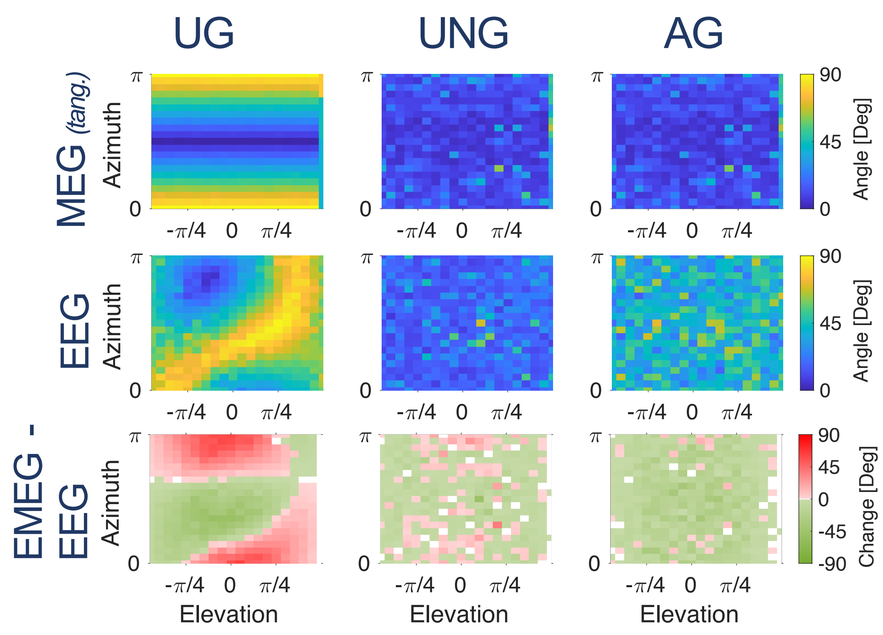
- UNG most robust against noise
- UG is clearly outperformed
- UNG & AG similar performance for low noise

Directionality of UG



UG estimates show bias towards certain orientation

B Performance for **fixed** orientations



- UNG & AG perform similar for all orientations
- UG performance depends on orientation
- including MEG changes EEG estimate

DISCUSSION & CONCLUSION

- choice of beamformer influences target estimate
- UNG is recommended for long data
- depending on noise, combined EMEG improves estimate

UNG Beamformer leads to the best estimate of the target orientation.

UG Beamformer is most sensitive for noise.

AG Beamformer might be used for shorter data.

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