SRA: An online tool for spectral and roughness analysis of sound signals

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SRA is the only application of its kind available online [http://www.acousticslab.com/roughness/index.html]. It is included in Musicalgorithms [http://musicalgorithms.ewu.edu/algorithms/Roughness.html], a database of music composition/analysis algorithms hosted by EasternWashington University. In this web-based application, users can submit 250- to ˜1000ms-long portions of uncompressed sound files (.wav and .aif formats) for spectral and roughness analysis.

The spectral analysis uses an improved STFT algorithm, based on reassigned bandwidthenhanced modeling [Fitz, K. and Haken, L. (2002). "On the use of time-frequency reassignment in additive sound modeling," Journal of the Audio Engineering Society 50(11): 879-893], and incorporates an automatic spectral peak-picking process to determine which frequency analysis bands correspond to spectral components of the analyzed signal. It is implemented using the Loris open source C++ class library, developed by Fitz and Haken (CERL Sound Group). Users can manipulate 3 spectral analysis/peak-picking parameters: (a) frequency bandwidth (10Hz or 20Hz), (b) spectral amplitude normalization (Yes or No), and (c) spectral amplitude threshold (user-defined). To ensure the reliability and validity of the analysis results, every step of the file submission process includes detailed descriptions of the parameters, as well as suggestions on the settings appropriate to the submitted file(s) and the question(s) of interest.

The spectral parameters obtained from the analysis (frequency and amplitude values of the identified spectral components) are fed to a roughness estimation model [Vassilakis, P. N. (2005). "Auditory roughness as a means of musical expression," Selected Reports in Ethnomusicology (Perspectives in Systematic Musicology): 119-144], outputting a roughness estimate for the submitted sound file as well as estimates of the roughness contribution of each individual sinepair in the sound file's spectrum. The model includes 3 terms that represent the dependence of roughness on a sine-pair's (a) intensity (related to the combined amplitude of the sine-pair), (b) amplitude fluctuation degree (related to the amplitude difference between the sines in the pair), and (c) amplitude fluctuation rate (frequency difference between the sines in the pair) and register (frequency of the lower sine).

A detailed outline of the roughness estimation model will be followed by a demonstration of the tool, a discussion of research studies that have employed it, and an outline of future possible research applications.

Key words: Roughness, Spectral analysis, Computer model

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