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Estimating emotions and tracking interest during movie watching, based on multimedia content and physiological responses

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Outline

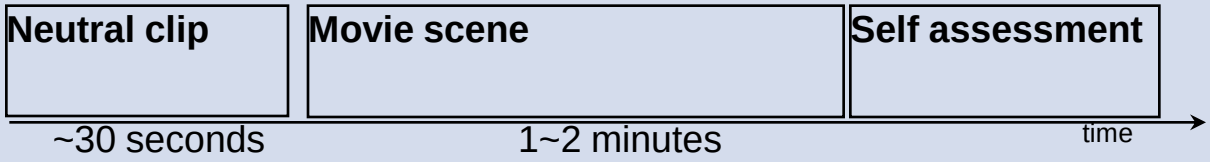
- Introduction
- Dataset
- Affective model
- Multimedia and physiological signals correlation
- Affective characterization
- Classification for interest detection
- Conclusion and future work

Introduction

- Affect and interest detection from movie scenes is useful for indexing, highlighting and user profiling.
- Find correlates features
- Assessment of user behaviour and emotions
  - User's emotion prediction by arousal/valence levels from audio-video content analysis
  - User's emotional characterization by arousal/valence levels from physiological signals
- Assess interest levels

Video dataset

- In the experimental data set we have 8 movies from 4 different genres:
  - Horror: The Ring, 28 days later
  - Action: Kill Bill VOL I, Saving private Ryan
  - Drama: Hotel Rwanda, The Pianist
  - Comedy: Mr. Bean's Holiday, Love actually
- 8 short video clips were extracted from these movies.
- Neutral clip between each two video clips to record baseline and let the participant to return to neutral state.
- Total duration ~2 hours.



Multimedia content features

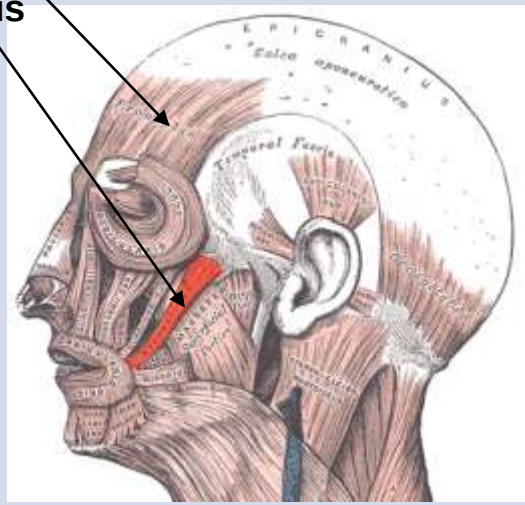
- All video content features are extracted with the help of OVAL and OMT software packages (*Viper*)
- Features extracted from multimedia content, namely:
  - Average shot duration
  - Shot change rate and variation
  - Color variance
  - Key lighting
  - Zero crossing rate (ZCR)
  - Audio energy
  - Audio type vector (music, speech, environment sound, and silence ratio over time)

Physiological feature extraction

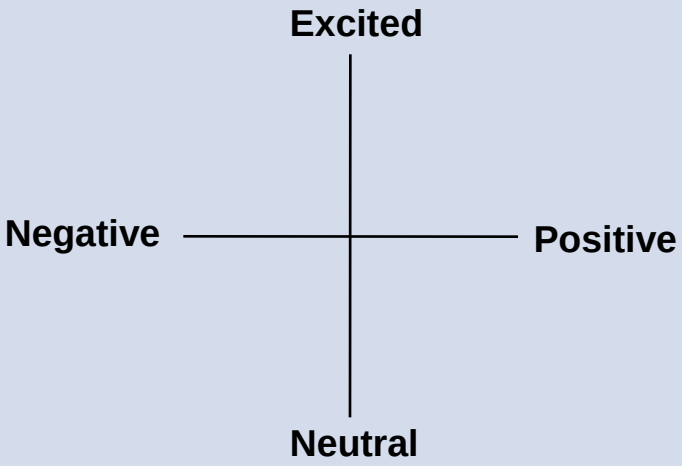
EMG	**Contraction Power**
ECG	**Heart Rate**
	Heart Rate Variability
	Inter-Beat- Interval
Blinks	**Blink Amplitude**
	Blink Duration
	Blink Frequency
Plethysmo-graph	**Heart Rate**
	Heart Rate Variability
	Inter-Beat- Interval
Respiration	**Respiration Depth**
	Respiration Rate
GSR	**GSR**
	Number of peaks
	Peak amplitude
	dGSR/dt
Temperature	**Temperature**
	dTemp/dt

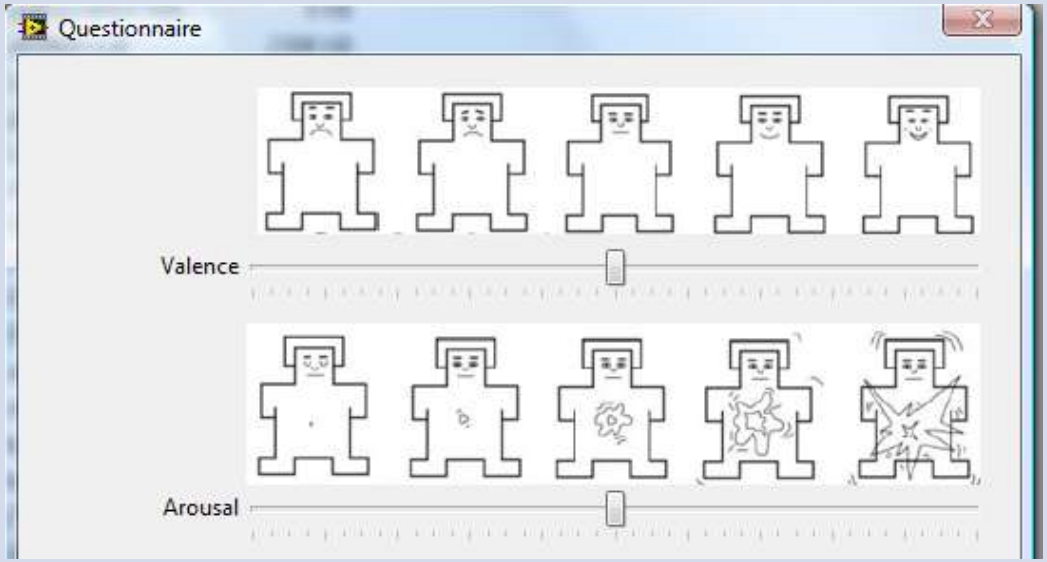
Frontalis

Zygomaticus



- Introducing the arousal valence space





Feature correlation

Correlation of selected multimedia features with physiological features of 8 participants				
	EMG Zygomatic. Energy/Key lighting	Skin temp.standard deviation /5th autocorrelation of MFCC coefficient	Skin temperature range/Shot length variation	EMG Zygomatic. energy/ 15th/20 bin of hue histogram
1	0.24	-	-	-0.41
2	0.62	0.44	0.42	-0.41
3	0.46	0.40	0.56	-0.34
4	0.40	0.32	0.43	-0.30
5	0.36	0.39	0.58	-
6	0.44	0.31	0.51	-0.32
7	0.47	0.34	0.27	-0.43
8	0.54	0.34	0.42	-0.45

Affect characterization

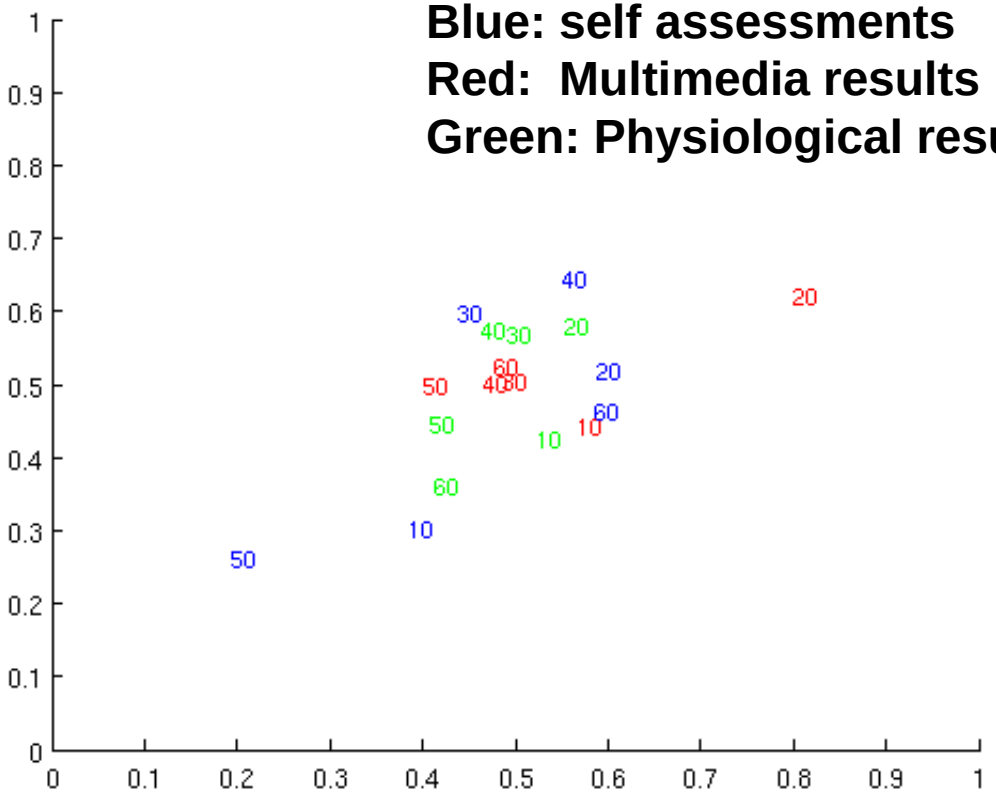
- Relevance vector machine is used to compute linear regression weights (w_i) to estimate arousal/valence scores. (Tipping toolbox)
- y_j is the estimation from arousal or valence value for j-th observation (video clip), x_i is the i-th feature

$$\hat{y}(j) = \sum_i w_i x_i + w_0$$

- Leave one out cross validation

Results of affect characterization

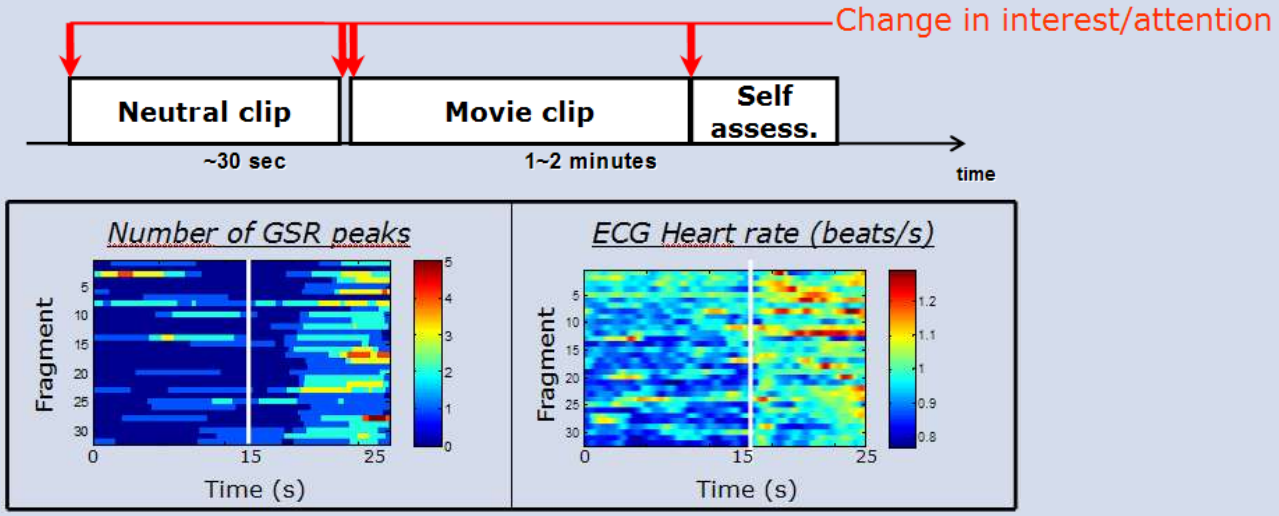
Average ts and
self-a or



Participar		ces with eatures
1		
2		
3		
4		
5		
6		
7		
8	0.17	0.19

Interest detection

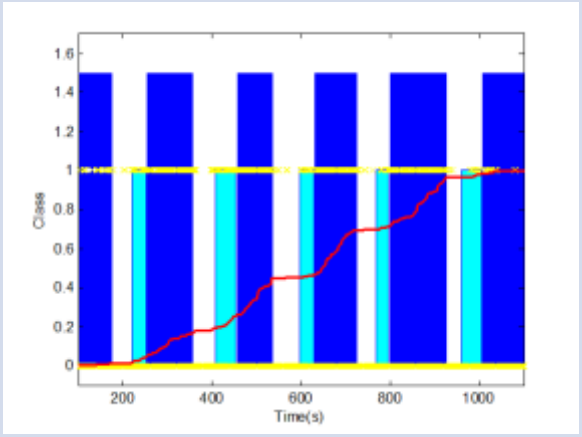
Need for training data which contains relevant features for at least two levels of interest.

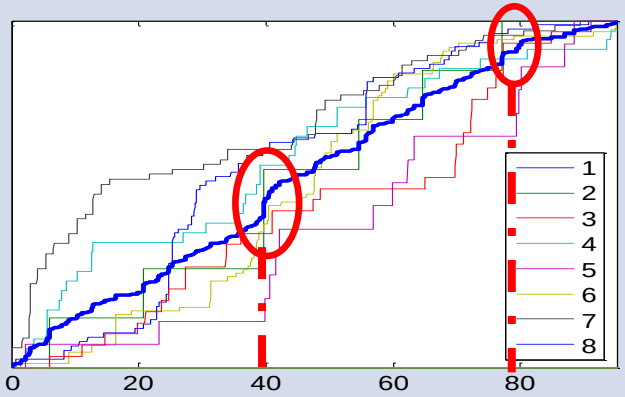


LDA Classifier output: 72% accuracy

Interest detection during movies

- Analyze full experiment.
- Compare participants.
- Evaluate.





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Conclusion

- The correlation between stimuli (multimedia) and response (physiological signals) was shown.
- Results show the ability of the physiological signals for affective characterization
- Temporal detection of interesting movie fragments is feasible.

Future work

- Implementation of head-movement and facial expressions as features.
- Obtaining objective measure for detecting interesting episodes instead of visual inspection.
- Using prior information for affect estimation (genre, users rating, etc)
- Modeling and estimating dynamics of affect in movie watching by multimedia features.