International Journal of Current Engineering and Technology
E-ISSN 2277 – 4106, P-ISSN 2347 – 5161
Available at http://inpressco.com/category/ijcet
©2015 INPRESSCO®, All Rights Reserved

Research Article

Cluster Based Melody Generation

Mahajan Karishma†*, Jangam Shivani ‡, Gandhi Juhi† and Kale Pradnya† and Kiran Avhad†

†Department of Computer Engineering, Sinhgad Academy of Engineering, Pune, Maharashtra, India

Accepted 28 Nov 2015, Available online 03 Dec 2015, **Vol.5, No.6 (Dec 2015)**

Abstract

This project describes the development of an application for generating tonal melodies. The goal of the project is to ascertain our current understanding of tonal music by means of algorithmic music generation. The method followed consists of four stages: 1) selection of music-theoretical insights, 2) translation of these insights into a set of principles, 3) conversion of the principles into a computational model having the form of an algorithm for music generation, 4) testing the "music" generated by the algorithm to evaluate the adequacy of the model. As an example, the method is implemented in Melody Generator, an algorithm for generating tonal melodies. The program has a structure suited for generating, displaying, playing and storing melodies, functions which are all accessible via a dedicated interface. The actual generation of melodies, is based in part on constraints imposed by the tonal context, i.e. by meter and key, the settings of which are controlled by means of parameters on the interface. Out proposed system will add parallel processing activities to get output in very short time.

Keywords: *Melody, Music Generation, Music-theoretical Insights, Melody Generator, Tonal Melodies.*

1. Introduction

Most of the approaches above exhibit very simple representations in an attempt to decrease the search space, which in some cases compromises their output quality. Musical questions are sometimes left unanswered, too. how can we expect to evaluate the system's response if we do not have a harmonic context for it? Melody is a series of musical notes arranged in succession, in a particular rhythmic pattern, to form a recognizable unit. Any melody is a composition of permutation and combination of only 7 notes, sa re ga ma pa dha ni. To create an application where we will help music composers to create a unique melody. The major problem is computation power required to do such operation. This project describes the development of an application for generating tonal melodies. The goal of the project is to ascertain our current understanding of tonal music by means of algorithmic music generation. The method followed consists of four stages: 1) selection of music-theoretical insights, 2) translation of these insights into a set of principles, 3) conversion of the principles into a computational model having the form of an algorithm for music generation, 4) testing the "music" generated by the algorithm to evaluate the adequacy of the model. As an example, the method is implemented in Melody Generator, an algorithm for generating tonal melodies. The program has a structure suited for generating, displaying, playing and storing melodies, functions which are all accessible via a dedicated interface. The actual generation of melodies, is based in part on constraints imposed by the tonal context, i.e. by meter and key, the settings of which are controlled by means of parameters on the interface. Out proposed system will add parallel processing activities to get output in very short time. The basic objective of project is of what constitutes a melody, and in particular a beautiful melody, is constantly changing in music. Music composers have to invest much amount of time and efforts to create a beautiful melody. We wanted to develop a system which will apply rhythmic fitness rules to filter good melody from the randomly generated melody sequence. This will help music composer to create a good melody in very short time as per his/her need.

*Corresponding author **Mahajan Karishma, Jangam Shivani, Gandhi Juhi and Kale Pradnya are students and Kiran Avhad** is working as Professor

2. Literature Review

A. T-Music: A Melody Composer based on Frequent Pattern Mining

There are a bulk of studies on proposing algorithms for composing the melody of a song automatically with algorithms, which is known as algorithmic composition. However, within a song, there usually exists a certain extent of correlation between its melody and its lyric. Hence, we need a new melody composition algorithm and a melody composer which employs this composition algorithm. When a lyric is present in a song, algorithmic composition should consider not only the temporal correlation among all notes (or sounds) of the melody in the song but also the lyricnote correlation between the notes and the lyrics in the song.

3. Frequent Pattern Mining

Let D be the set of s-sequences corresponding to the songs in the Song Database. Let S be a s-sequence. We define the length of S, denoted by |S|, to be the number of (note, tone ID)-pairs in S. We denote by S[i, j] the s-sequence consisting of all (note, tone ID)-pairs which occur between the ith position and the jth position in S. For example, S[1,m] corresponds to S itself, where m is the length of S. Given two s-sequences S = ((n1, t1),.. (nm, tm)) and S′ = ((n'1, t'1), ..., (n'm', t'm′)), we define the concatenation between S and S', denoted by S ◊ S′ , as the s-sequence of ((n1, t1), ..., (nm, tm), (n'1, t'1), ..., (n'm', t'm')). Besides, we say S' is a sub-string of S if there exists an integer i such that S[i, i + m'− 1] is exactly S', where m' is the length of S'. We define the support of a s-sequence S wrt D to the number of s-sequences in D that have S as its sub-string. Given a threshold t, the Frequent Pattern Mining utility finds all s-sequences S with its support wrt D at least t.

B. Melody Generation System based on a Theory of Melody Sequence

The IRM is a music theory, which was proposed by Eugene Narmour. The IRM abstracts music. It then expresses music according to symbol sequences based on information constituting the music pitch, rhythm, and rests. When analyzing melody using the IRM, we have the following two steps. The first step is to enclose the tones successively with a bracket. The bracket is an important structure when abstracting melodies. In the procedure of bracket abstraction, first, a large note column group is created in order to detect the location where the bracket is interrupted. A bracket containing three successive tones is then formed from the beginning to the end of the group. A set of three tones can not form a bracket, if there are only one or two tones. In such a case, we re-structure the tones sequence and then form a bracket. The second step of analyzing a melody using the IRM is to assign a symbol to each bracket. Tones enclosed in brackets are assigned a symbol and are called "basic structures". Previous melody generation systems are mostly based on tone transition models, which do not have function of abstracting melodies observed in training data. Previous approaches to melody generation can be summarized as below: One approach is to learn the probability model of the transition of pitch and then the next coming pitch is predicted following the melody input given by a user. Another approach is to generate based on evolutionary computation. In those previous approaches, melody generation systems do not have function of abstracting melodies observed in training data. Thus, they are not able to output certain melody, which is rarely observed in the training data. Our melody generation approach, on the other hand, is based on the IRM and properly abstracts melodies in training data. It analyses and classifies the melody in this abstraction process. We first developed an automatic melody analyzer based on the IRM in our proposed melody generation system. The IRM can analyze atonal and tonal music. The "Generative Theory of Tonal Music (GTTM)" analyzer is an automatic melody analyzer based on a music theory . It can analyze tonal music but not atonal music. The Automatic Melody Analyzer can analyze tonal and atonal music. In the IRM, it is assumed that listeners of music consciously or unconsciously predict the next melody when listening to music, which means that the IRM expresses the melody context. Our melody generation method can be regarded as a combination of a probabilistic model and a music theory. Our melody generation system consists of two models; that of symbol sequence transition and that of generating tones from symbols. With the former model, the symbol transition probability model is trained with the results of the IRM analysis. The system then generates an optimal symbol sequence according to the probability model. Then, from a set of tones, each symbol sequence generates a melody. The system analyzes input melody by using the IRM. The system builds a symbol transition probability model from the results of the IRM analysis. The system then generates several output symbol sequences based on the probability model. Finally, the system generates a melody by assigning a symbol to each tone set.

C. Melody Extraction from Polyphonic Music Signals: Approaches, Applications and Challenges

Melody extraction algorithms aim to produce a sequence of frequency values corresponding to the pitch of the dominant melody from a musical recording. Over the past decade melody extraction has emerged as an active research topic, comprising a large variety of proposed algorithms spanning a wide range of techniques. This article provides an overview of these techniques, the applications for which melody extraction is useful, and the challenges that remain. We start with a discussion of 'melody' from both musical and signal processing perspectives, and provide a case study which interprets the output of a melody extraction algorithm for specific excerpts. We then provide a comprehensive comparative analysis of melody extraction algorithms based on the results of an international evaluation campaign. The extraction of melody from polyphonic music signals is such a technology and has received substantial attention from the audio signal processing and music information retrieval (MIR) research communities. known as "Melody Extraction", "Audio Melody Extraction", "Predominant Melody Extraction", "Predominant

Melody Estimation" or "Predominant Fundamental Frequency Estimation", the task involves automatically obtaining a sequence of frequency values representing the pitch of the dominant melodic line from recorded music audio signals.

D. Functional Generation of Harmony and Melody

Composition consists in two things only. The first is the ordering and disposing of several sounds in such a manner that their succession pleases the ear. This is what the Ancients called melody. The second is the rendering audible of two or more simultaneous sounds in such a manner that their combination is pleasant. This is what we call harmony, and it alone merits the name of composition. We present FCOMP, a system that generates chord sequences (harmony) and accompanying melodies. It can be a seen as a simplified, or foundational, automatic music composition system. FCOMP (a combination of the words "functional" and "composition") deals only with harmony and melody generation, leaving all other aspects of music unaddressed (at least for now, but see Section 7). FCOMP should thus be seen as a foundational tool; its output is not meant to be music comparable to that composed by humans. Instead, we see it as an exercise in functional modelling of music. It showcases the benefits of Haskell, a pure, statically-typed functional programming language (Peyton Jones 2003): FCOMP is highly modular, easy to adapt and improve, and uses advanced functional programming techniques (such as indexed types and generic programming) to model the high-level concepts of music theory in a natural and effective way. Haskell's algebraic data types behave similarly to context free grammars, which can be used to model the language of well-formed chord sequences. Furthermore, functional composition without explicit mutable state provides a composable way for defining a pipeline of independent processes, making the global algorithm easier to understand and adapt.

Conclusions

In a system for automatic generation of harmony and accompanying melody in a functional setting, designed to be simple and easy to understand and improve.

First, in our melody composition algorithm, to utilize the lyric-note correlation information, which is captured by frequent patterns, we choose to build a Probabilistic Automaton. However, we believe that Probabilistic Automaton is not the only option. In fact, one can consider exploring other models for this purpose. We've seen how our system can generate simple but pleasing pieces, and how it can be modified to support different harmonies and melody styles.

References

Cheng Long, Raymond Chi-Wing Wong, Raymond Ka Wai Sze, The Hong Kong University of Science and Technology "T-Music: A Melody Composer based on Frequent Pattern" FSGRF12EG50

Yazawa, Sakurako, Masatoshi Hamanaka, and Takehito Utsuro (2014.). Melody generation system based on a theory of melody sequence, Advanced Informatics: Concept, Theory and Application (ICAICTA), 2014 International Conference of. IEEE

Salamon, Justin, et al. (2014) Melody extraction from polyphonic music signals: Approaches, applications, and challenges." Signal Processing Magazine, IEEE31.2: 118-134.

Jos´e Pedro Magalhaes, Department of Computer Science, University of Oxford, Hendrik Vincent Koops, Department of Information and Computing Sciences, Utrecht University , Functional Generation of Harmony and Melody , EPSRC EP/J010995/1.