# A Meta-Analysis of Music Emotion Recognition Studies

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Author roles were classified using the Contributor Role Taxonomy (CRediT; https://credit.niso.org/) as follows: *Tuomas Eerola***:** conceptualization, methodology, formal analysis, and writing – original draft. *Cameron J. Anderson***:** data curation, formal analysis, and writing – original draft

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**Abstract**

This meta-analysis examines music emotion recognition (MER) models published between 2014 and 2024, focusing on predictions of valence, arousal, and categorical emotions. A total of 553 studies were identified, of which 96 full-text articles were assessed, resulting in a final review of 34 studies. These studies reported 204 models, including 86 for emotion classification and 204 for regression. Using the best-performing model from each study, we found that valence and arousal were predicted with reasonable accuracy ($r = 0.67$ and $r = 0.81$, respectively), while classification models achieved an accuracy of 0.87 as measured with Matthews correlation coefficient. Across modeling approaches, linear and tree-based methods generally outperformed neural networks in regression tasks, whereas neural networks and support vector machines (SVMs) showed highest performance in classification tasks. We highlight key recommendations for future MER research, emphasizing the need for greater transparency, feature validation, and standardized reporting to improve comparability across studies.

*Keywords*: music, emotion, recognition, computational, model, meta-analysis

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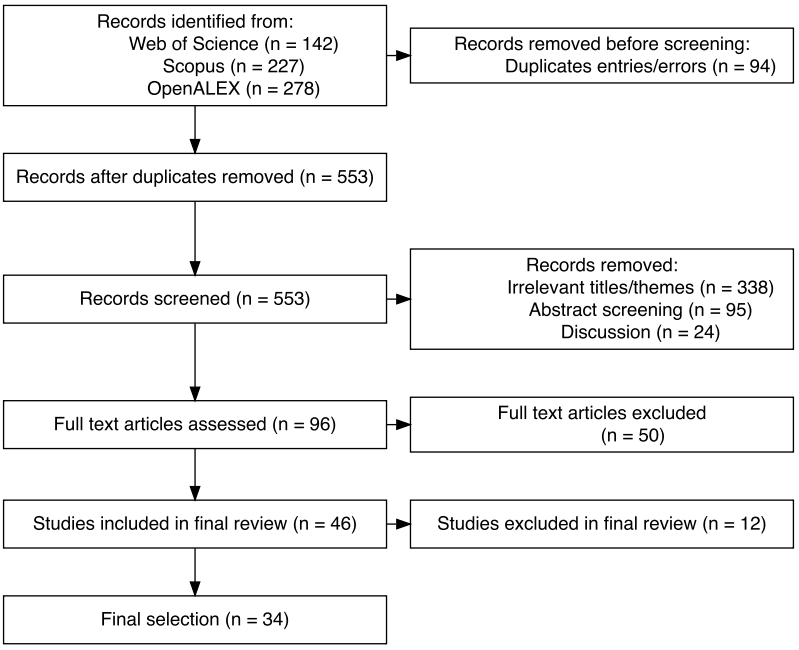
## Introduction

Emotional engagement is a key reason why people engage with music in their every day activities, and it is also why music is increasingly being used in various health applications (Agres et al., 2021; Juslin et al., 2022).

## Methods

**Figure 1**

*Flowchart of the study inclusions/eliminations.*




## Results

| Info | Regression | Classification | Total |
|---|---|---|---|
| Study N | 22 | 12 | 34 |
| Model N | 204 | 86 | 290 |
| Techniques | Neural Nets: 64 | 21 | 85 |
| Techniques | Support Vector Machines: 62 | 26 | 88 |
| Techniques | Linear Methods: 62 | 19 | 81 |
| Techniques | Tree-based Methods: 14 | 16 | 30 |
| Techniques | KS, Add. & KNN: 2 | 4 | 6 |

| Info | Regression | Classification | Total |
|---|---|---|---|
| Feature N | Min=3, Md=653, Max=14460 | Min=6, Md=98, Max=8904 | NA |
| Stimulus N | Min=20, Md=324, Max=2486 | Min=124, Md=300, Max=5192 | NA |

**Figure 2**

*Forest plot of the best valence models from all MER studies.*

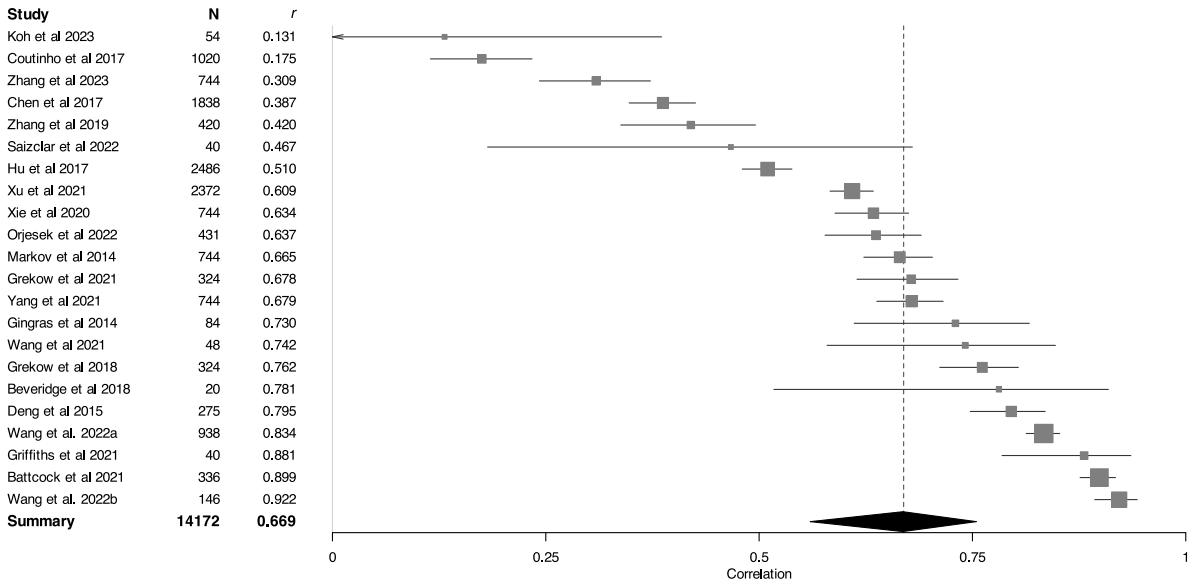



**Figure 3**

*Forest plot of the best arousal models from all MER studies.*

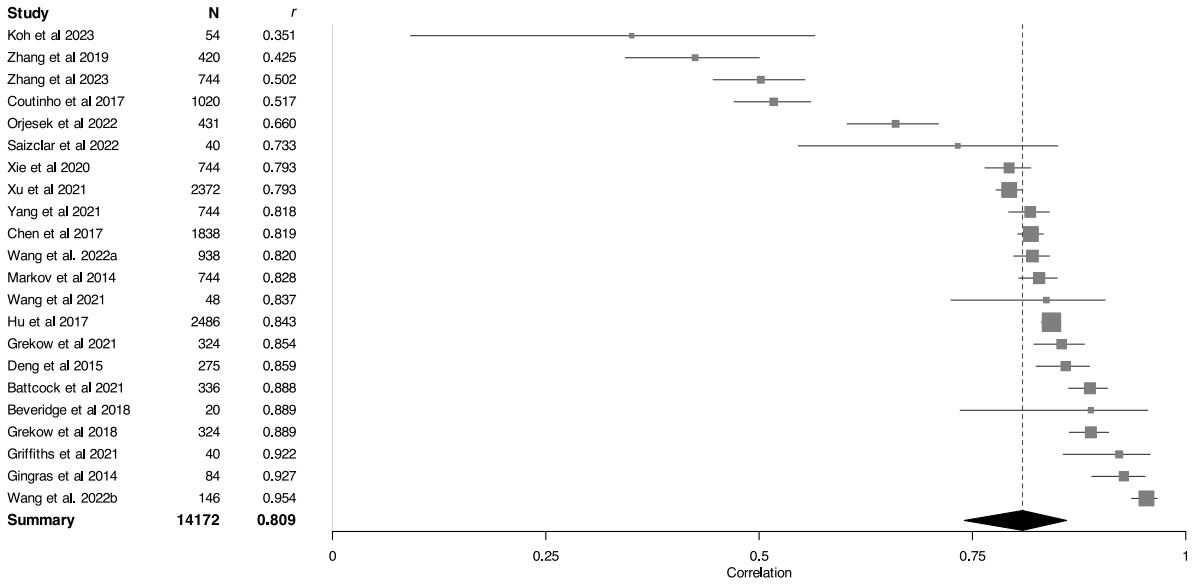
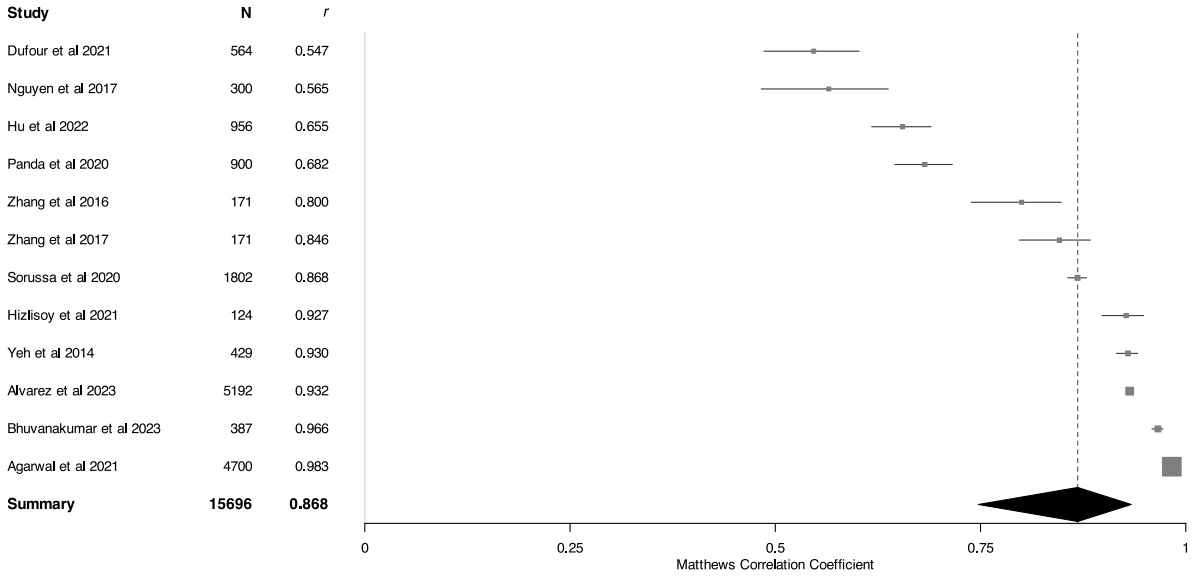



**Figure 4**

*Forest plot of the best classification models from all MER studies.*




## Discussion and conclusions

***Funding statement***

CA was funded by Mitacs Globalink Research Award (Mitacs & British High Commission - Ottawa, Canada).

***Competing interests statement***

There were no competing interests.

***Open practices statement***

Study preregistration, data, analysis scripts and supporting information is available at GitHub, https://tuomaseerola.github.io/metaMER.

## References

Agres, K. R., Schaefer, R. S., Volk, A., Van Hooren, S., Holzapfel, A., Dalla Bella, S., Müller, M., De Witte, M., Herremans, D., Ramirez Melendez, R., et al. (2021). Music, computing, and health: A roadmap for the current and future roles of music technology for health care and well-being. *Music & Science*, *4*, 2059204321997709.

Juslin, P. N., Sakka, L. S., Barradas, G. T., & Lartillot, O. (2022). Emotions, mechanisms, and individual differences in music listening: A stratified random sampling approach. *Music Perception: An Interdisciplinary Journal*, *40*(1), 55–86.