



An information-theoretical approach to EEG source-reconstructed connectivity

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Elements of the thesis

Information theory

Source reconstruction

Connectivity

Information theory



Information theory

Quantify information

How much ignorance can be removed

Information theory

Quantify information

How much ignorance can be removed



Information theory

Quantify information

How much ignorance can be removed



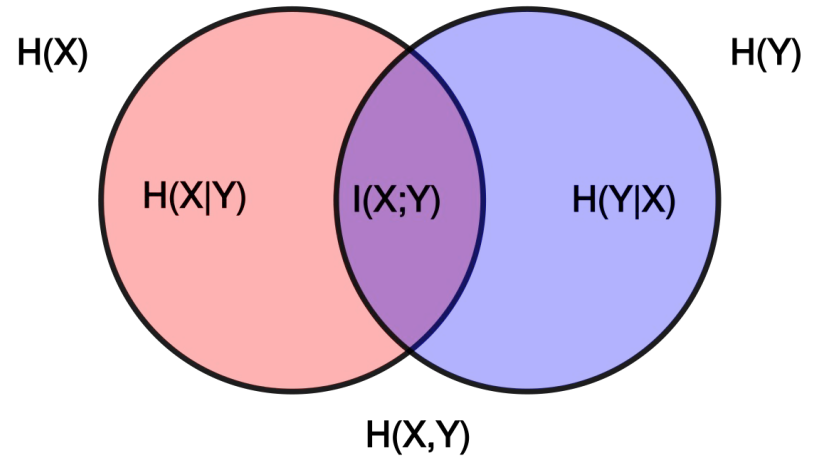


Mutual information

How much information is shared between variables

Mutual information

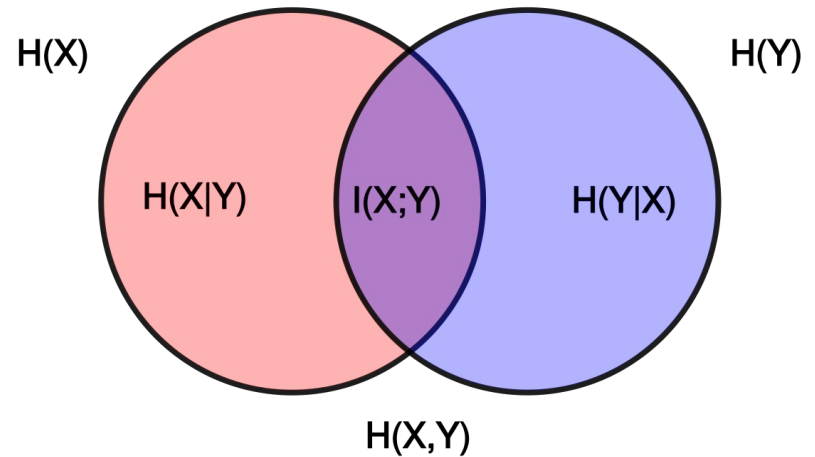
How much information is shared between variables



Mutual information

How much information is shared between variables

No assumptions related to:
Distributions
Nature of relationship



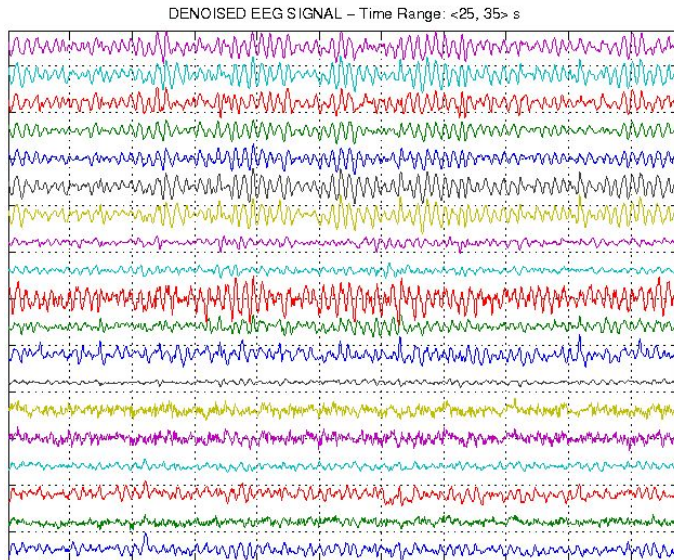


Directed information

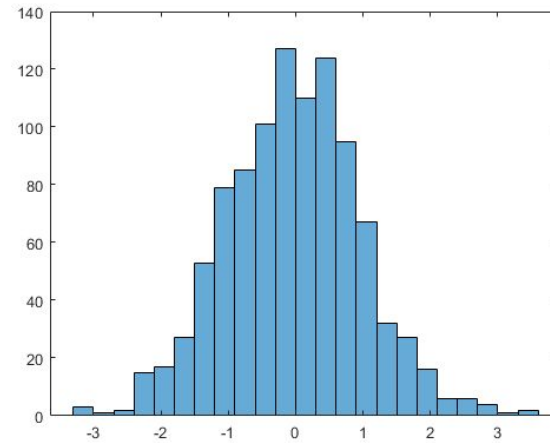
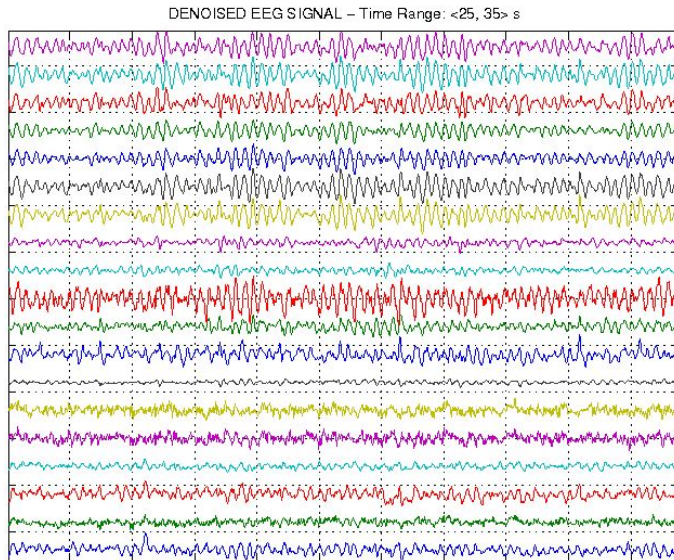
Mutual information is “blind”

Extension to directionality

Continuous data



Binning





Noise

Has impact on mutual information

More noise -> less mutual information



Noise

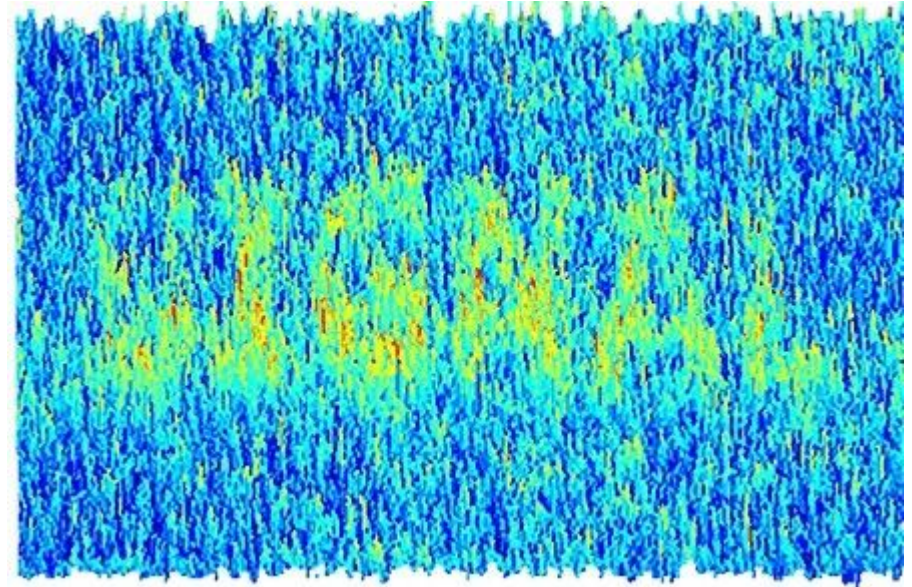
SIGNAL

SIGNAL



Noise

SIGNAL



Source reconstructed connectivity

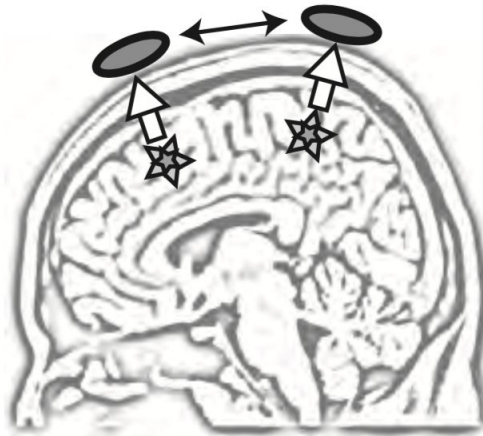


Connectivity

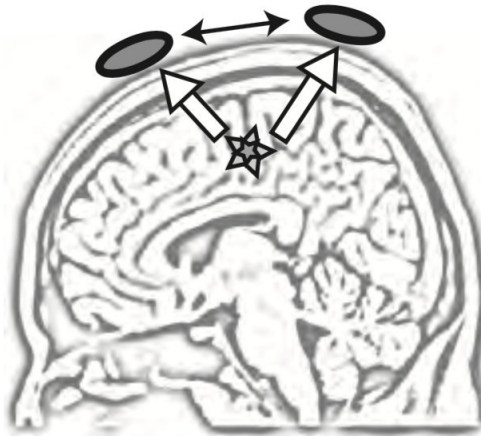
Connection/communication between brain regions

Danger of volume conduction

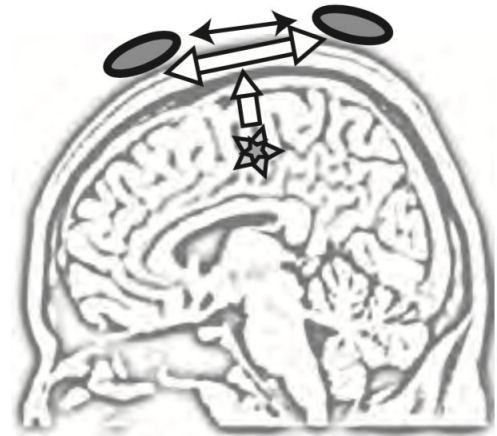
A) Connectivity: OK



B) Connectivity: NOT OK

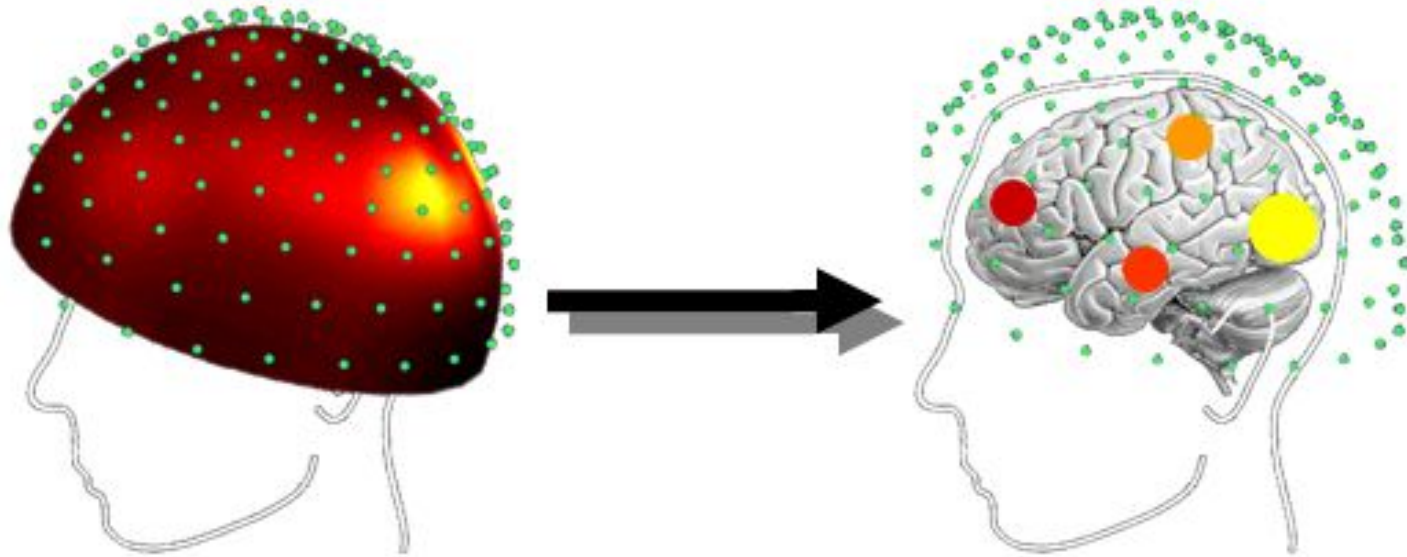


C) Connectivity: NOT OK

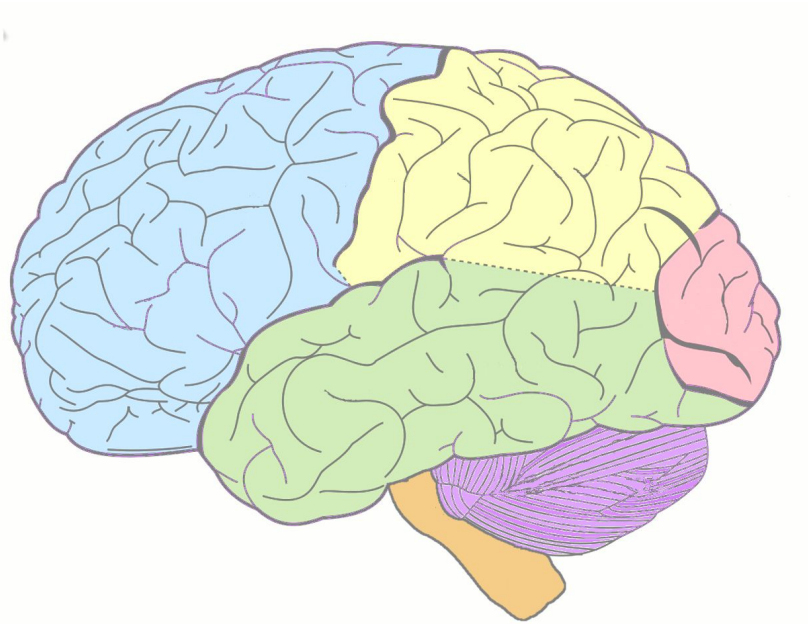


Cohen, M.X., 2014. Analyzing neural time series data: theory and practice. MIT press.

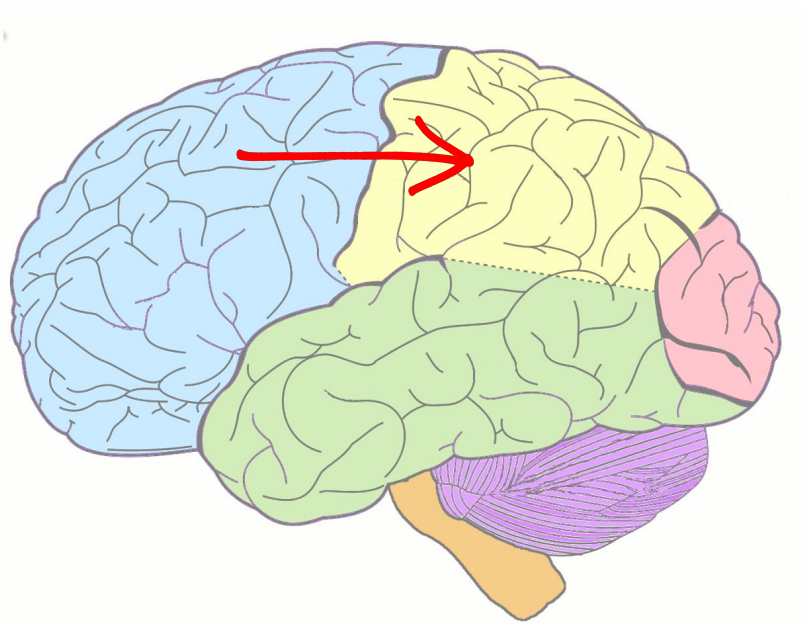
Source reconstruction



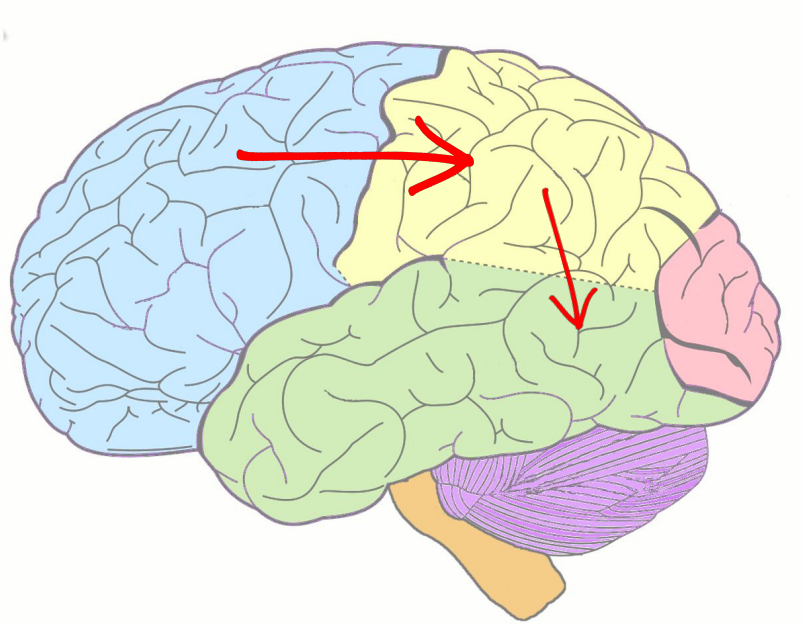
Connectivity



Connectivity

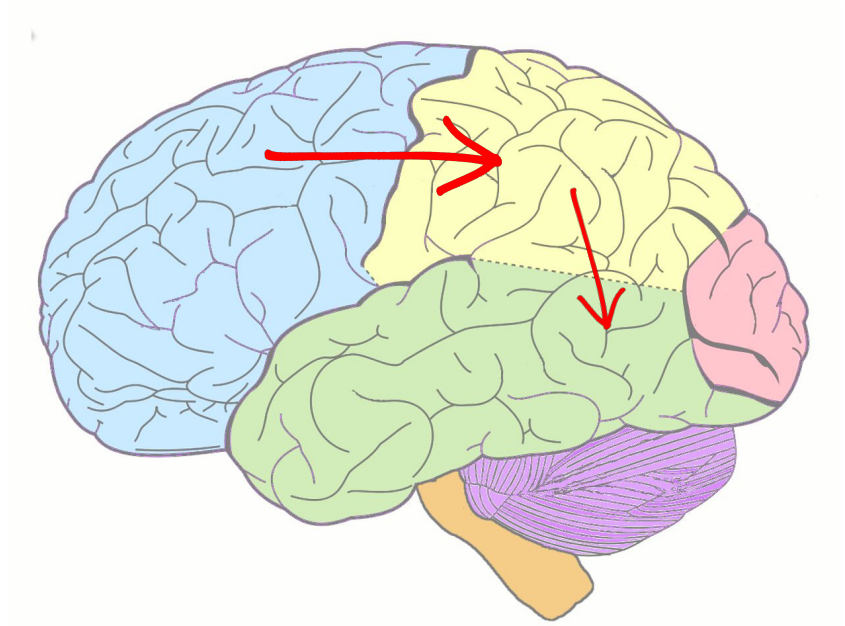
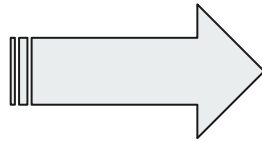


Connectivity



Novelty

Information theoretical
algorithms



Current progress



Literature study

Source localisation

Volume conduction

Brain connectivity

Information theory



Information theory

Mutual information

Conditional mutual information

Directed information (transfer entropy)

Directed feature information

Other statistical methods

Pearson correlation

Partial correlation

Granger causality

Dynamic causal modelling



Data

Experiments by Mansoureh

Word association

Positive/negative

Has been preprocessed

Source localization



Next steps

Work with data

Mutual information



Next steps

Work with data

Mutual information

Progress to other methods

Questions?
