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EEG-BASED EMOTION CLASSIFICATION USING GRAPH SIGNAL PROCESSING

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ABSTRACT

The key role of emotions in human life is undeniable. The question of whether there exists a brain pattern associated with a specific emotion is the theme of many affective neuroscience studies. In this work, we bring to bear graph signal processing (GSP) techniques to tackle the problem of automatic emotion recognition using brain signals. GSP is an extension of classical signal processing

dlimitedness assumption has been taken into account in several studies [5,6]. Bandlimited graph signals admit a sparse representation in the graph spectral domain. By considering graph signals as random vectors drawn from a Gaussian Markov random field distribution the graph learning problem becomes the estimation of the inverse covariance matrix [7,8].

An important aspect of human life is emotion since emotions

sensors

MDPI

Article

Emotion Recognition from Physiological Channels Using Graph Neural Network

Tomasz Wierciński [1,*], Mateusz Rock [2], Robert Zwierzycki [2], Teresa Zawadzka [1] and Michał Zawadzki [3]

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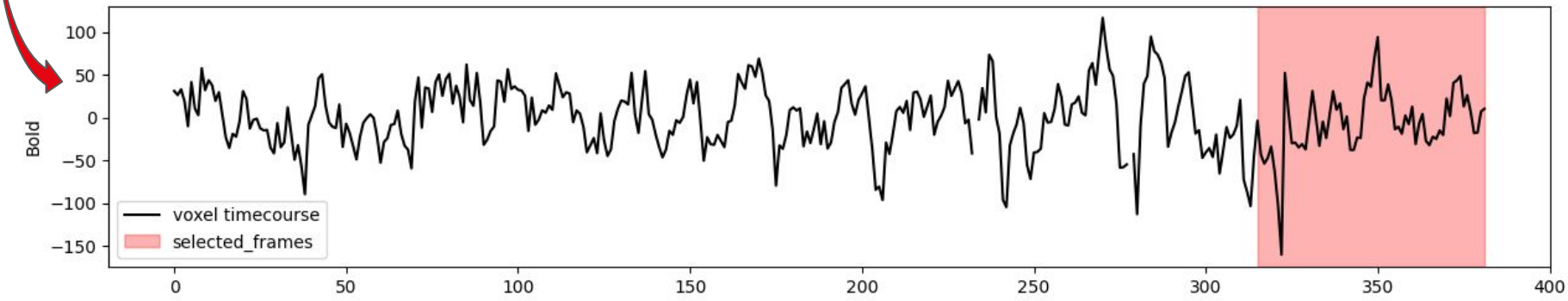
Limitations:

- fMRI never used
- dataset often paradigm / task like
- GSP rare
- Graph is often learned
- May lack some study on the interpretation of features

[1] S. S. Saboksayr, G. Mateos and M. Cetin, "EEG-Based Emotion Classification Using Graph Signal Processing," ICASSP 2021 - 2021 IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP), Toronto, ON, Canada, 2021, pp. 1065-1069, doi: 10.1109/ICASSP39728.2021.9414342.
[2] Wierciński, T.; Rock, M.; Zwierzycki, R.; Zawadzka, T.; Zawadzki, M. Emotion Recognition from Physiological Channels Using Graph Neural Network. *Sensors* **2022**, *22*, 2980. https://doi.org/10.3390/s22082980

Video Frame


Bold
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Movie Dataset:

- Short Movies available 0

MRI Dataset:

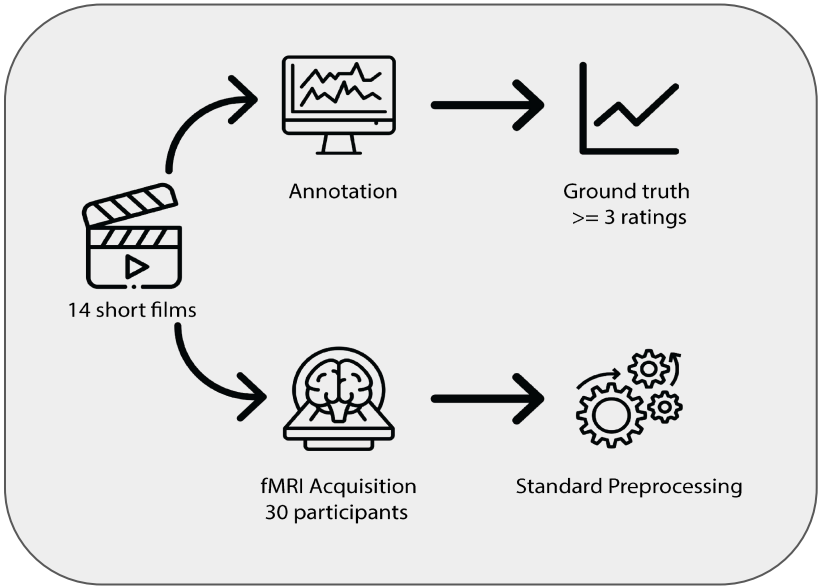
- fMRI during short movies and resting state
- Cortical regions (400 Schaefer parcellation) + Subcortical 14 regions
- Full volumes scales

Emotion / Affective Dataset:

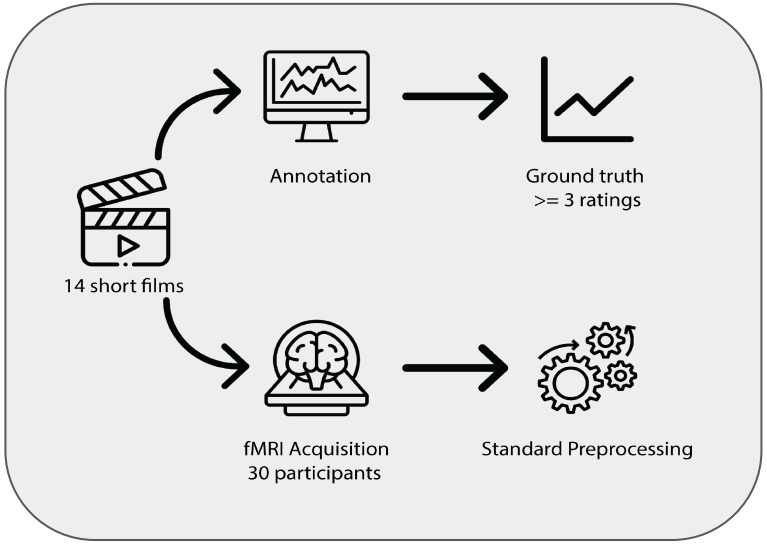
- 50 items (13 emotions) + affective scores recorded per movie and averaged across subset of participants

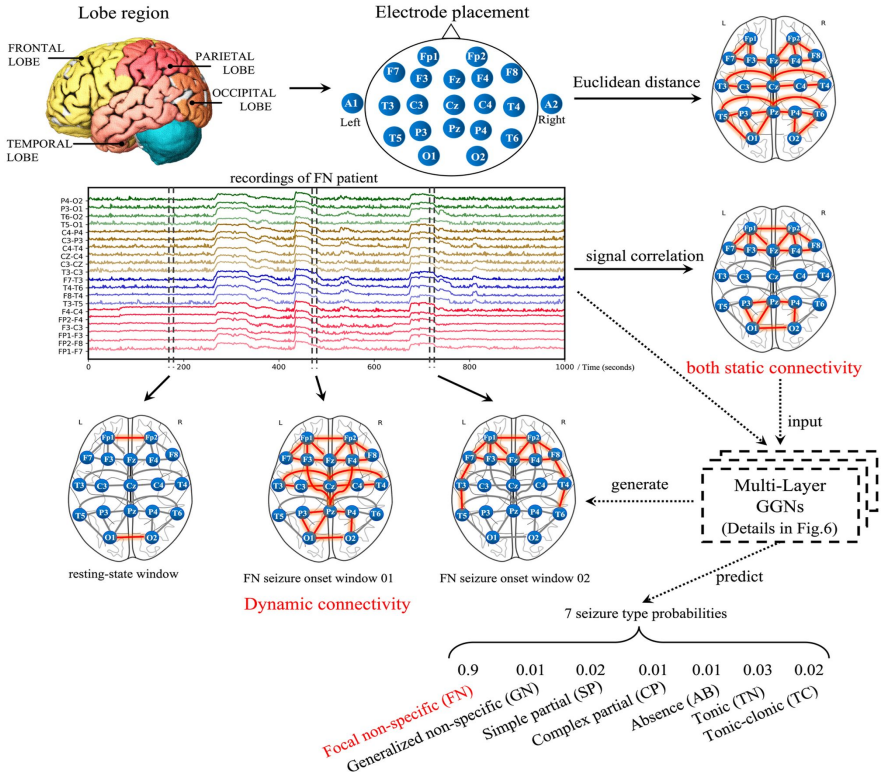
State Personality Index:

- DASS, Big5, BIS/BAS



Already pre-processed for general use cases (fmri-prep)





GSP + ML / GNN
(at various feature levels)

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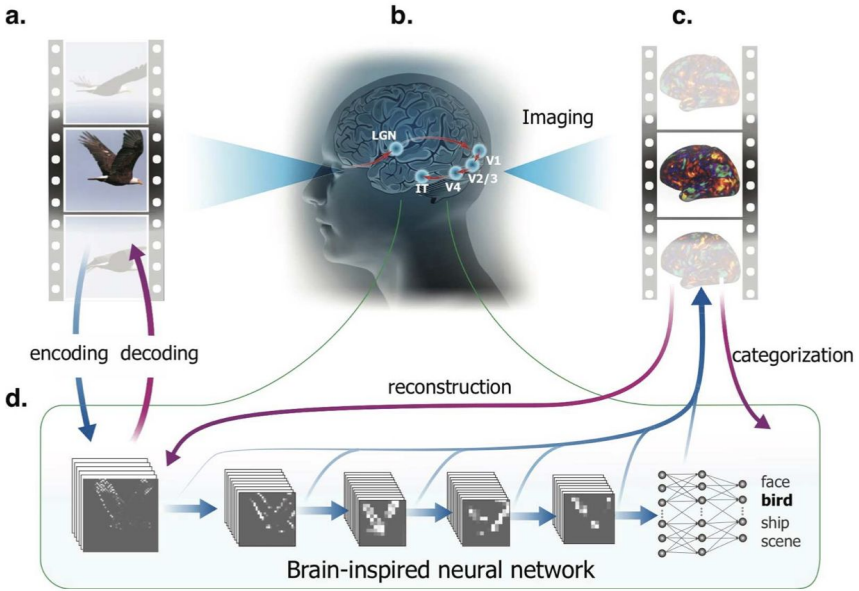
Neural Encoding and Decoding with Deep Learning for Dynamic Natural Vision

Haiguang Wen[2,3], Junxing Shi[2,3], Yizhen Zhang[2,3], Kun-Han Lu[2,3], Jiayue Cao[1,3], Zhongming Liu[*1,2,3]

Convolutional neural network (CNN) driven by image recognition has been shown to be able to explain cortical responses to static pictures at ventral-stream areas. Here, we further showed that such CNN could reliably predict and decode functional magnetic resonance imaging data from humans watching natural

computation underlying natural vision. What is needed is an alternative strategy that embraces the complexity of vision to uncover and decode the visual representations of distributed cortical activity.

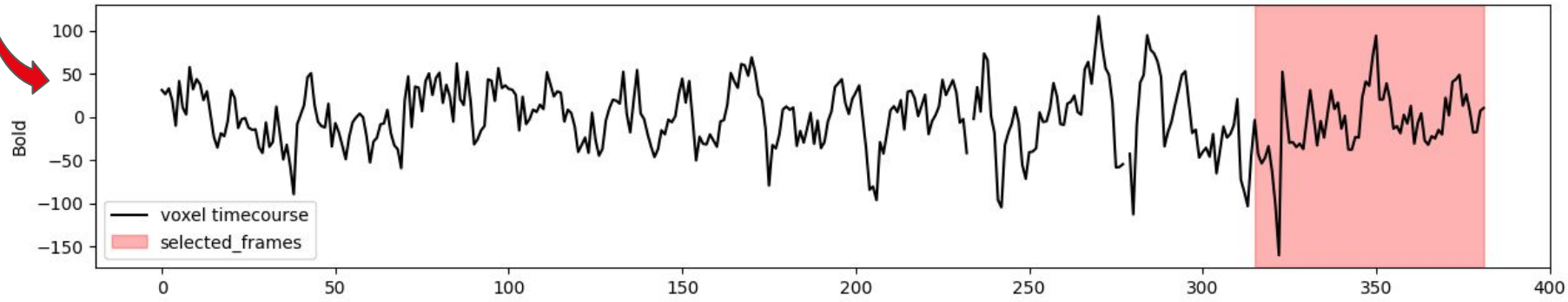
Despite its diversity and complexity, the visual world is composed of a large number of visual features



[1] Wen, Haiguang, Junxing Shi, Yizhen Zhang, Kun-Han Lu, Jiayue Cao, and Zhongming Liu. "Neural encoding and decoding with deep learning for dynamic natural vision." *Cerebral cortex* 28, no. 12 (2018): 4136-4160.

Video Frame #1

Video Frame #N



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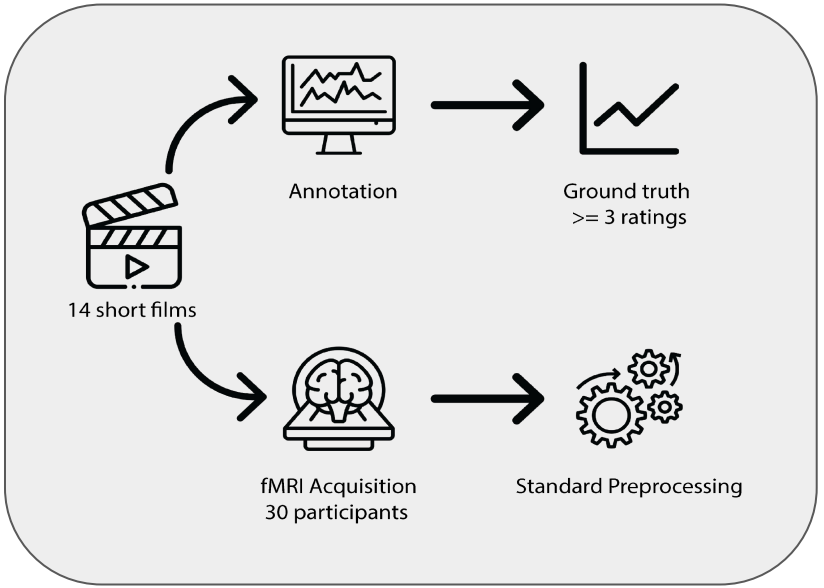

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