Orpheus: Automatic Composition System Considering Prosody of Japanese Lyrics

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1 Song Composition Algorithm Considering Prosody

We present an algorithm for song composition using prosody of Japanese lyrics. Since Japanese is a "pitch accent" language, listener's apprehension is strongly affected by the pitch motions of the speaker. For example, the meaning of Japanese word "ha-shi" changes with the pitch. It means "bridge" with an upward pitch motion, and "chopsticks" with the motion inversed. A melody attached to the lyrics cause an effect similar to the pitch accent. Therefore we can assume that pitches of Japanese lyrics give constraints on pitch motions of the melody. Furthermore, chord progression, rhythm and accompaniment give constraints on the transitions and occurrences of the melody notes. If a certain melody for the lyrics were obtained, the melody would satisfy these constraints. Conversely, we can compose a song by finding the melody which optimally meets the condition.

2 Implementation and Experimental Results

Orpheus is an automatic composition system that we implemented using melody composition algorithm based on prosody. This system computes melody from the lyrics input with choices of chord progressions, rhythm patterns, and accompaniment instruments. We used Galatea-Talk[4] text-to-speech engine to analyze the prosody of Japanese lyrics, and HMM singing voice synthesizer[5] to generate the vocal part. We also implemented the system as a web-based application[3].

We did two experiments to evaluate the system. Firstly, we asked a classical music composer to evaluate 59 generated songs in five-grade evaluation. Secondly, we uploaded our system to get comments from a large number of users on the internet. During a year of operation, about 56,000 songs were generated by the users and 1378 people answered the questions about *Orpheus* and the generated

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[3] http://orpheus.hil.t.u-tokyo.ac.jp/automatic-composition/index.en.cgi

songs. The results are shown in Fig. 1 and Fig. 2. Judging from the results, about 70.8% commented that the generated songs are attractive, and 84.9% of the users had fun trying this system.
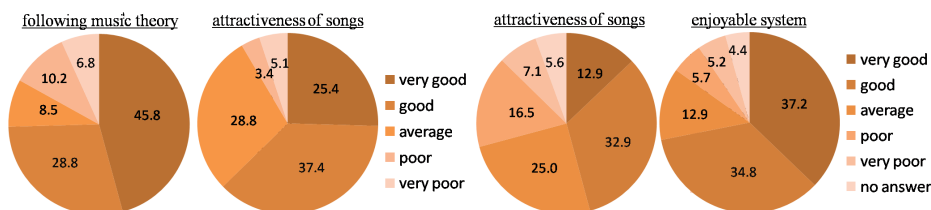
following music theory   attractiveness of songs   attractiveness of songs   enjoyable system

Fig. 1. Evaluation results on 59 songs by a classical music composer [%]

Fig. 2. Evaluation results on generated songs and the *Orpheus* by 1378 users [%]

3   Discussions and Conclusion

This research attempted to design an algorithm to compose a song automatically from the lyrics using prosody information, which enables users to make their original songs easily. The results indicate that our method and implemented system *Orpheus* is an enjoyable solution for amateur musicians.

However, it should be noted that our algorithm can be applied to lyrics written in "pitch accent" languages only. As a next step, we plan to extend the composition algorithm to handle "stress accent" languages, such as English, by putting constraints on metric structure of the melody.

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