# Introduction to **Audio Content Analysis**

module 13: mood recognition

alexander lerch

Georgia Tech | Center for Music Technology
College of Design

# introduction

## overview

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### corresponding textbook section

chapter 13

- **lecture content**
  - introduction to emotion and mood
  - models for mood
  - linear regression

- **learning objectives**
  - describe Russel's arousal-valence plane
  - discuss commonalities and differences between mood recognition and genre classification
  - implement linear regression in Matlab

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# mood recognition
## introduction

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- **objective**:identify mood/emotion of a song
- **terminology**:
  - *Music Mood Recognition* and *Music Emotion Recognition* usually used synonymously
- **processing steps** (similar to genre and similarity tasks)
  - extract features
  - classify (possibly regression)

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# mood recognition
## challenges



**What is the difference between mood and emotion**

# mood recognition
## challenges



**What is the difference between mood and emotion**

many definitions out there but general consensus on

- *emotion*:
  - temporary, evanescent
  - (directly) related to external stimuli
- *mood*:
  - longer term, stable
  - diffuse affect state

# mood recognition
## challenges



- **ground truth data**
  - *verbalization* of emotions/moods usually misleading
  - not easily *quantifiable*/categorizable
  - changing over time?

- **research questions**
  - are *basic emotions* (happiness, anger, fear, ...) representative for music perception?
  - should aesthetic emotions be distinguished from other emotions (guilt, shame, disgust, ...)?
  - *aroused vs. transported*/*evoked vs. conveyed* moods?

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# mood recognition
## models

- classification into **label clusters**[1]

| Cluster 1 | Cluster 2 | Cluster 3 | Cluster 4 | Cluster 5 |
|---|---|---|---|---|
| Rowdy | Amiable/Good Natured | Literate | Witty | Volatile |
| Rousing | Sweet | Wistful | Humorous | Fiery |
| Confident | Fun | Bittersweet | Whimsical | Visceral |
| Boisterous | Rollicking | Autumnal | Wry | Aggressive |
| Passionate | Cheerful | Brooding | Campy | Tense/Anxious |
| | | Poignant | Quirky | Intense |
| | | | Silly | |

- **mood model**, circumplex model

[1] X. Hu and J. S. Downie, "Exploring Mood Metadata: Relationships with Genre, Artist and Usage Metadata," in *Proceedings of the International Society for Music Information Retrieval Conference (ISMIR)*, Vienna, 2007.

# mood recognition
## models



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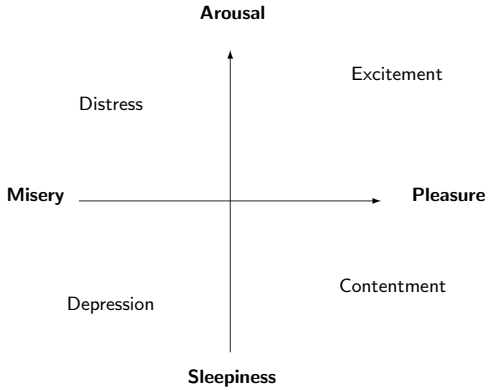



[1] J. A. Russel, "A Circumplex Model of Affect," *Journal of Personality and Social Psychology*, vol. 39, no. 6, pp. 1161–1178, 1980, ISSN:

# mood recognition

## mood model: regression modeling



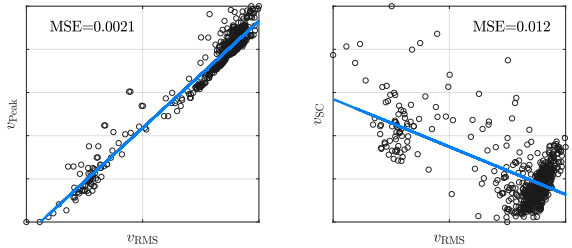
- **mapping**
  - (N-dimensional) observation (feature) to 2-dimensional coordinate (valence/arousal)
- **training**
  - find model to minimize error between data points and "prediction"

# regression
## regression



- linear regression: fit a linear function to a series of points $(x_j, y_j)$

$$y_n = m \cdot x_n + b$$




- other regression approaches: SVR, DNNs, etc.

matlab source: plotLinearRegression.m

# mood recognition
## range of results



- highly dependent on data
- **5 mood clusters**:
  40–60% classification rate
- **mood model**:
  0.1–0.4 absolute prediction error (unit circle)

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# summary
## lecture content



- **emotion and mood**
  - emotion: temporary, related to external stimuli
  - mood: long term, diffuse affective state
- **features**
  1. baseline features are identical to genre and similarity tasks
- **inference**
  1. often done as regression (as opposed to classification)