Review of Literature

Signal processing as a field of Computer Engineering is something that can be applied to many different disciplines. From recovering archaeological data to analyzing chess matches, the applications of signal processing are virtually boundless. These bounds also extend to encompass music, as all sound can be represented as a time-varying signal in the form of a pressure wave or voltage. The techniques of signal processing can then be applied to these signals, and information that may be imperceptible with the human ear can be extracted. Some signal processing techniques that can specifically be applied to music will be explored in this review.

The study of literature started broad, looking at recent developments in signal processing as it pertains to music. Machine learning is a big topic in signal processing lately; a paper by Therrick-Ari Anderson at Lincoln University studied musical instrument identification by using neural networks. The paper used libraries in a tool called MATLAB that took care of most of the signal processing [1]; the underlying algorithms under the libraries were also briefly introduced, mainly the Fast Fourier Transform (FFT).

In search of more recent work, we found research conducted by Atahan et. al. at Yildiz Technical University in Istanbul, Turkey. This paper focused on music genre identification using machine learning techniques such as autoencoders [2]. Again, we see the prevalence of machine learning in recent research. This study applied wavelet transforms to extract features from audio; the extracted features were then fed into the autoencoder algorithm developed by the team [2].

A common theme of time-to-frequency domain transforms appeared in the literature; both the FFT and wavelet transform take time-domain data and transform it into frequency domain information. This prompted further investigation into these algorithms. Research

conducted by the Department of Applied Electronics and Instrumentation at the Government Engineering College in Kozhikode, Kerala investigated using Spectrograms for Genre Classification [3]. A spectrogram is an application of the FFT that is very useful in analyzing sound data; it breaks a sound file into small pieces and applies the FFT to those small pieces. The study concluded that spectrograms were an accurate and reliable transformation to analyze music in the frequency domain [3].

Lastly, a more refined search was performed to locate literature that is directly pertinent to the subject matter of this study. A study conducted at the Department of Computer Science and Engineering at National Cheng-Kung University explored quantitative evaluation of violin performance by means of signal processing [4]. This study looked at both time and frequency domain data, making use of spectrograms in close relation to the goal of this project. The evaluation criteria set by the study, such as pitch variation and characteristics of vibrato [4], may be applied to our project to determine quality of instruments as opposed to quality of performance.

References

T. -A. Anderson, "Musical instrument classification utilizing a neural network," 2017 12th International Conference on Computer Science and Education (ICCSE), 2017, pp. 163-166, doi: 10.1109/ICCSE.2017.8085482.

Y. Atahan, A. Elbir, A. Enes Keskin, O. Kiraz, B. Kirval and N. Aydin, "Music Genre Classification Using Acoustic Features and Autoencoders," 2021 Innovations in Intelligent Systems and Applications Conference (ASYU), 2021, pp. 1-5, doi: 10.1109/ASYU52992.2021.9598979.

N. M R and S. Mohan B S, "Music Genre Classification using Spectrograms," 2020 International Conference on Power, Instrumentation, Control and Computing (PICC), 2020, pp. 1-5, doi: 10.1109/PICC51425.2020.9362364.

Y. Lin, W. -C. Chang and A. W. Y. Su, "Quantitative evaluation of violin solo performance," 2013 Asia-Pacific Signal and Information Processing Association Annual Summit and Conference, 2013, pp. 1-6, doi: 10.1109/APSIPA.2013.6694296.