MUSIC GENERATION USING RNN

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Abstract— **Music plays an important role in this world with emphasis on its use-cases and how various kinds of sounds and vocals are generated. Automation of art has extended its reach to envelope music during the recent years. Employing Machine Learning to automate the generation of music using algorithms is what has caught the attention of experts as well as enthusiasts. In this project we are using TensorFlow to utilize Recurrent Neural Networks to assist us in the generation of sequences of pop music. The potential of the same as been discussed as well**

*Keywords* – TensorFlow, RNN, music, machine learning

I. INTRODUCTION

Since the inception of music, there always has been augmentations in its use-cases as well as the myriad processes of generation with a multitude of shifts towards electronic creations using software on machines. The most recent trend has been the automation of music generation employing machine learning algorithms.

We are generating short sequences of pop music using RBM (Restricted Boltzmann Machine).

RBM - A dual layered neural network with a visible and a hidden layer. Every hidden node is connected to the visible node and the other way around is true as well. Nodes are basically where the calculations are a taking place, thus where are no visible to visible or hidden to hidden connections which presents a restriction. Each visible node, taken by a chord, is multiplied by a weight and the output of the node at hidden-layer level.

To sample out of RBM, we utilize Gibbs sampling.
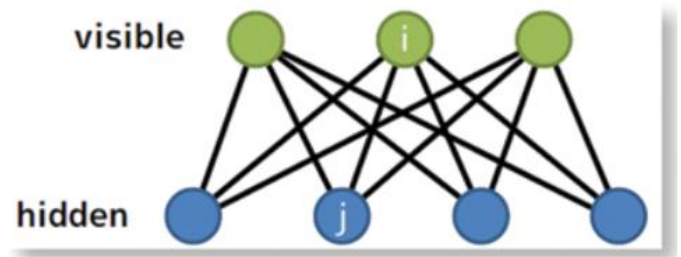
II. DEPENDENCIES

In order for our model to work we required an array of libraries. The following is a list of same:

- ➢ **TensorFlow,** our primary deep learning library providing us the complete structure for running RNN
- ➢ **Pandas**, required for the data analysis
- ➢ **numpy**, required for scientific calculations
- ➢ **msgpack-python**, allows exchange of data among multiple languages
- ➢ **glob2**, to capture patterns
- ➢ **tqdm**, for printing a progress bar during training
- ➢ **python-midi,** to interact with midi music files
- ➢ **midi_manipulation.py,** helper library

III. WORKING & USES

The program is sourcing music files as extensions of Midi files, where Midi is a technical standard which connects a wide variety of electronic musical instrument, computers and relevant audio devices. Most of the learning machines are fed MIDI as their input because

MIDI is the musical instrument digital interface. But why Midi? Cause the information that is transferred contains information about the note, pitch, velocity, and tempo making it a technical standard.

Using *midi_manipulation.py*, the midi files are converted to msgpack for ease of manipulation. To begin with, certain parameters are drawn by working up the midi files; epochs, batch size, learning rate as well as the variables are laid out. Different parameters values would render varying outputs. Post which, a K-gibbs chain is run to sample from the probability distribution of the RBM defined by the variables. Following the sampling is a contrastive divergence algorithm which is integral in activating the hidden nodes appropriately and speeding up the sampling process. A graph is finally run where a model is trained by initializing the variables of the model. The iterations are run as many times as defined earlier. Each song is reshaped in order to have each training examples as a vector with 'no. of time-stamps * 2 (note range elements)'. The model is trained using the batch examples, one at a time. Once model is trained, the gibbs chain is run to initialize the visible nodes to 0. Now, the vector is reshaped to be 'time * node' and the vector is saved as a midi file.

The uses cases for the music are unlimited while the same for AI generated sequences doesn't have a permissible boundary either. AI artist as well as filmmaker, Taryn S. took leveraged AI for her album 'I AM AI' using AIVA, an AI based electronic composer.

The AI generated music can be categorized based on the moods of the songs or perhaps the tempo, resulting in a completely user preferred choice of songs similar in tones and aura. This could potentially assist users in gaining access to similar kind of music. For instance, an AI developer took compositions of Bach to generate similar sounding compositions using a model trained using original compositions of Bach, and convinced a group of experts that the AI generated sequences were actually undiscovered compositions of Bach himself.

Lastly, one of the prominent uses of the same has found way in the thousands of mini-gaming-apps on the mobile as well as the web applications. The music sequences are usually repetitive in sound but not exactly looped over. The process of generating the same leverages AI algorithms for composition.

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