

Tutorial 3

Markov Logic Networks for Music Analysis

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Abstract

The automatic extraction of relevant content information from music audio signals is an essential aspect of Music Information Retrieval (MIR). Music audio signals are very rich and complex, both because of the intrinsic physical nature of audio (incomplete and noisy observations, many modes of sound production, etc.), and because they convey multi-faceted and strongly interrelated semantic information (harmony, melody, metric, structure, etc.). Dealing with real audio recordings thus requires the ability to handle both uncertainty and complex relational structure at multiple levels of representation. Until recent years, these two aspects have been generally treated separately, probability being the standard way to represent uncertainty in knowledge, while logical representation being used to represent complex relational information. Markov Logic Networks (MLNs), in which statistical and relational knowledge are unified within a single representation formalism, have recently received considerable attention in many domains such as natural language processing, link-based Web search, or bioinformatics. The goal of this tutorial is to provide a comprehensive overview of Markov logic networks and show how they can be used as a highly flexible and expressive yet concise formalism for the analysis of music audio signals. We will show how MLNs encompass the probabilistic and logic-based models that are classically used in MIR. Algorithms for MLN modeling, training and inference will be presented, as well as open-source software packages for MLNs that are suitable to MIR applications. We will discuss concrete case-study examples in various fields of application.