

## ISE575 Paper Review

Title : AI Methods for Algorithmic Composition: A survey, a Critical View and Future Prospects

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Algorithm composition is not brand new method to make a music piece. It is originated from the Pythagoras around 500 B.C. Even though there are regular rules which make repetition and pattern in a music piece, there is still something missing in algorithmic composition by computer programming rather than human composing. Now, I get to be more curious about what is computer music and how can it substitute human being's composition? Why contemporary music tends to use computer algorithms? Does algorithm composition music impress you as much as classic music? If not, why do current trend pursue composition in mathematical algorithm?

Through survey, author epitomizes algorithmic composition methods into 6 categories roughly, such as "Mathematical models", "Knowledge based systems", "Grammars", "Evolutionary methods", "Systems which learn", and lastly "Hybrid systems". However, a special algorithm, such as EMI, could be categorized into three categories simultaneously. Additionally evolutionary methods and system which learn are the most popular methods.

In Mathematical models, many composers commonly used 'Markov chains' and 'Stochastic processes', which is easy and fast enough to make real-time composing system. Conklin and Witten examine the prediction and generation of music using a multiple viewpoint system and then find out that machine learning techniques to extract the information from a number of examples in order to create their models. However these models also have two disadvantages. Firstly it requires many data. Secondly, getting the norm from higher or abstract levels of music is really difficult.

Backtracking Specification Language(BSL), Constraint Logic Programming(CLP) and Constraint Satisfaction Techniques(CST) are kinds of methods for implementing Knowledge Based Systems(KBS). This system tend to make a cohesive music because it is reasoning based algorithm, which means there are always cause and effect in every music component. Zimmermann used the desired tension curve of the music as an input to the system. However, it still requires much data for better knowledge elicitation. That is very good for engineers because pure engineers are apt to novice

to music composing, but still hope to make and/or listen melodious music. Even for them, this algorithmic music, especially Knowledge Based Systems, can be a good solution.

Experiments in Musical Intelligence(EMI) extract signatures from at least two pieces. This is also exactly engineering based algorithm, pattern matching. Even though it looks perfect algorithm to generate specific genre music, grammar based music can not express chaotic and non-hierarchical human motifs. The author says this in following sentence, “Usually a grammar can generate a large number musical string of questionable quality.”, which I totally agree.

Evolutionary algorithms are very good candidates for a search engine in a musical application. In the implementation respects, it can be divided into two categories, “Use of an objective fitness function” and “Use of a human as a fitness function”. Both of them uses evolutionary algorithms for music composition but the difference is on the evaluation methods. The former evaluates composed music with math function while the latter uses human mind. Both of them have advantages individually. Even though, I prefer the human fitness function to the objective fitness function. Who want to listen a music piece, which is mathematically made but do not have impression on human mind. Music should exist for human, of human, not only by the human but also by the human aid including computer. If music is only composed of objectively quantifiable data, it can not make deep impression to human, because music is subjective itself.

Machine Learning or Artificial Neural Networks uses music samples. In other words, it does not need training data before composing. That is good point. However, I do not separate them with prior models except using examples, because prior models also depending on human’s pre-defined parameters to make a model and also these models uses samples to extract some signatures(or features) of the music information. Therefore, these systems, even though small space required, can not express music which conflicts the examples but people want to listen to.

To minimize these shortcomings from each system, hybrid systems came out. There are some examples, such as HARMONENT(using ANN and CST)and Gibson and Byrne’s piece(using ANN and GA). However, there are still defects, time consuming problem solved and verification, implementation and validation required.

Author insisted ‘Music generations with algorithm are not the problem solving

processes but the creative and meaningful processes. That makes him to suggest to algorithm composer to do more on two things. 'Firstly, do more evaluation of the output by real music experts and secondly, evaluate the system itself more deeply by composer your self', on which I didn't make consideration for 1minutes music piece composing homework by Gibbs sampling. Also he mentions about creativity implementation in algorithm. Even though the human creativity can be implemented, there are still questions like this, "Do we want to simulate human creativity itself or the results of it?" It is really hard to answer, because that is not perfect question as it is. Because it is hard to make a distinction between the cognitive modeling and the knowledge engineering. On Engineering basis, creativity can be imperfectly implemented in a way such that trial-and-error processes and limiting-computable processes.

Therefore, he suggests that there should be an algorithm system which can control human feeling, moods or intentions when composing in the future not on engineering basis but on human centered basis. The reference can be something abstract like an emotion, or something more objective such as a picture or a landscape. Also it could control the musical tension, intension, expectation and melodic closure.