Reranking CCG Parser for Jazz Chord Sequences

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In the field of Artificial Intelligence, we try to make computer to "think" like human. Music is another field that computer scientists effort to build the computer can perform useful tasks such as composing music, analyzing music, simulating human cognition. Before doing such incredible functions mentioned above, we need to formalize or modeling the musical structure so that the computer able to accomplish computations. In current studies, many authors are troublesome in constructing theory for musical formalism. A Generative Theory of Tonal Music proposed by Fred Lerdahl Ray Jackendoff in the 1983 is the current appropriate theory which was applied in some researches. This is a theory of music that describes the musical intuitions of a listener who listening to the music by using grouping analysis and metric analysis. Those analyses try to group and identify the rhythmic structures of music.

Besides, we can approach musical structure by using Natural Language Processing (NLP) techniques. This is because we have researched NLP for long time ago and have successful results. In addition, natural language and music share common structures such as listening by ear, uttering by throat and tongue, etc. In the research of Mark Granroth-Wilding (2014), he used Natural Language Processing parsers and Combinatory categorial grammar (CCG) for analyzing structure of Jazz harmony.

Unfortunately, in analyzing music, we also get difficulty in ambiguity when interpreting the structure of musical grammar. With the same chord progression, we can derive more than one musical structure. Although Probabilistic Combinatory categorial grammar (PCCG) and Supertagging Probabilistic Combinatory categorial grammar (St+PCCG) have high results with 92.29% in precision and 92.79% in recall correspondingly, the recall value in PCCG only get 88.78%, and the precision value in St+PCCG only get 90.18%. The reason is that the final parse result of each chord progression is the highest parsing probability but not the correct candidate of n-best parse results.

Discriminative ranking is one method for constructing high-performance statistical parsers (Charniak and Johnson, 2005). The main idea of reranking model divided into two stages. In stage one, the baseline parser produces a set of candidate parses (n-best) for each input sequence. And stage two, we attempt to improve the accuracy by using additional features of the parse results as evidence for picking the correct candidate.

In this thesis, we proposed Reranking model for improving the performance of CCG parsers of Jazz chord sequences. By selecting a set of simple n-gram features and configuring perceptron algorithm for finding optimizing parameters, we have improved performance of the system by 2.2% in PCCG parse results. And even 6.57% if we perfectly pick the correct candidate from 5000-best parse outcomes.

In current research, we found that the critical point in improving the accuracy of the system is defining the appropriate set of features template for Reranking model. In the future, we will explore more informative structure from parse results generated by baseline parsers. With more information, we can define more interesting features for enhancing the current performance of the system.