ICA Application

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Outline

• Why use ICA?
• Results from ICA analyses
  - Frontal midline theta in working memory
  - Visual cueing and discrimination task
  - Spectral changes during emotional imagery
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ICA can help filter out artifacts

ICA can also isolate brain sources

Onton and Makeig, Prog. Brain Res. (2006)
Why analyze source activity instead of channels?

Onton and Makeig, Prog. Brain Res. (2006)
Separating EEG source activities

Independent component analysis (ICA) separates mixed EEG signals at the scalp into temporally independent time courses.
ICA creates a spatial filter for each temporally independent source.
Various 'alpha' frequencies WITHIN subject
Goal: to cluster matching ICs across subjects

Onton and Makeig, Prog. Brain Res. (2006)
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Frontal midline theta cluster

B
FMθ Cluster

C
FMθ Cluster
20 Components

D
Fz Electrode,
19 Subjects

E
Not Localized
12%
Posterior
20%
Other
Anterior
20%
FMθ
47%

Onton et al., NeuroImage 27 (2005) 341 - 356
FMθ: average time/frequency power

Onton and Makeig, NeuroImage (2005)
Theta power across trials

All load-related theta power from frontal midline cluster!
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Visual Cueing Task:

Does the target differ in shape or color?
Different Dimension (dD)
Enhanced Frontal ERP for dD Trials

Left frontal cluster back-projections to channel F3
Different dimension

Back-projection of all clusters

Same feature

Different feature
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What is spectral instability?

change in frequency power over time
What causes spectral instability?

Thalamocortical loops

Figure drawn by Thierry Bal
Spectral modulation envelopes
Clusters of spectral modulators
Independent (Co-)Modulators of EEG Source Activities
Alpha (+ harmonic) modulation
High frequency modulation
Many ICs, many IMs…
IM weight correlation
IM weight interactions

![Graph showing IM weight interactions](image)
Mean weight for each emotion
IM interactions during emotional imagery
Conclusions

- Why use ICA?... Why NOT??!!
- Advantages of using ICA
  - artifact rejection
  - isolates specific brain processes
- Other applications
  - ICA decomposition of spectral modulations