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Survey of Affect Representation Schemes used in Music Automatic Affect Prediction

A Systematic Literature Review

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1 BACKGROUND

- **Affect** - term which covers various types of mental response (emotions, feelings, moods, attitudes)
- **Music automatic affect prediction** - computations which aim to predict or recognize emotions perceived or induced by music
- Use cases:

Music therapy [1]

Mental health [2]

User experience

- **Affect Representation Scheme** (**ARS**) - used to represent affects in systems
- This research will :
  - give a descriptive overview of ARSs in music automatic affect prediction
  - help with speeding up the process of decision making by furure reserchers
- Examples of affect representation models [3] :

Categorical

Dimensional

Custom

2 RESEARCH QUESTIONS

Which Affect Representation schemes are used in Music Automatic Affect Prediction ?

There are 7 sub-questions that covers the type of input data, types and popularity of ARSs with motivation, trends over time, psychological background and correlation between targeted affective states and chosen ARSs.

3 METHODS

A systematic literature review was conducted

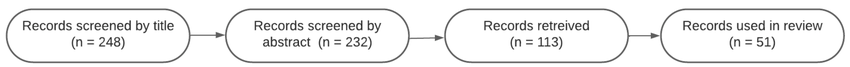
- **Search Engines**: Scopus, IEEE Explore and Web of Science
- **Search Strategy**: 3 core concepts were identified:
  - affect representation,
  - automatic affect prediction,
  - music
- **Filtering**:

additional feasibility filter was added - benchmarking datasets

Table 2: Inclusion and exclusion criteria

Inclusion	Exclusion
People listening to music in various situations	
English language papers	Papers written in different languages than English
Papers from Computer Science field	Papers from a field other than Computer Science
Research whose main focus is on music automatic affect (or emotion/ mood/ feeling) prediction (or recognition/ detection)	Research that does no automatic computations on music or other input signals
Only journals, conference papers or books chapters	Literature reviews

- **Search Results:**



4 RESULTS

- Types of ARS used:
- **Dimensional**: usually Russell's [4] or Thayer's [5] valence/arousal space
- **Categorical**: distinguished between
  - ***emotion labels*** - usually 4 broad categories (happy, angry sad, neutral)
  - ***quadrants*** - based on valence/arousal representation changed to be categorical
  - ***GEMS*** (Geneva Emotional Music Scale) - developed for music domain (3-lever hierarchy of emotion labeling)
- **Both:** unique combination of dimensional and categorical approaches
- **Input Data**:
  - 66 % uses audio sample
  - 24% uses music features
  - 6 % used EEG (Electroencephalography) signals - induced emotions
  - 9 out of 12 studies which used features use dimensional ARS
- **Targeted affective states:** **Emotion - 46 papers** **Mood - 5 papers**
- **Popularity over time:**

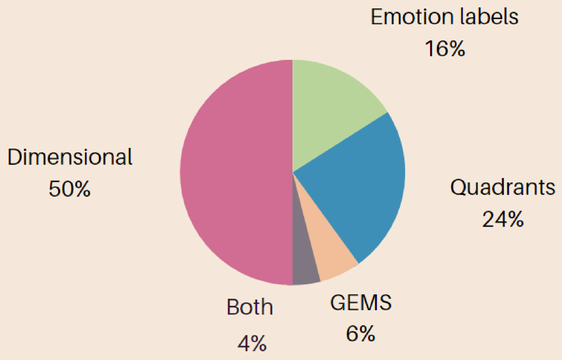


Figure 1: Percentage usage of certain ARS

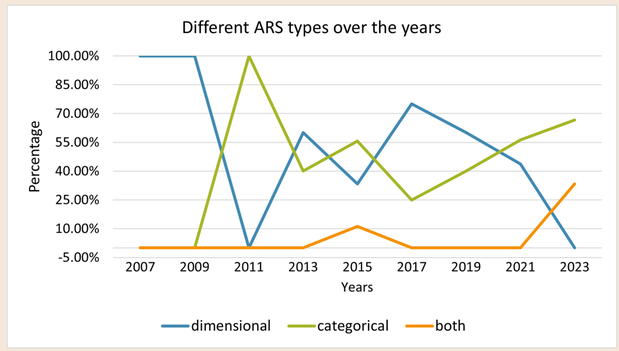


Figure 2: Percentage of papers which used certain representation schemes over the years

Psychological Theories:

66% - based on psychological theories

33% - not based on psychological theories

5 CONCLUSION

- Both dimensional and categorical approaches are used and are similarly popular
- The extracted data might be influenced by dataset bias
- A great majority of research focuses on emotions as an affective state
- It is common to use dimensional ARS when using features as input
- There is no visible trend over the years
- Not enough researchers base their decisions on psychological theories
- There are only a few unique mixed ARS (using both approaches)

6 LIMITATIONS

- Time constrain of 10 weeks
- Only one person conducting the research
- Not included ISMIR (International Society for Music Information Retrieval) which might add relevant literature
- Added feasibility filtering which might cause bias

7 FUTURE WORK

- Include all retreived records with additional literature from other databases or journals (ISMIR or ACM publications may be relevant)
- Perform filtering without feasibility filter
- More detailed analysis of used schemes with more in-depth distinction between ARS types

REFERENCES

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[2] ManasaPisipati and AnupNandy. Human emotionrecognitionusingeeg signal in musiclistening. In 2021 IEEE 18th India Council International Conference (IN- DICON), pages 1–6, 2021

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[4]James A. Russell. A circumplex model of affect. Journal of Personality and Social Psychology, 39:1161–1178, 12 1980.

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