Prof. Dr. Holger Hoos
Chair for AI Methodology
RWTH Aachen University

Open Project:

Support in Teaching Activities and Empirical Studies for Optimisation of Music Data Analysis using Artificial Intelligence

Type:		**Daily Supervisor:**
Bachelor Thesis	☐	Dr. Igor Vatolkin
Master Thesis	☐	vatolkin[AT]aim.rwth-aachen.de
Student Assistant	☒	Theaterstrasse 35-39, 52062 Aachen, Room 328

Description

Music Information Retrieval [2] or—more generally defined—Music Data Analysis [10] is a highly interdisciplinary research domain which involves computer aided processing and analysis of data sources related to music: audio signals, digital scores, lyrics, album covers, etc. Related applications include genre and style recognition [8], automatic music and accompaniment generation [5], instrument and vocal detection [4], music structure analysis [6], plagiarism detection [1]. To increase the quality and the efficiency, many techniques can be applied, such as automatic hyperparameter tuning, classification with neural networks, feature selection, or multi-objective optimisation by means of evolutionary algorithms. The scope of this student position is to provide support for studies optimising various music data analysis applications, and also to integrate them into educational offerings at the chair of Artificial Intelligence Methodology, amongst others enhancing the open source Java framework AMUSE (Advanced MUSic Explorer) [9, 7].

Tasks

- Further development of AMUSE (integration of new plugins for feature extraction and classification, enhancement of the user interface, documentation, etc.)

- Contribution to research studies, e.g., optimisation of music classification tasks by means of neural architecture search [3], and participation / co-authorship in publications based on study results

- Support in the organisation of educational offerings (test of new applications, review of code, participation with own ideas)

- Implementation of demos / participation in school projects, e.g., for InfoSphere – Student Laboratory for Computer Science

Requirements

- Very good programming skills in at least one of the following languages: Java, Python, Matlab

- Willingness to learn further programming languages

- Passion for music and basic understanding of music theory (playing a music instrument is not a requirement but is useful)

- Some experience in machine learning and optimisation (e.g., relevant courses or seminars, experience in Keras, WEKA, or scikit-learn)

Further information

The position will be filled as soon as a suitable candidate is found. Please send a brief letter of motivation, CV, and an academic transcript to the email address mentioned above.

References

[1] C. Dittmar, K. F. Hildebrand, D. Gaertner, M. Winges, F. Müller, and P. Aichroth. Audio forensics meets music information retrieval — a toolbox for inspection of music plagiarism. In *Proc. of the 20th European Signal Processing Conference, EUSIPCO*, pages 1249–1253, 2012.

[2] J. S. Downie. Music information retrieval. *Annual Review of Information Science and Technology*, 37(1):295–340, 2003.

[3] T. Elsken, J. H. Metzen, and F. Hutter. Neural architecture search: A survey. *Journal on Machine Learning Research*, 20:55:1–55:21, 2019.

[4] Y. Han, J.-H. Kim, and K. Lee. Deep convolutional neural networks for predominant instrument recognition in polyphonic music. *IEEE ACM Transactions on Audio, Speech, and Language Processing*, 25(1):208–221, 2017.

[5] E. R. Miranda, editor. *Handbook of Artificial Intelligence for Music*. Springer Nature, 2021.

[6] J. Paulus, M. Müller, and A. Klapuri. State of the art report: Audio-based music structure analysis. In *Proc. of the 11th International Society for Music Information Retrieval Conference, ISMIR*, pages 625–636, 2010.

[7] I. Vatolkin, P. Ginsel, and G. Rudolph. Advancements in the music information retrieval framework AMUSE over the last decade. In *Proc. 44th Int'l ACM Conf. on Research and Development in Information Retrieval (SIGIR)*, pages 2383–2389, 2021.

[8] I. Vatolkin and C. McKay. Multi-objective investigation of six feature source types for multi-modal music classification. *Transactions of the International Society for Music Information Retrieval*, 5(1):1–19, 2022.

[9] I. Vatolkin, W. M. Theimer, and M. Botteck. AMUSE (advanced music explorer) - A multitool framework for music data analysis. In *Proc. of the 11th International Society for Music Information Retrieval Conference, ISMIR*, pages 33–38, 2010.

[10] C. Weihs, D. Jannach, I. Vatolkin, and G. Rudolph, editors. *Music Data Analysis: Foundations and Applications*. CRC Press, 2017.