NN+NLP Project

Team members

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Project title

Musical notes generation

Description

We build NN models that generate subsequent musical notes when given some (short) initial sequence of notes.

What we wanted to achieve and why:

- always wanted to be a musician but didn't have the talent
- see if we can produce good quality music
- it was a new and challenging topic
- AI should be able to generate music

Was there any challenge?

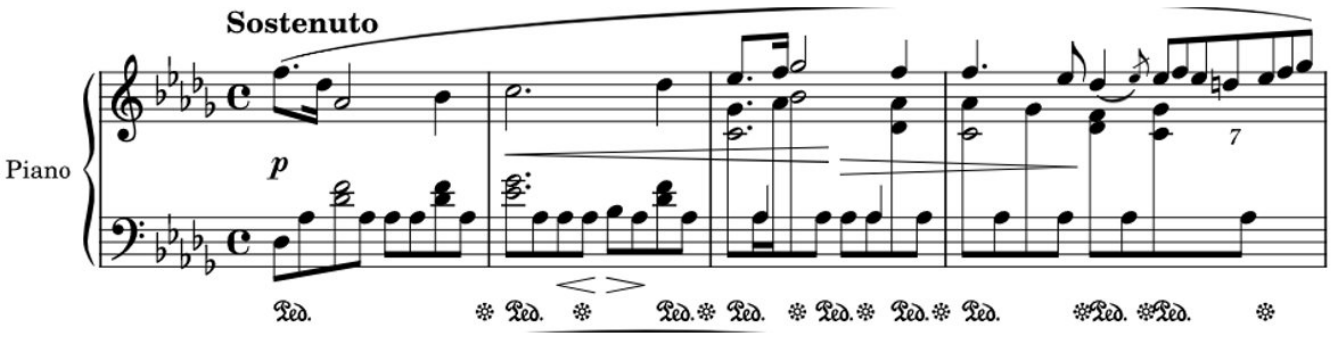
- Seemed similar to Language Modelling
- Yet different: music structure != language structure
  - language sentence == a tree of words
  - music == a flow of notes + …

Data

Lakh Pianoroll Dataset is a collection of 174,154 multitrack pianorolls derived from the Lakh MIDI Dataset (LMD).

Data preparation:

How to turn



into tokens?

- Brainstormed a few approaches used in the field.
- Chose the simplest one.

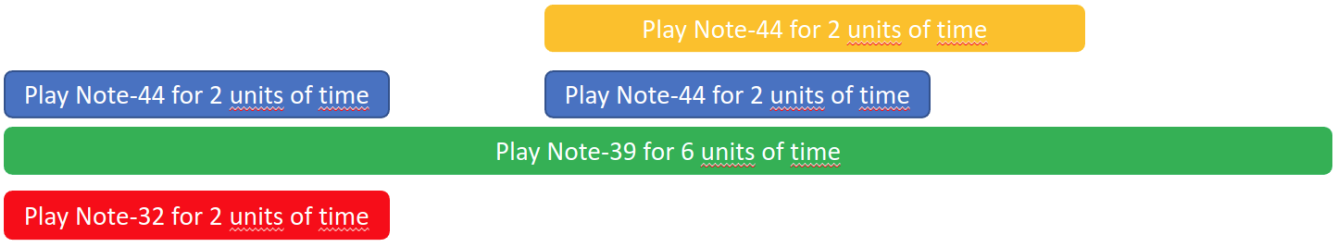
Sample encoding:

xxsep d34 n44 d2 n39 d6 n32 d2

xxsep d1 n44 d2 n33 d3

xxsep d2 n46 ...

that corresponds to



Models

RNN-based

- LSTM:
    - written and trained from scratch
    - embedding_dim = 128, lstm_size = 256, num_layers=2, ...

Transformer-based:

- GPT2 (LMHeadModel)
    - wanted to finetune a model from a library
    - the tricky part: model was not trained on musical notes …
    - so decided to train a mini GPT2 form scratch instead
    - n_ctx = 128, n_embd = 64, n_layer = 3, ...

Success evaluation

Empirical - if model generates reasonably fine-sounding and fairly diverse songs based on different initial notes we would call it a success.

How to evaluate a notes-generating model?

1. Does the generated music sound good? - YES
2. Is the model able to generate music or just remembered a few pieces? - YES
3. Perplexity:

- LSTM perplexity:
- GPT2 perplexity:

Conclusions

What have you learned?

- data preparation may get tricky and might require domain specific knowledge;
- models take a long time and a lot of resources to train.

What was good or bad?

- good: the results were cool;
- bad: didn't have enough time/resources to finish training the models.

What could have been different?

- encode more information when encoding notes to tokens.

What could you do next?

- expand it to handle multiple instruments.

Examples

Examples with generated music in data/ directory.

Literature

Deep Learning Music Generation

MuseNet

Compound Word Transformer: Learning to Compose Full-Song Music cover Dynamic Directed Hypergraphs