**Team Name:** fermata

**Facebook Project:** No

**Project Title:** Stylistic Melody Generation with Deep Learning

**Project Summary:**

Many great composers throughout history have composed pieces that were both creative and deliberate. Is it possible for artificial intelligence to aid the creative process by learning to create novel melodies in alignment with the style of a particular original melodic sequence? One possible approach is to learn the style of a musical sequence by feeding its corresponding embedded MIDI data into an RNN model. Style may take the form of an abstract melodic sequence or be characterized by ground truth metadata such as genre, composer, etc. Accordingly, after learning the style of the original input melodic sequence, we will predict and evaluate the success of a corresponding output music sequence.

**Approach:**

* **many-many RNN** Since the input will be a sequence of nodes, it’s a multi-class classification. We will use Categorical Cross-Entropy as a loss function. And use softmax as the final layer.
* **LSTM** We can also use LSTM to learn long-term dependencies.
* To optimize our model, we can use Adaptive Moment Estimation which is a good choice for RNN.
* We will evaluate the success, i.e. similarity, of the network’s output melodic sequence with the original input melodic sequence in accordance with metrics presented in [4].
* The bibliography and datasets in this proposal also provide our team with additional ways of extending our project goal as well as methodology with regards to e.g. model architecture, tackling the problem of learning over multiple musical bars/measures (a problem LSTMs still do not suffice for).

**Resources / Related Work:**

There has been considerable work regarding melody generation with RNNs, LSTMs, and GANs. The bibliography below showcases a selection of existing work that has already been done featuring for example Google’s Magenta team’s melodic\_rnn, melodic and rhythmic style transfer, and explicitly conditioned melody generation. Moreover, evaluation of the subjective results generated have been considered and discussed in favor of more objective measures. The use of monophonic MIDI melodies are generally preferred for ease of melodic analysis which involves both pitch and rhythmic components.

[1] Magenta, magenta/magenta. Magenta.

[2] A. Pati, ashispati/InpaintNet. 2021.

[3] B. Genchel, *bgenchel/Reinforcement-Learning-for-Music-Generation*. 2021.

[4] L.-C. Yang and A. Lerch, “On the evaluation of generative models in music,” Neural Comput & Applic, vol. 32, no. 9, pp. 4773–4784, May 2020, doi: 10.1007/s00521-018-3849-7.

[5] R. Vidiyala, “Music Generation Through Deep Neural Networks,” Medium, Oct. 21, 2020. https://towardsdatascience.com/music-generation-through-deep-neural-networks-21d7bd81496e (accessed Mar. 21, 2021).

[6] S. Verch, “I Made an AI that Learned to Make Music,” Able, May 28, 2020. https://able.bio/GalacticGlum/i-made-an-ai-that-learned-to-make-music--620lxbn (accessed Mar. 21, 2021).

[7] H. Patel, “Music Generation using Deep Learning,” Medium, Aug. 26, 2020. https://medium.com/@harsh2000.hp/music-generation-using-deep-learning-59159b95fe68 (accessed Mar. 21, 2021).

[8] J.-P. Briot, G. Hadjeres, and F.-D. Pachet, Deep Learning Techniques for Music Generation. Cham: Springer International Publishing, 2020.

[9] B. Genchel, A. Pati, and A. Lerch, “Explicitly Conditioned Melody Generation: A Case Study with Interdependent RNNs,” arXiv:1907.05208 [cs, eess], Jul. 2019, Accessed: Mar. 21, 2021. [Online]. Available: http://arxiv.org/abs/1907.05208.

[10] A. Pati, Neural Style Transfer for Musical Melodies. 2018.

[11] S. Oore, I. Simon, S. Dieleman, D. Eck, and K. Simonyan, “This Time with Feeling: Learning Expressive Musical Performance,” arXiv:1808.03715 [cs, eess], Aug. 2018, Accessed: Mar. 21, 2021. [Online]. Available: http://arxiv.org/abs/1808.03715.

[12] C.-Z. A. Huang et al., “Music Transformer,” arXiv:1809.04281 [cs, eess, stat], Dec. 2018, Accessed: Mar. 21, 2021. [Online]. Available: http://arxiv.org/abs/1809.04281.

[13] D. Ghosal and M. H. Kolekar, “Music Genre Recognition Using Deep Neural Networks and Transfer Learning,” in Interspeech 2018, Sep. 2018, pp. 2087–2091, doi: 10.21437/Interspeech.2018-2045.

[14] A. Huang and R. Wu, “Deep Learning for Music,” arXiv:1606.04930 [cs], Jun. 2016, Accessed: Mar. 21, 2021. [Online]. Available: <http://arxiv.org/abs/1606.04930>.

[15] “WaveNet: A Generative Model for Raw Audio,” *Deepmind*. [/blog/article/wavenet-generative-model-raw-audio](https://doi.org//blog/article/wavenet-generative-model-raw-audio) (accessed Apr. 08, 2021).

**Datasets:** Monophonic melodies are used for ease of analysis.

* General MIDI melodies (The Meertens Tune Collection): <http://www.liederenbank.nl/mtc/>
* MIDI melodies for various genres (Henrik Norbeck’s ABC Tunes): <http://www.norbeck.nu/abc/>
* MIDI melodies in the style of various classical composers (MusicNet): <https://homes.cs.washington.edu/~thickstn/musicnet.html>

**Group Members:**

* Alison Ma
* Bowen Ran
* Yilun Zha
* Yufei Xu
* Iman Haque

**Looking for more members:** No

**Instructions**

**What goes in a project proposal?**

1. Team Name
2. Is this a Facebook project?
3. Project Title
4. Project summary (4-5+ sentences). Fill in your problem and background/motivation (why do you want to solve it? Why is it interesting?). This should provide some detail (don't just say "I'll be working on object detection")
5. What you will do (Approach, 4-5+ sentences) - Be specific about what you will implement and what existing code you will use. Describe what you actually plan to implement or the experiments you might try, etc. Again, provide sufficient information describing exactly what you'll do. One of the key things to note is that just downloading code and running it on a dataset is not sufficient for a description or a project! Some thorough implementation, analysis, theory, etc. has to be done for the project.
6. Resources / Related Work & Papers (4-5+ sentences). What is the state of art for this problem? Note that it is perfectly fine for this project to implement approaches that already exist. This part should show you've done some research about what approaches exist.
7. Datasets (Provide a Link to the dataset). This is crucial! Deep learning is data-driven, so what datasets you use is crucial. One of the key things is to make sure you don't try to create and especially annotate your own data! Otherwise the project will be taken over by this.
8. List your Group members.
9. Are you looking for more members?

Each member of your group will then reply to this post to confirm they are part of the project.