Functional Connectivity Using Complex-Gaussian Graphical Models of EEG

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Submitter Anirudh Wodeyar

Affiliation University of California, Irvine

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Presentation Abstract Summary Functional connectivity can be measured with electroencephalography (EEG) data using a variety of metrics that emphasize different aspects of brain dynamics. Coherence, which measures the consistency of relative phase between channels, is a widely used measure of synchronization in different frequency bands and describes marginal dependence between channels. The interpretation of coherence as reflecting a functional connection in the brain is confounded by volume conduction of current and by common inputs to both channels. In this paper we assume that EEG data in a frequency band are generated by a complex multivariate normal (CMVN) in order to define a complex-Gaussian Graphical Model of the data. Conditional dependence between channels is reflected in the precision values of the model. Compared to coherence, precision estimates suppress volume conduction and common input effects, while providing, by way of the graphical lasso, a sparse estimate of the underlying network. We show through simulation that this model outperforms coherence as an estimate of connectivity and captures the most important features of the network. We apply this technique to estimate how networks in the alpha (8-13 Hz) band are modified in a working memory task .

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Co-author Information

* Presenting Author

First Name	Last Name	Affiliation	E-mail
Anirudh *	Wodeyar *	University of California, Irvine	awodeyar@uci.edu
Ramesh	Srinivasan	University of California, Irvine	r.srinivasan@uci.edu

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