ICLabel for classifying ICA components

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Outline

● Why would you want to automatically classify (label) independent components (ICs)?
● ICLabel
  ○ ICLabel EEGLAB plugin
  ○ ICLabel website
● Practicum
Why automatically label ICs?

- Speed and time saving
- Consistency
- Automatization
- Lack of ability
- Laziness

Two situations where automatic labelling really shines:

- Large studies
- Real-time ICA-enabled applications
ICLabel

A multi-stage project, the final product of which is an automatic IC classifier

Stages:

1. Collection of existing datasets
2. Labeling the collected datasets through crowdsourcing
3. Training deep neural networks to classify ICs
4. Packaging the final network as an EEGLAB plugin

For details, see

Cautionary Note

No automatic EEG component labeler is perfect!

This may change in the future, but it’s not the state of affairs now.
ICLabel Demo

Load a dataset with an ICA decomposition
ICLabel Demo

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Tools → Classify components using ICLabel → Label components
ICLabel Demo

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Tools → Classify components using ICLabel → Label components

Options:
- Default (recommended)
  - Best accuracy
- Lite
  - Faster, but at a slight cost to accuracy
- Beta
  - Included for posterity
ICLabel Demo

Wait for it to calculate ... should only take a few seconds
ICLabel Demo

It will then offer to plot results

Which components to plot. Can be slow if you have hundreds.

Which frequencies to show in the power spectral density figure.

Events are nice to see, but can be a hindrance if there are too many.
ICLabel Demo

Classification

Topoplot

Percent data variance accounted for by IC

ERP Image

Scrolling Activity

PSD

Dipoles here if available

% scalp data var. accounted for: 20.7%

IC1 Activity Power Spectrum

ERP 10^10 log_10(uV^2/Hz)
Aside: Viewprops Plugin

This viewer is available as its own plugin as well.
ICLabel Demo

ICLabel is also accessible through the command line:

```matlab
>> EEG = iclabel(EEG);
ICLabel: extracting features...
Scaling components to RMS microvolt
Recomputing ICA activations
ICLabel: calculating labels...
ICLabel: saving results...
>> EEG.etc.ic_classification.ICLabel

ans =

struct with fields:

    classes: {'Brain' 'Muscle' 'Eye' 'Heart' 'Line Noise' 'Channel Noise' 'Other'}
    classifications: [32x7 single]
    version: 'default'
```
Two other IC Classifiers

IC_MARC

“Classification of independent components of EEG into multiple artifact classes.” Laura Frølich, Tobias S. Andersen, Morten Mørup (2014).

MARA (Multiple Artifact Rejection Algorithm)


Others exist as well...
ICLabel Website

Address: iclabel.ucsd.edu
ICLabel Website
Practicum

1. Repeat the demo as shown:
   a. Load a dataset with an ICA decomposition
   b. Run ICLabel: Tools → Classify components using ICLabel → Label components
   c. Explore some of the ICs properties

2. Do the same as above on another dataset

3. Try to recreate the whole process through the command line
   a. Hint: type `help iclabel` into the command line (without quotes)
   b. Hint: you will need the viewprops plugin to recreate the figures, so feel free to skip that part
   c. Explore the results structure saved in `EEG.etc.ic_classification.ICLabel`