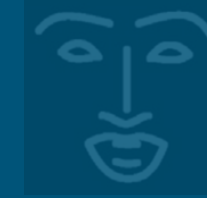


# Survey of Affect Representation Schemes used in Automatic Vision-Based Affect Prediction

## A Systematic Literature Review



### Background 1

#### Definitions

**Affect:** *n. any experience of feeling or emotion* [1]

**Affect representation scheme (ARS):** *a model used for classification of emotions, usually dimensional or discrete* (Fig. 1)

**Automatic affect recognition (AAR):** *estimating a subjects' affective state from a given input (in this case visual)*

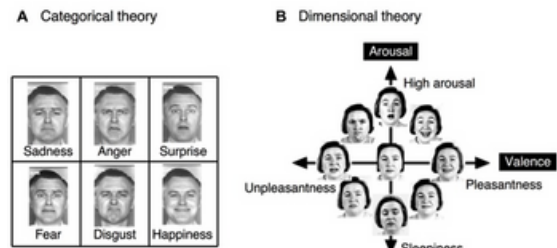


Figure 1: Theories of emotion perception [2]

#### AAR applications [3, 4]



#### Knowledge gap & motivation

Prior surveys on AAR systems focus mainly on the algorithms and approaches used, but not on the ARS used. Having a clear understanding of ARS, how when and why they are used, and the impact they can have on AAR results, will allow future researchers to make more informed decisions when developing their systems.

This research provides these insights with the research question:

**What is the current state of affect representation schemes in research on automatic vision-based affect recognition?**

### References

[1] American Psychological Association. (n.d.). Affect. In APA Dictionary of Psychology. Retrieved May 10, 2023 from <https://dictionary.apa.org/affect>

[2] Matsuda, Yoshi-Taka & Fujimura, Tomomi & Katahira, Kentaro & Okada, Masato & Ueno, Kenichi & Cheng, Kang & Okanoya, Kazuo. (2013). The implicit processing of categorical and dimensional strategies: An fMRI study of facial emotion perception. *Frontiers in human neuroscience*. 7. 551. 10.3389/fnhum.2013.00551.

### Method 2

#### Systematic Literature Review

- Ensures reproducibility of results
- From 549 papers from WebOfScience we screened 333, of which 53 were included in the review (Fig. 2)
- Benchmarking datasets for feasibility
- Eligibility criteria:

include	exclude
<ul style="list-style-type: none"> <li>• English</li> <li>• CS paper proposing vision-based AAR system</li> </ul>	<ul style="list-style-type: none"> <li>• Surveys and reviews</li> <li>• Group affect recognition</li> <li>• Micro-expressions</li> <li>• Multimodal input (feasibility constraint)</li> </ul>

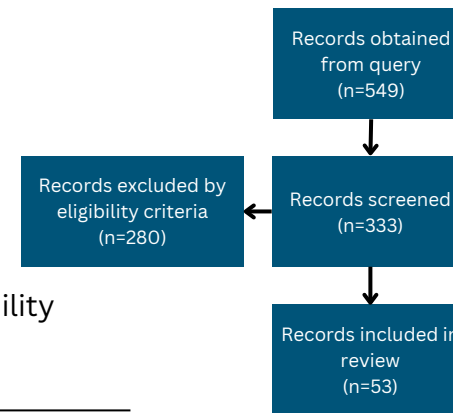


Figure 2: Simplified PRISMA diagram

### Discussion & Conclusion 4

- It has become the norm to use ARS aligning with the emotions proposed Ekman's Basic Emotion Theory (BET).
- Contempt not used as often as BET-6/7N despite it being more recent research.
- Indicates researchers don't keep up to date with developments in psychology
- Concerning due to AAR being rooted in psychology
- Researchers don't provide enough motivation behind decisions
- Hinders further development in AAR
- Critical thought is necessary especially with the rise of AI and credibility and trustworthiness being questioned more frequently.
- For useful, trustworthy, understandable, and credible systems, it is necessary to critically think about and report on the decision making process.

### Results 3

#### Types of Affective States

- Utilitarian emotions (52),
- Mood (1)
- 49+ papers target *joy, sadness, disgust, surprise, fear, and anger*
- 28 papers target *neutral*
- 13 papers target *contempt*

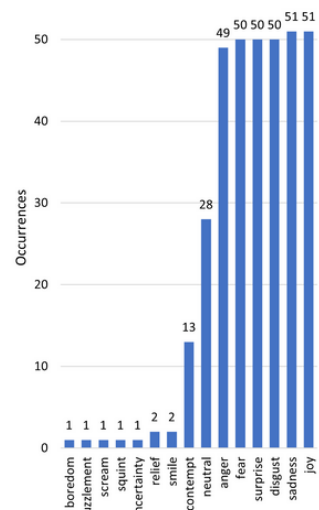


Figure 3: Occurrence of targeted affective states

#### ARS Usage & Popularity

- All use categorical ARS
- 2 use an additional dimensional ARS
- 12 different categorical ARS
  - 8 based on Ekman's theories
  - 4 not explicitly based in psychology
- ARS popularity (all-time)
  - BET-7N
  - BET-6
  - BET-7C
  - BET-8
  - Others
- ARS popularity (2018-2023)
  - BET-7N
  - BET-6
  - BET-8
  - Others
  - BET-7C

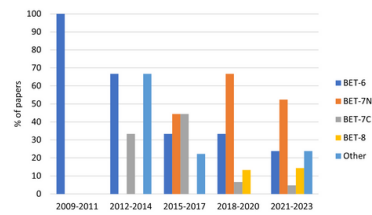


Figure 4: % of papers using certain ARS

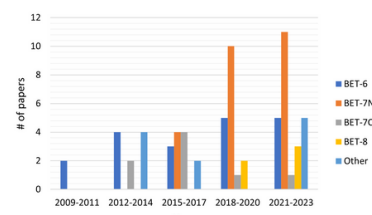


Figure 5: # of papers using certain ARS

### Future Research 5

- Increase sample size for more representative data
- Explore ARS usage in multimodal input systems
- Explore how ARS usage differs for different modalities (e.g. speech, visual, physiological)

[3] Jenn Fulmer. The value of emotion recognition technology, Sep 2021.

[4] Vinola, C.; Vimaladevi, K. «A Survey on Human Emotion Recognition Approaches, Databases and Applications». *ELCVIA : Electronic Letters on Computer Vision and Image Analysis*, Vol. 14 núm. 2 (2015), p. 24-44. DOI 10.5565/rev/elcvia.795 <<https://ddd.uab.cat/record/144806>> [Consulta: 22 maig 2023].