Mean-field modeling of brain-scale dynamics for the evaluation of EEG source-space networks

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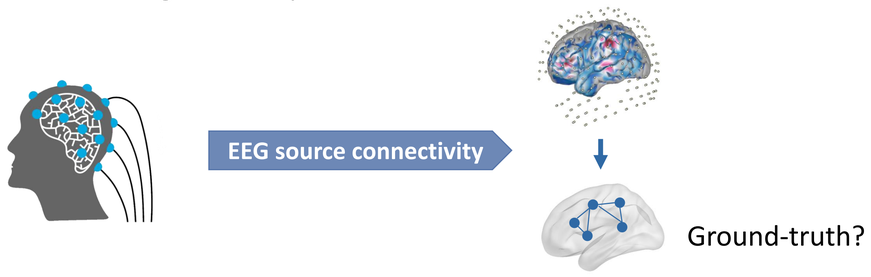
Introduction

Problematic:

- The absence of a '**ground truth**' when applying EEG-source connectivity on real EEG data represents a challenge for comparative studies

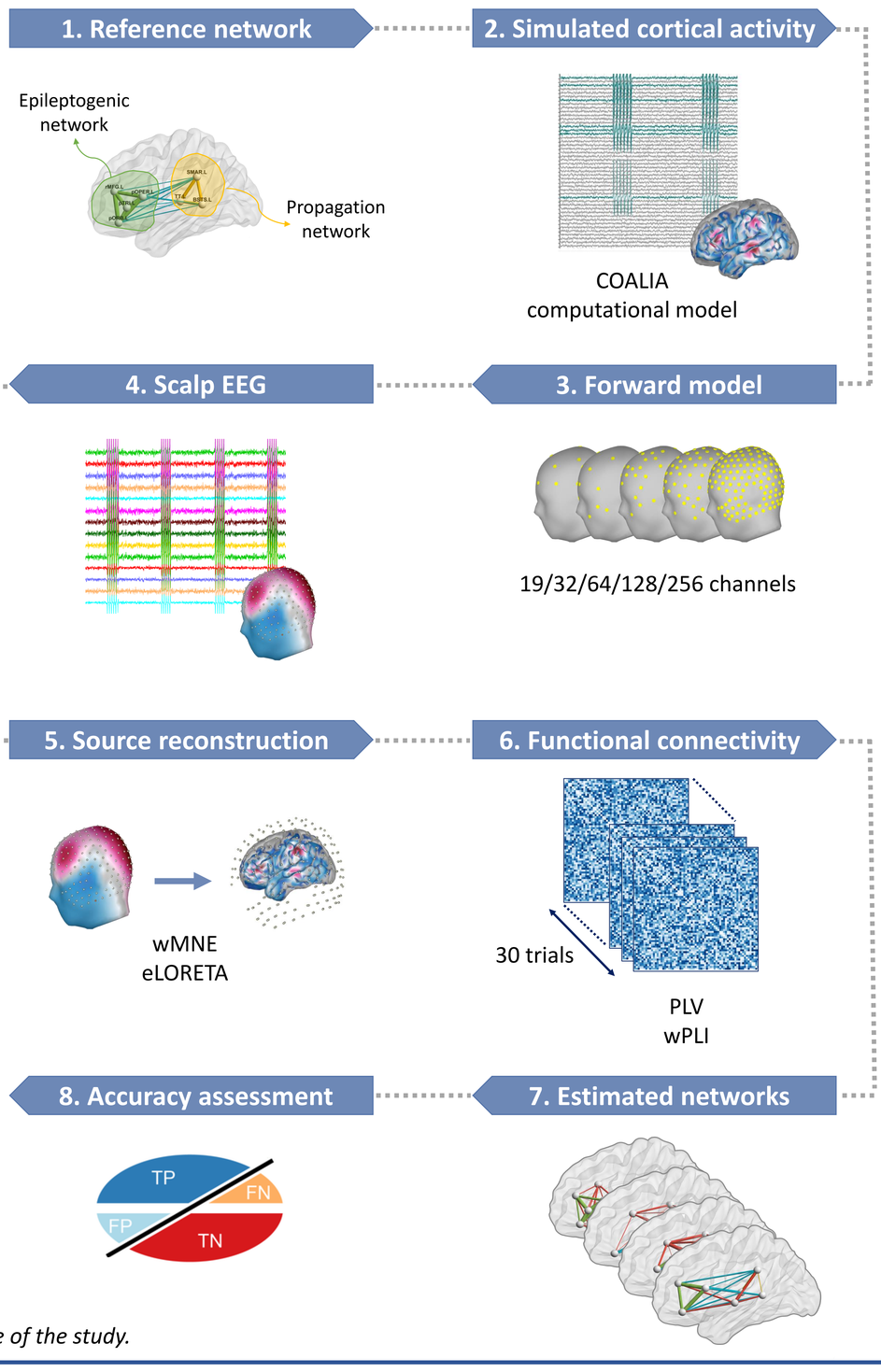


Objective:

- Use **COALIA**, a physiologically-inspired model to generate epileptiform, cortical activity and evaluate the effect of:

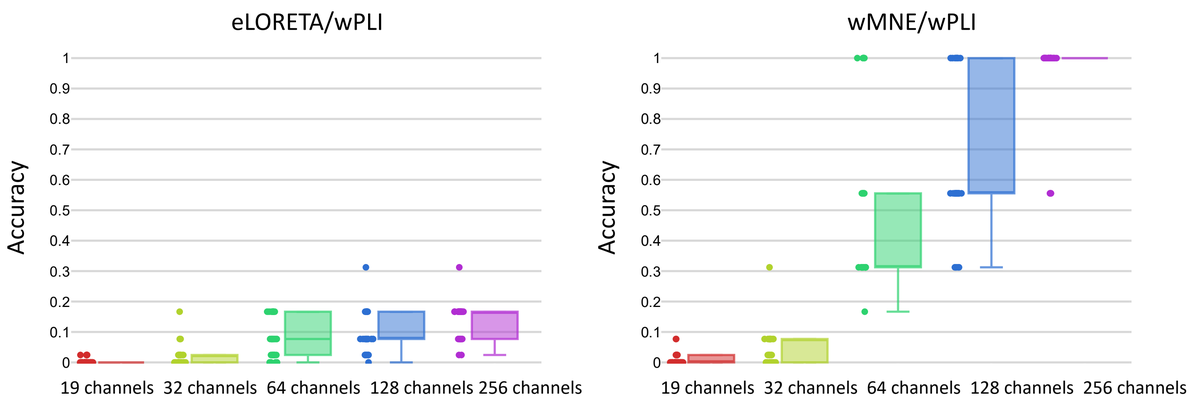
1. five different electrode densities
2. two inverse solution algorithms
3. two functional connectivity measures

Materials and Methods



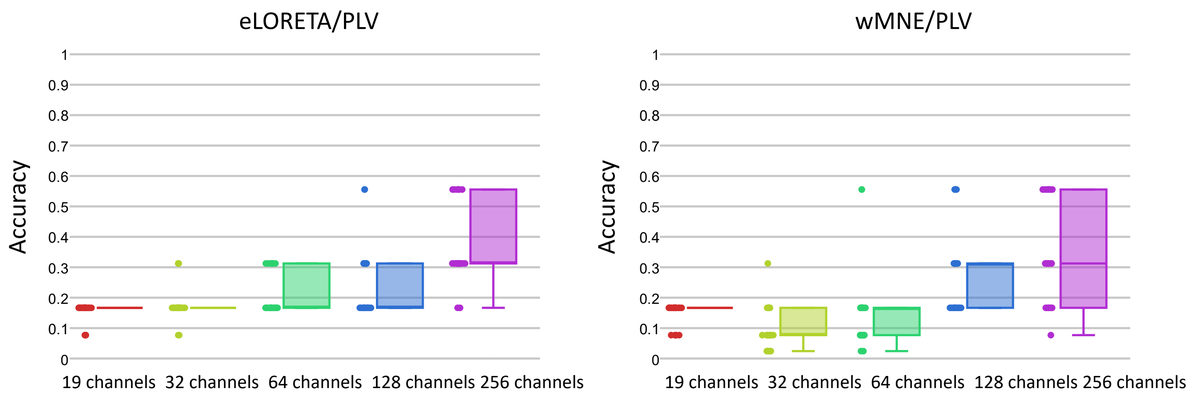
Pipeline of the study.

Results

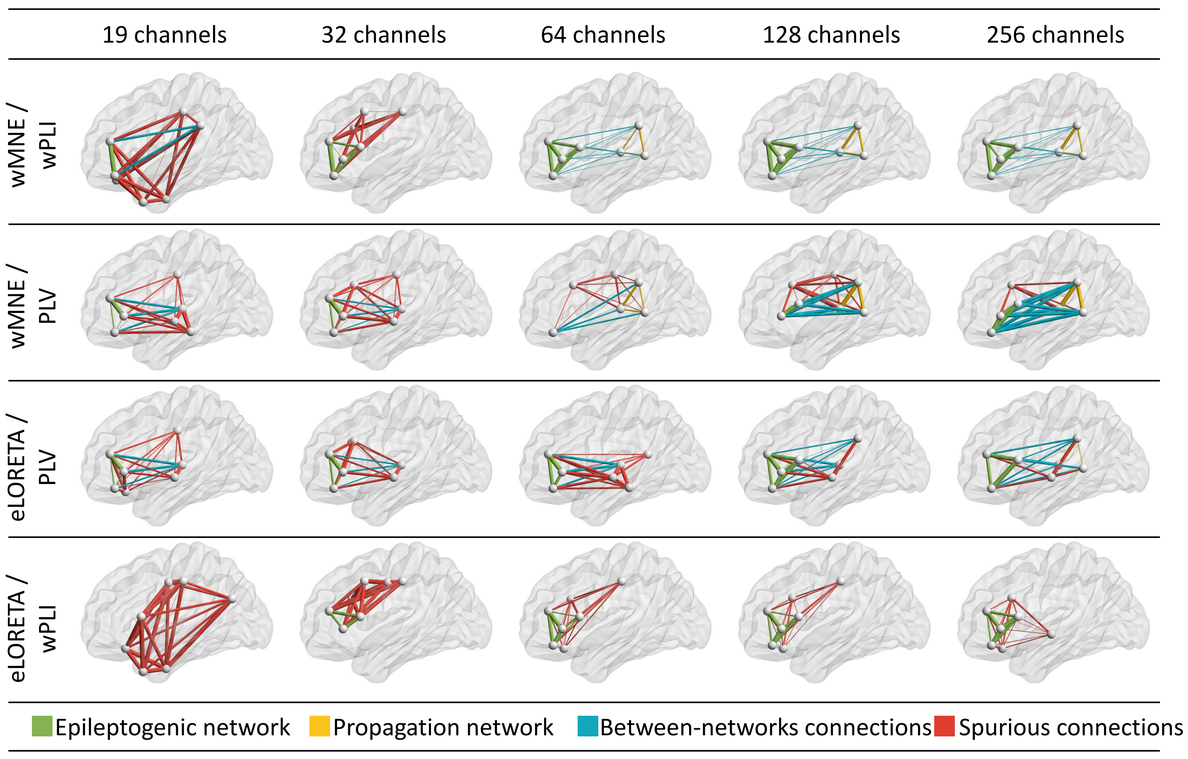


Accuracy of the estimated networks based on different electrode montages for eLORETA/wPLI and wMNE/wPLI

Results



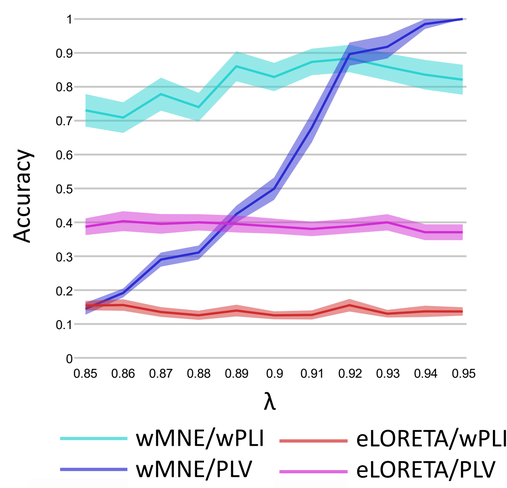
Accuracy of the estimated networks based on different electrode montages for eLORETA/PLV and wMNE/PLV



Average networks over trials for all electrode montages and inverse solution/connectivity measure combinations.

Qualitative results:

1. Higher sensor density → Better performance
2. wMNE/wPLI → Best performance
3. eLORETA/wPLI → Worst performance
4. wMNE/PLV → Most affected by noise



Mean accuracy and standard error of each inverse solution/connectivity measure combination plotted against different levels noise for the case of 256 electrodes

Conclusions

1. Proof of concept that COALIA can provide a ground-truth for comparative studies aiming at optimizing the EEG-source connectivity pipeline.
2. A higher network estimation accuracy requires a high number of EEG electrodes
3. A careful choice of an inverse solution/connectivity measure combination is necessary.

Citation:

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Acknowledgments

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