

Music generation

T. Ardoin – M. Dufraisse – N. Lichtlé
A. Riou – R. San Roman

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Goal

Generate pieces of music using neural networks.

Dataset : MIDI files encoding classical music
(<http://kern.ccarh.org/>)

Sortie : A MIDI file.

Dataset

- Dataset of classical music.
- Size : around 600 files.
- Everything was transposed in C in order to "normalize" the music.
- Dataset downloaded by a depth-first search in CCARH website's source code

Music encoding

Idea: associate to each measure a matrix M such that $M[i, j] = 1$ iff pitch i is played at time j . A bar is divided in 48 in order to be able to do both 16th notes and triplets.

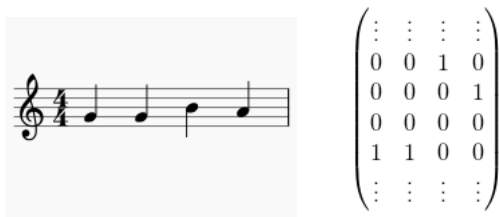


Figure 1: Encoding from score to matrix

Many ways to encode measures in matrix because of silences...

- *MidiNet: A Convolutional Generative Adversarial Network for Symbolic-domain Music Generation*
by Li-Chia Yang, Szu-Yu Chou, Yi-Hsuan Yang in 2017.
- GAN that uses CNN for the generator instead of RNN;
- Can be used to follow a melody, produce multitrack melody or create a melody within a chord progression.

Architecture

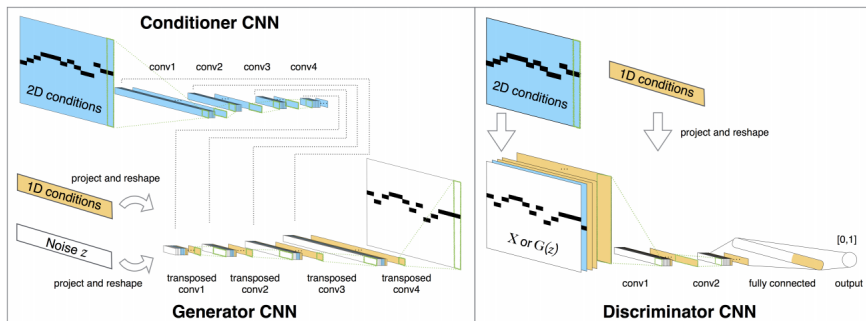


Figure 2: The architecture of the MidiNet Network

- Loss: BCE with sigmoid

$$\ell(x, y) = \text{mean}\{l_1, \dots, l_N\}$$

$$l_n = -[y_n \cdot \log \sigma(x_n) + (1 - y_n) \cdot \log(1 - \sigma(x_n))]$$

- Train the generator twice more than the discriminator

Results

- The conditioner helps prevent mode collapse.

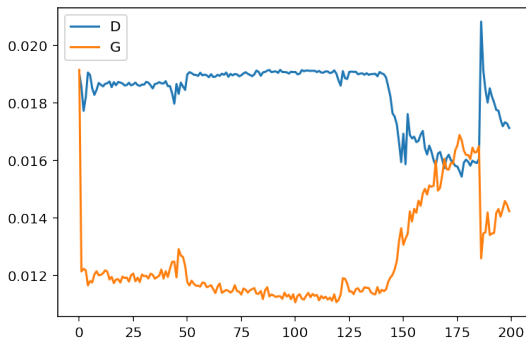
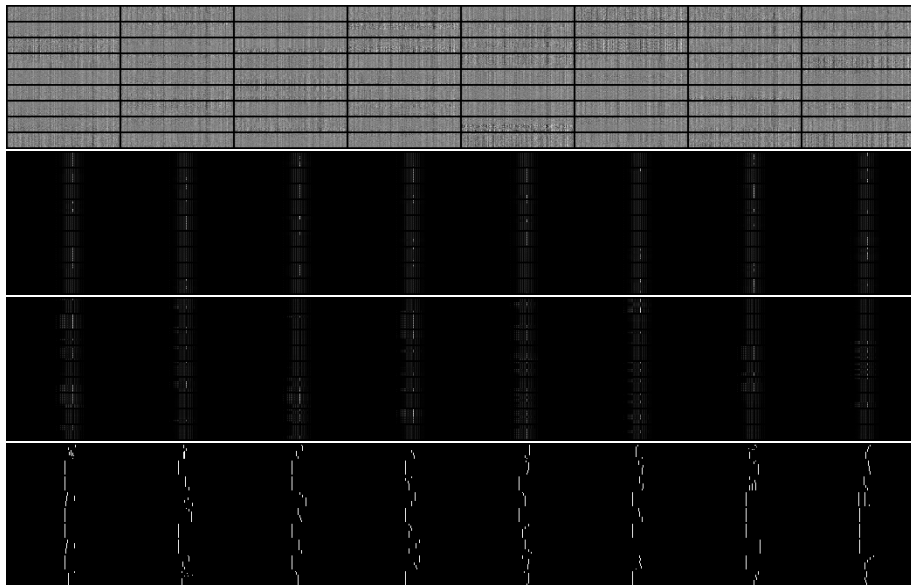


Figure 3: Loss over time for the generator and the discriminator

Generation



A Hierarchical Latent Vector Model for Learning Long-Term Structure in Music by Adam Roberts, Jesse Engel, Colin Raffel, Curtis Hawthorne, Douglas Eck

- Based on a variational autoencoder.
- Uses a hierarchical structure to have some long-term consistency.

Architecture

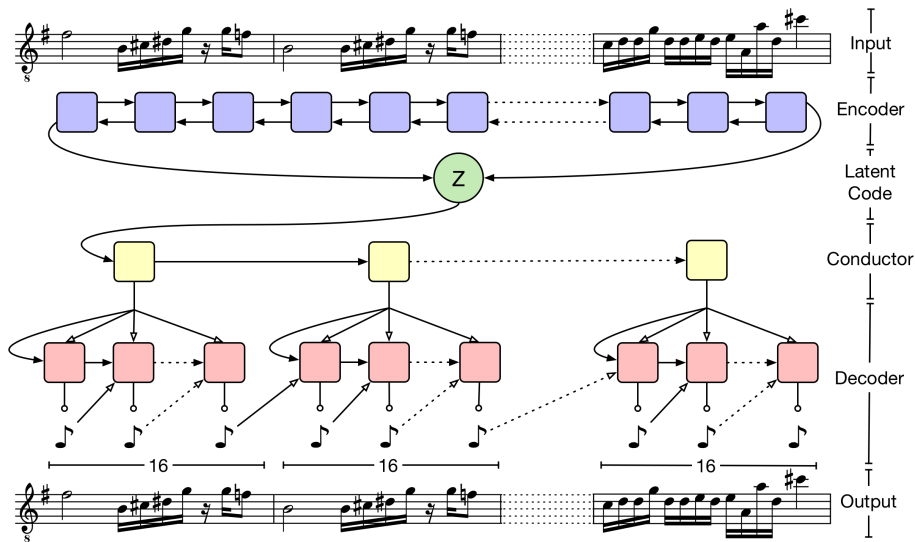


Figure 4: The architecture of the MusicVAE model

- The hierarchical structure promotes the use of the latent code.
- Can't generate music out of nothing. . .
- . . .but can be used to interpolate between two melody.

Questions?