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Computational Musicology
Final Project

Project summary:

My final project for Computational Musicology will consist of two main parts. The first part of the project will involve performing a number chroma analyses on Metallica's classic 1986 thrash metal album *Master of Puppets*. By utilizing a variety of different chroma analysis techniques, I hope to create a comprehensive data set that allows thorough dissection of harmonic and melodic content on the record. The second part of this project involves using the chroma data extracted from the methods applied in the first portion of the project to draw conclusions about the musical composition of the album. The main emphasis here is isolating specific chord progressions, keys, and phrasings that appear to be common on many of the tracks.

This is the first time that I am undertaking a project of this nature and magnitude, so I am unsure of what results my research may yield. However, I am very familiar with the record itself, which I believe gives me an advantage when dealing with chroma data. This project is as much a personal exercise as it is a way to dissect a well known record down to a scientific level.

Annotated Bibliography

Bartsch, Mark A., and Gregory H. Wakefield. "Audio thumbnailing of popular music using
    chroma-based representations." *IEEE Transactions on multimedia* 7.1 (2005): 96-104.
    (https://ieeexplore.ieee.org/document/1386245)

This article seems to be somewhat ubiquitously referenced in nearly every other article I have found on chroma analysis published after 2005. That fact leads me to believe that this is an essential work in the field, and should be useful for my purposes. In this article I am specifically interested in the use of chroma features in isolating structural redundancies in music, since this is essentially what I am going to be attempting to do in my project.

Jiang, Nanzhu, et al. "Analyzing chroma feature types for automated chord recognition." *Audio
    Engineering Society Conference: 42nd International Conference: Semantic Audio*. Audio
    Engineering Society, 2011.
    (http://www.aes.org/e-lib/browse.cfm?elib=15943)

As chord progression analysis will play a significant part of my own project, I believe it is essential to include at least one reliable reference on chord recognition via chroma features. I think this will likely be the foundation of my project as a whole, since key and other important musical signifiers can be drawn from chordal information. This work is another that seems to be

referenced in other papers very frequently, leading me to speculate again that it is an essential work that should be included with my own references.

Ellis, Daniel PW. "Classifying Music Audio with Timbral and Chroma Features." *Ismir*. Vol. 7.
    2007.
        (https://academiccommons.columbia.edu/doi/10.7916/D8C255SD)

This article is of particular interest because it discusses using beat synchronous chroma analysis. This is, according to the article, a more effective means of deriving meaningful pitch information regardless of instrument type. This is valuable for my project in particular because heavy metal typically features prominent percussive rhythms and highly distorted guitar timbres. If possible, we want to eliminate possible issues brought on by sonic distortions.

Englmeier, David, et al. "Musical similarity analysis based on chroma features and text retrieval
        methods." *Datenbanksysteme für Business, Technologie und Web (BTW
        2015)-Workshopband* (2015).
        (https://www.researchgate.net/publication/273427352_Musical_Similarity_Analysis_based_on_Chroma_Features_and_Text_Retrieval_Methods)

This article mainly discusses common issues related to musical information data retrieval. It does not seem to heavily focus on chroma, but it definitely skews towards topics in popular music. This could be beneficial to investigate for my own project because heavy metal (arguments aside) often feature pop adjacent songwriting styles and techniques. Isolating these in my own project using chroma analysis could be very helpful in matching up common musical elements across a single record.

Mulder, D. G. J. "Automatic Classification of Heavy Metal Music." (2014)
        (http://www.scriptiesonline.uba.uva.nl/515210)

This was the only specific paper I could find that related directly to the digital signal processing and the analysis of heavy metal music. Although it does not seem as though chroma features are discussed to great length, there is enough of a discussion to warrant its inclusion in my own references. Also, the author likely has some insight into any specific issues that may arise from the genre's sonic characteristic during analysis. This could prove invaluable in my own project.

Other possible resources:
https://www.ee.columbia.edu/~dpwe/talks/denmark-chroma-2007-05.pdf