Decoding EEG via distributed pattern analysis

*Data preparation -*
- Collect data with 79 electrode cap (1000Hz sampling rate)
- Remove trials with excessive noise or blinks
- Perform frequency deconvolution
  - Wavelet decomposition (6 cycle Morllet wavelet)
  - 69 frequency bands between 2.1-128Hz
- Extract power of each frequency band

*Classification preparation -*
- Build an artificial neural network (ANN) classifier for each time bin
- Input patterns:
  - Significantly discriminating frequency/ electrode combinations
- Output patterns:
  - Binary regressors

*Decoding procedure -*
- Training the classifiers (for each time bin)
- Use backpropagation learning algorithm
- Use N-1 approach validation algorithm
- Train on 1/10th of the trials
- Test on remaining 9/10th
- Repeat 10x

Task Design 1: Delayed-match-to-sample

200ms Fixation
1500ms Sample Image
500ms Mask
1500ms Match Image

Results:
- We are able to classify the category of a presented image from the EEG over a transient burst during the first 500ms of the image presentation.

Task Design 2: Delayed-match-to-sample with distractors

Added superimposed image, ask subjects to ignore it
Sample image tinted red to guide subjects
Second image is always from a different category
Three levels of distractor existence: None / Weak / Strong

Results:
- E.g.

Task Design 3: Preliminary results only

Delayed-match-to-sample with cue & probe distractors

Manipulation Design: Present distractor during sample, and again during match

Results:
- Boxed images all use the same background distractor image.

These preliminary results indicate that the distractors on the fastest trials had shown greater activation during the preceding sample image displays.

Results & Discussion

It is possible to decode which image category the subject is viewing. The trained decoders can detect the category of multiple presented images.

The presence of distractor output images will manipulate the stimulus. Preliminary evidence suggests that the distractors will be used to examine difficulties to observe dynamics such as distractor activation in a negative priming study.

References


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