



Project on Application of Machine Learning Approaches

Music Generation using LSTM

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Problem Definition

Music composition is a vital task that artists have used to express themselves since the birth of civilization. In the field of artificial intelligence, designing algorithms that produce human-level art and music is a complex but fascinating and satisfying challenge. Recent breakthroughs in neural networks have aided us in moving away from defining music composition rules and toward developing probabilistic models that learn empirically-driven rules from a large collection of previous music. Furthermore, deep learning systems do not provide direct methods for controlling generation (e.g., imposing some tonality or other arbitrary constraints). Again, deep learning architectures are autistic automata that make music autonomously without human user input, which is far from the goal of enabling musicians to develop and refine music interactively.

TODO: (Highlighting issues and Your work)

Related Work

In the paper, Briot and Pachet focused on issues such as control, structure, creativity, and interactivity. In this work, the authors selected several drawbacks of a direct application of deep learning to music generation and examined why the difficulties are not met and how various techniques can overcome them.

Challenges :

1. Control

Musicians regularly seek to adapt notions and patterns borrowed from other contexts to their own goals, such as transposition to another key or reducing the number of notes. Control is the ability to direct the generation of a deep learning architecture. Some strategies to control the network generation are shown below:

- i. Dimensions of control strategies are: Input, Output, and Encapsulation/reformation
- ii. Sampling a model to generate content may be an entry point for control if we introduce constraints on the output generation.
- iii. The strategy of conditioning (sometimes also named conditional architecture) is to condition the architecture on some extra conditioning information,
- iv. Input manipulation is the idea that states that the initial input content, or a brand new (randomly generated) input content, is incrementally manipulated in order to match a target property.
- v. The strategy of reinforcement is to reformulate the generation of musical content as a reinforcement learning problem, while using the output of a trained recurrent network as an objective and adding user-defined constraints, e.g., some tonality rules according to music theory, as an additional objective.

2. Structure

Another challenge is that most of the existing systems have a tendency to generate music with “no sense of direction.” In other words, although the style of the generated music corresponds to the corpus learned, the music lacks some structure and appears to wander without some higher organization, as opposed to human-composed music which usually exhibits some global organization (usually named a form) and identified components

3. Creativity

The issue of the creativity of the music generated is not only an artistic issue but also an economic one, because it raises a copyright issue. There are two known approaches to resolve this *a priori* and *a posteriori*.

4. Interactivity

In networks, the generation is automated, with little or no interactivity. As a result, local modification and regeneration of musical content are usually not supported, the only available option being a whole regeneration (and the loss of the previous attempt). This is in contrast to the way a musician works

TODO: Methodology
Experimental Results and Discussion
Conclusion
Future Work
References