Pattern Annotation Framework (PAF): The Analysis of Annotators' Pattern Discovery Perception in Diverse Music Datasets

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Pattern discovery remains a non-trivial challenge in the field of music information retrieval (MIR), stemming from the definition of a pattern, which is strongly connected to an individual's perception, familiarity, and expertise. To further explore these influential factors with regards to the inter-annotator agreement, we conducted an experiment including four genre-diverse subsets of music: the HEMAN and JKU-PDD datasets, a set of Dutch folksongs and a dataset of jazz solo excerpts (22 monophonic music excerpts in total). The datasets were annotated by five musicology graduate and undergraduate students, ranging from the age of 20 to 24, with extensive musical backgrounds and theoretical expertise, using an improved version of the *Pattern Annotation Framework (PAF)*, see [3]. The research goal is to analyse and assess the annotators' perception of patterns within the context of various music excerpts, define how music familiarity impacts annotators' pattern perception, and find how it influences the definition of a pattern.
The results of the annotation analysis shows that the musical patterns can be divided into two groups with different perspectives. The first provided patterns greater in number of events and of shorter time durations, while the latter provided patterns with a lower number of events and of longer time durations. In the majority of music excerpts, one particular user combined both perspectives, creating a comprehensive approach in pattern annotation. Despite the obvious differences between the two groups, we also explore how they are intertwined. The analysis unravels common characteristics, e. g. pattern naming and subdivisions, and outliers of annotators' pattern perception, such as the ranking importance system for patterns. With direct impact on the inter-annotator agreement, considering pattern occurrences, coverage, duration, note range, pitch direction changes, repeated, most common, and unique notes, we aim for a better understanding and further research in the field of pattern discovery.

References

1. Prerau, D. S. (1972, May). Computer pattern recognition of printed music. In *Proceedings of the November 16-18, 1971, fall joint computer conference* (pp. 153-162). doi:10.1145/1479064.1479089.
2. Ren, Y., Nieto, O., Koops, H. V., Volk, A., & Swierstra, W. S. (2018). Investigating musical pattern ambiguity in a human annotated dataset. Proceedings of the 15th International Conference on Music Perception and Cognition, Graz, Austria.
3. Tomašević, D., Wells, S., Ren, I. Y., Volk, A., & Pesek, M. (2021). Exploring annotations for musical pattern discovery gathered with digital annotation tools. In *Pattern in Music* (pp. 100-113). Journal of Mathematics and Music. doi:10.1080/17459737.2021.1943026.
4. Chen, T. P., & Su, L. (2017). Discovery of repeated themes and sections with pattern clustering. *Music Information Retrieval Evaluation eXchange (MIREX 2017)*.
5. Pesek, M., Leonardis, A., & Marolt, M. (2017). SymCHM—an unsupervised approach for pattern discovery in symbolic music with a compositional hierarchical model. *Applied sciences*, *7*(11), 1135. doi.org/10.3390/app7111135.
6. Velarde, G., Meredith, D., & Weyde, T. (2016). A wavelet-based approach to pattern discovery in melodies. *Computational music analysis*, 303-333. doi.org/10.1007/978-3-319-25931-4_12.
7. Collins, T. E. (2011). *Improved methods for pattern discovery in music, with applications in automated stylistic composition*. Open University (United Kingdom).
8. Janssen, B., De Haas, W. B., Volk, A., & Van Kranenburg, P. (2014). Finding repeated patterns in music: State of knowledge, challenges, perspectives. In *Sound, Music, and Motion: 10th International Symposium, CMMR 2013, Marseille, France, October 15-18, 2013. Revised Selected Papers 10* (pp. 277-297). Springer International Publishing. doi:10.1007/978-3-319-12976-1_18.
9. Dannenberg, R. B. (2001). Music Information Retrieval as Music Understanding. In *ISMIR*. doi.org/10.1007/978-3-319-12976-1_18.
10. Pesek, M., Tomaševic, D., Ren, I. Y., & Marolt, M. (2019). An Opensource Web-Based Pattern Annotation Framework–PAF. In *Proceedings of the International Conference on Music Information Retrieval (ISMIR)* (pp. 1-2).
11. Melkonian, O., Ren, I. Y., Swierstra, W., & Volk, A. (2019, August). What constitutes a musical pattern?. In *Proceedings of the 7th ACM SIGPLAN International Workshop on Functional Art, Music, Modeling, and Design* (pp. 95-105). doi.org/10.1145/3331543.3342587.

Presentation statement

I would prefer to present my topic orally.