EEG-based emotion recognition from during paying attention to prosodic information

Background

- Early-Gamma Response: 0.1 - 0.3 s, 40 Hz
- Evoked Gamma: 0.10 - 0.15 s, phase-locked with stimulus-characteristic, working memory
- Induced Gamma: 0.15 - 0.3 s, changed by the emotional arousal on the visual or auditory stimuli.

Arousal emotional classification model during voice

Materials and Methods

- Sound stimuli:
  - /a·ra·i·sa·n/
  - /a·ra·i·sa·n/

- Stimuli sequences:
  - Positive
  - Negative
  - Neutral

- Emotional Tone is neutral.

- Emotional Intonation:
  - Joy (n=10)
  - Sad (n=10)
  - Neutral (n=10)

EEG data acquisition

- Subjects: n = 4 (age; mean = 24.7) one subject was excluded for remarkable noise.
- EEG: Brain Vision acticap, 32CH (re-referenced on FCz)
- Sampling: 1000Hz, hpf-0.1Hz, lpf-60Hz, artifact rejection with ICA

Subjective evaluation of emotional arousal

- Subjective evaluation was done after the experiment by Self-Assessment Manikin (SAM).
- This values were used for the class label of the classification model whether it is high(5-9) or low arousal(1-4).

Fig.01 Stimuli sequences

- ISI (inter stimulus interval) is 10s.
- 10 sounds for each emotion block which is sad, joy, and neutral emotional sound.

Confusion Matrices

- Sub01 Evoked
- True label
  - High
  - Low
- Predicted label
  - High
  - Low

- Sub01 Induced
- True label
  - High
  - Low
- Predicted label
  - High
  - Low

- Sub02 Evoked
- True label
  - High
  - Low
- Predicted label
  - High
  - Low

- Sub02 Induced
- True label
  - High
  - Low
- Predicted label
  - High
  - Low

- Sub03 Evoked
- True label
  - High
  - Low
- Predicted label
  - High
  - Low

- Sub03 Induced
- True label
  - High
  - Low
- Predicted label
  - High
  - Low

Discussion and Conclusion

- Accuracy of all subjects have exceeded the chance level.
- All subjects have no abnormality of accuracy from Confusion Matrices.
- All of the subjects had a higher accuracy to amplitude of induce gamma than evoked gamma. Whether or not it reflects cognitive function requires more scrutiny by increasing the number of subjects.
- It will be useful for developing communication support tools and devices that real-time detect his/her changes in physiological state emotions through the voice.

Classification procedure with Machine learning

- EEG signal preprocessing:
  - FFT (35-45 Hz)
  - Evoked gamma (100-150ms)
  - Induced gamma (500-300ms)
  - 32 channels
  - The EEG data epoched with single run

- Feature extraction:
  - 31 features = number of channels
  - Data standardization
  - Dimensionally Reduction by PCA(n=5)

- Classification:
  - Linear SVM, leave-one-out cross-validation
  - Subject dependent model
  - Dimensionally Reduction by PCA (Top component)
  - Classes arousal model: high (SAM: 5-9) and low (SAM: 1-4)

References

- Mu Li et al. Emotion Classification Based on Gamma-band EEG, IEEE, EMBC, 2007

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I have no COI with regard to the presentation.