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Supplement to my Lectures on Fourier Analysis for 2nd Semester Students.

A first step into audio spectral analysis by generating a simple spectral fingerprint for music tracks

A few remarks on the test results

On the one hand the chosen test tracks were relatively good recognized: 15 test examples out of 20 are correctly recognized. The reason for this is the spectral diversity of these tracks and the small number of tracks in test at all.

On the other hand, we readily experience false recognitions:

2 test answers are correct only for one channel, but false on the second (test_track8 and test_track9).
2 answers are false on both channels, but with the same artists or the same instrumentation, i.e. with similar spectral properties in these 4 answers (test_track15 and test_track19).
1 test answer is false despite of very different perceptive impressions (test_track11).

When different and longer track segments of the corresponding recordings are taken, then the tests recognized the right tracks (test_track21 to test_track25).

Conclusion:

Only a few test examples have already shown the difficulty of a reliable recognition algorithm and why much research and signal processing is done in the field. The results suggest the need of time pattern information as well as the need of information on tonal properties of audio examples. The inspection of the data shows only small differences in the computed components of the test fingerprint in the direction of the data base fingerprints. The maximum of these components is used here for recognition of a track. Therefore one has also to work on better decision criteria for a recognition.

To learn more on "*acoustic fingerprints*", their applications and professional products in that field, please read the according article in Wikipedia and follow the links given there.

Suggestions for further experiences:

As a second step interested students could proceed with the following work: Test an analogous generation of more fingerprint information using Short time Fourier analysis, to obtain information on the time patterns of music tracks, and try to recognize dominant tones per subband. Test other subband partitions. Test with other error measures than orthogonal projections between the fingerprint vectors. Adapt the fingerprint generation and the recognition test.