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Music Feature Extraction Tools and a Comparative Analysis of Compositional Styles

The world of classical music has had thousands of composers over its rich history of composition, practice, and performance. Scholars delineated specific eras of music, from Renaissance and Baroque to Romanticism and Modernism, to distinguish periods of similar compositional styles as they morphed over time. Setting, which can be defined as both “time” and “place”, also led to the development of a field of study called Musical Nationalism. Noting the rise of national identity during the 19th century, theorists wondered whether the same could be heard in music; is there perhaps a quality that makes French music sound French, or Russian music Russian? While there has been much music theoretical-historical research performed on the question of setting, it has not been supported by nearly as much quantitative analysis. For example, does the abstracted beauty of French piano pieces in the late 19th-early 20th century come from a use of a specific register of the instrument, a certain chord progression, a lack of tonal grounding, or from an extended usage of glissandos? Why and how does Scandinavian music tend to convey looming mountainscapes and frigid rivers, as compared to Russia’s far-reaching, at once festive and earthy, sound? I also note that there is not much research done in juxtaposing two/more composers to see what similar and different musical features exist on an individual-to-individual basis. These questions and more spring immediately to mind when considering the intersection of classical music and machine learning models, and I hope to provide another, quantitative perspective on the validity behind these claims.

To begin this research however comes first the question of how exactly a machine can recognize musical features. Thankfully, as part of the Music Information Retrieval (MIR) field, many tools have been developed to combat this issue and dissect audio recordings (the likes of which can be found, usually for free, on a website such as imslp.org). An [evaluation study from 2015](#) compared the output feature sets, usability, reliability, and computational efficiency of 10 of the most popular musical feature extraction frameworks, concluding that either a combination of Essentia and MIR Toolbox with Vamp Plugins or LibXtract and Marsyas with Vamp Plugins would be ideal. This is especially important for classical music, with its many interweaving and complex components that even to the human ear can be difficult to pick up. Having access to tools with reported good coverage of features then is Essentia(I), from dynamics and harmony to spectral metrics and number of musical layers.

However, these tools tend to be behind paywalls, and manually downloading every audio recording, spanning potentially hundreds of pieces across different countries and

composers, would be near impossible. Additionally, the computing power required to perform a time-step analysis on each piece exceeds the capabilities of my personal computer. I am therefore requesting \$300 funding to access certain feature extraction tools, purchase a powerful, large-scale web scraper such as Web Scraper (\$50/month, and this would be useful in another idea I had, to scrape program data from the New York Philharmonic archives, should I choose to head in that direction), and cloud computing resources, probably from AWS.