Project Proposal
Computational Ethnomusicology-- Melodic Analysis on Traditional Beijing Opera

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Overview

Within the last two decades, two fields that blend research from music and science---music information retrieval (MIR) and computational musicology---have grown exponentially in popularity thanks to numerous technological and AI advances. During this time, the MIR technologies have earnestly striven towards automatic description of signals from musical phenomena. Various applications such as music identification, retrieval and recommendation have thus emerged and expanded. However, while plentiful, the majority of studies are limited to Western music. At the same time, computational musicology, which grows out of music theory and digital humanities, similarly has a history of bias towards Western classical music as the subject of analysis.

In order to uncover "big picture" patterns in music, it is imperative that computational musicology practices are more inclusive towards studying and understanding non-Western music. Our proposed project aims to study traditional Chinese music, and more specifically, Beijing opera---the most dominant form of East Asian opera that combines music, vocal performance, mime, dance, and acrobatics---using a combination of MIR and computational analysis techniques. This project describes a systematic, empirical study of melody in Beijing opera based on a computational analysis of machine readable (symbolic) scores. The conclusion of the project will be marked by an academic research paper, with the goal of submitting the paper to a conference for presentation.

Objectives and Goals

This project aims to apply empirical and systematic techniques from MIR and computational musicology to the analysis of traditional Chinese opera, which is grossly under-studied both in musicology generally and in computational musicology. We plan to carry out both hypothesis-driven and exploratory research related to the analysis of melody in Beijing opera. Specifically, we aim to test an important claim made in a prior paper examining Western opera. In addition, this study will allow us to formalize knowledge from an under-studied musical tradition and provide means to formulate research hypotheses that are not testable through traditional musicological analytical methods. Personal development of building and improving scientific method skills and computational programming skills is also expected. The results of this research will be submitted to an appropriate academic conference for presentation, such as the *Analytical Approaches to World Music* conference.

Related Work and Background Information

Research in speech prosody and ethology suggests that pitch height communicates positive and negative social cues. Shanahan and Huron (2014) examined the role of tessitura (i.e., pitch range) in relation to sociability in a corpus of 68 opera arias, and proposed an association between lower-pitched voices and less sociable (i.e., "villainous") characters, in contrast to higher-pitched voices being associated with more affable (i.e., "heroic") characters.

Tessitura is not conventionally considered a determining factor in the categorization of role types in East Asian vocal music. Characters presented in Beijing opera are intended to reflect the stratification of traditional Chinese society as well as the relationships among these strata (Ludden, 2013). The lead male character is classified as *laosheng*, portraying generals, statesmen, emperors, or Confucian scholars, whereas the lead female character is classified as *dan,* portraying virtuous women of high social status. We attempt to analyze not only conventional categories like *laosheng* and *dan*, but also unconventional roles of 'heroes' and 'villains' with computational methods to search for empirical evidence in support of a previously proposed cross-cultural phenomenon.

Significant scholarly work has been dedicated to the pursuit of music theory and musicology topics through empirical methods, yet have mainly done so with Western music (or Western musical structures) as the focus (see, e.g., Clark and Cook, 2004; Nettl and Bohlman, 1991). At the same time, a small yet growing number of scholars has used these computational techniques to look at non-Western music (e.g., Kroher et al., 2018), but Chinese opera in particular has not been examined, despite that a digital corpus of this repertoire was published in 2014 (Repetto and Serra., 2014).

Methods, Techniques, and Resources

The field of musicology can be seen as the comprisal of both music history and music theory which examine the historical/contextual and structural/theoretical aspects of music, respectively. Within its subfields, a common approach is "comparative musicology", where certain features or phenomena in one group are examined in terms of similarities or differences with other groups. This is a common tool within the field of ethnomusicology where non-Western musics are commonly the focus. (Merriam, 1977) We will use computational musicology methods and techniques to perform a comparative analysis. Computational musicology is the appropriate method/tool for this research since it involves analysing a large body of music and systematically counting and evaluating differences across various groupings and categories, which would be difficult or impossible with traditional humanistic methods.

For corpus development, this project expects to use common tools and resources from data science and musicology such as the Humdrum toolkit (Huron, 1995) and music21 (Cuthbert, 2010). An existing collection of 92 aria scores for corpus-based Beijing opera research (Repetto and Serra, 2014) will be used as the focus of our analysis. For data analysis, this project expects to use additional computational packages and libraries within the Python environment such as Pandas and StatsModels.

Qualifications

My current coursework in MUSI 4843/8803 Special Topics under the guidance of Dr. Claire Arthur requires the fulfillment of a research project that explores the topic of computational musicology. My project involves a cross-cultural inspection of lullabies' soothing traits via computational methods, which will prepare me with foundational knowledge in corpus study and data analysis by the end of the current semester. As a native Chinese speaker who has been learning traditional Chinese music and playing instruments specifically designed for Beijing opera for 16 years, I am well-acquainted with and truly passionate about the Beijing opera repertoire. I have proficiency in interpreting and analyzing *jianpu* musical notation as well as Chinese operatic lyrics, which are the two main components of this project's corpus.

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