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Worshop 1 - Participative Exercise

1. Topic/project chosen

Using deep neural networks to produce novel music

2. In lay terms, describe what this topic/project is about

This project will investigate how deep neural networks can be used to produce novel music. The project will involve literature search so that the student can familiarise herself with the relevant techniques. Subsequently, a network will be trained with examples of a particular style of music. After the training, the network should then be able to produce novel music in the style of the trained examples.

Moreover, we want to add more criteria to produce novel music (increasing the bass, mix style, etc.).

3. Give an indication of the type of project (exploratory, testing out, problem solving)

This project is about analyzing and learn from different kind of music in order to reproduce this kind of song by differentiating the different patterns of the song. To do so we will have to test and analyze the different patterns of a song and then learn to reproduce it in order to create basic samples of music. The objective is to provide musicians basic instrumentals in order to create song or find new ideas of song.

4. Give at least one reason why this research is of value

This research is of value because a lot of classification already exists in the music field, so we will have a lot of background paper to help us to create the deep neural network that will analyze and categorize. Moreover, it will be useful for artists.
Research speaking, it is a concise and possible project that will give exploitable results.
As a musician, it is something i am interested in and as a software engineer, it will allows me to learn and make my own neural network and also to apply and practice all the informations received during the first term on neural network.

5. Give at least one milestone for this research (what by when)

a. First we need to know how to encode the music. In which way, to evaluate which component of a music is relevant for training our model, which one are less, etc. (dynamics, timbre, etc.)

   Using this encoded music informations we will try to create a GAN. A GAN is a generative adversarial network. Two neural networks contest with each other in a game (in the sense of game theory). Given a training set, this technique learns to generate new data with the same statistics as the training set. The *generative* network generates candidates while the *discriminative* network evaluates them.

b. Then, we need to create the generative network, trained with the created music data.
c. Finally, we should make sure that our compositions respect the major musical rules about structure and dynamics. (= discriminative network)

6. Describe how do you intend to achieve this milestone

a. In order to encode music we will need to read articles on how to encode it, how to extract the relevant part of the song and then we need to create a small software / script to create our database, with a music database as input.
b. We need to create a deep neural network for the music generation (we need to learn how to do it, and then applied it to our case)
c. For the discriminative network creation we need to learn the major musical structure and dynamics rules.

7. Three useful publications in this area (justify briefly your choices)

GAN algorithm adapted to music (we choose this article because it is really close to our subject, and it doesn't use recurrent neural networks as the other one, but DeeMinds):
https://arxiv.org/pdf/1703.10847.pdf

To generate music, we could need more than only a simple deep neural network and we could combine different types of machine learning. This paper is an approach to this different combinations in order to create new songs:
https://link.springer.com/content/pdf/10.1007%2F978-3-540-78761-7_55.pdf

In order to generate new songs from other songs, we should be able to analyze these songs and detect reproducible patterns. This paper speak about how to automatically detect the notes played during a song:
http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.159.510&rep=rep1&type=pdf