



The Board of Doctoral Study Prague,
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Report on the PhD Thesis “Cover Song Identification using Music Harmony Features, Model and Complexity Analysis”

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This thesis summarizes works covering the author’s study and research combining software engineering methods and methods of interdisciplinary science Music Information Retrieval (MIR) focused on analysis of digital music and its retrieval based on the audio features. Obviously, the focus is mainly on the precision of the retrieval algorithms, but also on end-users and their understanding of the query and the result. He participated in development a music analysis system which is based on music theory and contains visualizations meaningful for those interested in harmony aspects of music by exploiting the chord notation and tonal harmony rules.

In Chapter 1, the author specifies necessary basics of music theory and MIR focused, particularly, on (audio) cover song identification. Basics of signal processing and other MIR definitions are present, too. Chapter 2 focuses on related works in musicology and in MIR. The high-level formal approach is sound and seems to open new directions. Chapter 3 can be conceived as the core of thesis. A number of notions are proposed and used here: a new model of music harmony, new distances between chords and chroma vectors. The implemented approach enables to evaluate harmonic complexity. Some experiments of the performance of the new features (standard and new), their comparison, and improvements are contained in Chapter 4. Chapter 5 describes an open-source project - harmony-analyzer - supporting creating, naming, and analyzing chords and visualize chord progressions. The analyzer was used for experiments described and discussed in the thesis.

Chapter 6 describes details of KaraMIR project and Kara1k dataset focused on karaoke song with a separate voice track. This dataset was created in a partnership with a French music company Recisio. The international team, in which Ladislav participated, has used core time on the IT4Innovations supercomputers for evaluations. Using its new model of harmony analysis Ladislav achieved a close to 90% accuracy for a search of cover songs in his dataset that is a competitive result within the dynamic time warping algorithms state-of-the-art. Both the dataset and harmony-analyser are publicly available.

The results presented in the thesis have been published in papers of representative international conferences, like, e.g., CISIM 2017, IEEE Int. Symposium on Multimedia (ISM) 2017 and Symposium on Applied Computing, (SAC) 2017 as well as in the respected journal Int. J. Semantic Computing (2018). The conference proceedings have been published by Springer, ACM, and IEEE publishers. Ladislav participated also in the ACM SRC competition within the SAC conference and was awarded the first price out of 50 contestants. The DBLP Bibliography Server records 7 items of which Ladislav is the co-author. Consequently, I recommend that the candidate be awarded the PhD degree.

Prof. Jaroslav Pokorný
supervisor