

AUTOMATIC MELODY COMPOSITION INSPIRED BY SHORT MELODIES USING A PROBABILISTIC MODEL AND HARMONIC RULES

**Lorenzo J. Tardón, Isabel Barbancho,
Ana M. Barbancho, Carles Roig**
ATIC Research Group,
Universidad de Málaga, Andalucía Tech,
Málaga, Spain
lorenzo@ic.uma.es

George Tzanetakis
Computer Science Department,
University of Victoria,
Victoria BC, Canada

EXTENDED ABSTRACT

This demo shows how automatic melody composition of melodies that follow the style of a certain single short melodic excerpt can be achieved in such a way that the sample excerpt can be considered an inspirational piece of music for the automatic composer.

Music composition has been faced from diverse perspectives and using different approaches, among them the utilization of probabilistic schemes is common since early stages. For example, Brooks et al. [1] consider the direct utilization of m-order Markov chains for music analysis and generation, and other authors have followed a relatively similar path [2]. Often large data sets are necessary to train music generation systems, though in some rare cases algorithms are developed to perform automatic melody composition based on a single sample melody [5]; in such case, the application of explicit rules is of great importance.

Considering the probabilistic approach to music models and music rules on the basis of the melody generation model developed in [4], a melody generation scheme is designed that is capable of generating music excerpts with the style and resemblance of short individual MIDI melody samples.

Since only one sample melody of arbitrarily small duration will be considered, some modification must be done to the system described in [4]. Specifically, modifications are necessary in the extraction of musical parameters and in the generation scheme in order to provide with the necessary musical variability for the adaptation of extracted musical parameters and patterns.

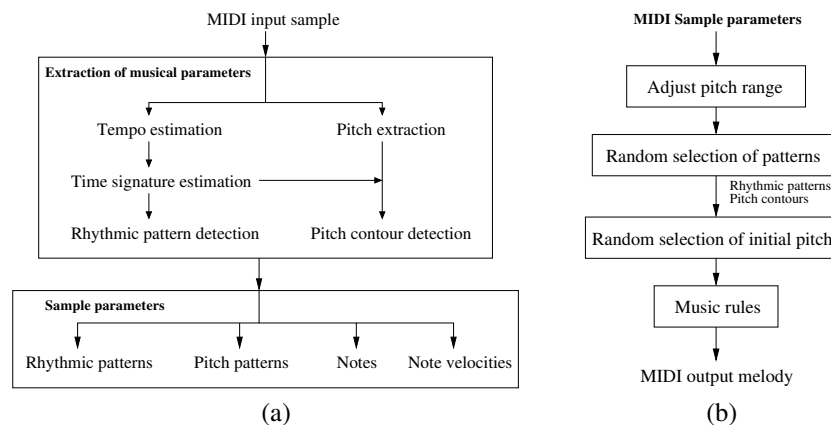


Figure 1. A schematic representation of the MIDI excerpt analysis system (a) and the melody generation system (b).



Fig. 1 (a) shows a schematic representation of the steps performed by the analysis system and the musical parameters extracted. It must be taken into account that, as in [4], the length of the basic rhythmic structure is the bar and, accordingly, so is the basic pitch contour structure.

In the generation process, rhythmic and pitch patterns are considered separately, selected randomly and employed to build new bars to construct the melody by concatenation following computational music rules based on the Schellenberg's simplification of Narmour's Realization-Expectation model as described in [4]. The starting pitch of the generated melody is randomly chosen, however, in order to attain good resemblance to the sample excerpt, the pitch range employed in the whole composition generated is based on the pitch range of the original sample, though it is assured that at least a whole octave is allowed. Fig. 1 (b) shows a schematic representation of the steps performed by the music generation scheme developed.

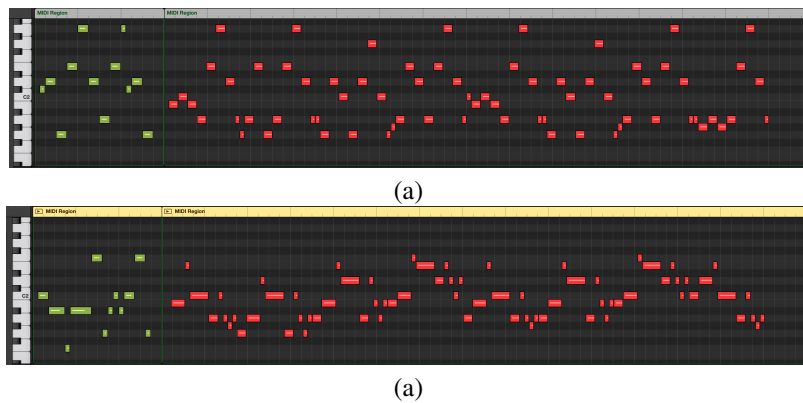


Figure 2. Piano roll representation of the origination MIDI excerpts (left) and the MIDI melody generated (right). MIDI samples: (a) 00b7561d-c09b-41f2-bf21-537603fbe758.mid from the Patterns for Prediction Development Dataset (PPDD-Sep2018) (small) and (b) ff5b0dc3-2cd4-44fd-b16a-e2bfedcfccd4.mid from the Patterns for Prediction Development Dataset (PPDD-Sep2018) (small)

Fig. 2 shows two examples of the resemblance of two generated musical pieces to the originating short musical excerpts taken from the Patterns for Prediction Development Dataset (PPDD-Sep2018) [3]. Note that variations can be introduced by the generation system in the creation of the melodies on the basis of the random selection of the different patterns extracted from the MIDI sample and the minimum pitch range defined, which can be larger than the originating melody's pitch range.

ACKNOWLEDGMENTS

This work was funded by Ministerio de Economía y Competitividad of the Spanish Government under Project No. TIN2016-75866-C3-2-R. This work has been done at Universidad de Málaga, Campus de Excelencia Internacional Andalucía Tech.

REFERENCES

- [1] Frederick P. Brooks, A.L. Hopkins, Peter G. Neumann, and William V. Wright. An experiment in musical composition. *IRE Transactions on Electronic Computers*, (3):175–182, 1957.
- [2] D. Conklin. Music generation from statistical models. In *Proceedings of the Symposium on Artificial Intelligence and Creativity in the Arts and Sciences (AISB 2003)*, pages 30–35, 2003.
- [3] MIREX. Patterns for prediction development dataset (PPDD-SEP2018). https://www.music-ir.org/mirex/wiki/2019:Patterns_for_Prediction, last viewed Sep. 21, 2019.
- [4] Carles Roig, Lorenzo J Tardón, Isabel Barbancho, and Ana M Barbancho. Automatic melody composition based on a probabilistic model of music style and harmonic rules. *Knowledge-Based Systems*, 71:419–434, 2014.
- [5] Chuan-Kang Ting, Chia-Lin Wu, and Chien-Hung Liu. A novel automatic composition system using evolutionary algorithm and phrase imitation. *IEEE Systems Journal*, 11(3):1284–1295, 2015.