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AI Music Generation

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Degree Scheme: Computer Science G400

CS39440

Date: 07.02.2020

Version: 1.0

Status: Release

Project Description

The goal of the project is to create a program that generates music (in the form of a MIDI file) that is stylistically similar to the music created by Johann Sebastian Bach. This will be achieved by training an LSTM Neural Network on Bach's music. Initially, the goal will be to generate just the melody rather than a full piece.

The plan is to develop this project in Java, implementing the design of the Neural Network in code by using DL4J library- an open source library for deep-learning. The Neural Network will be trained on all known works of Jan Sebastian Bach that are available in the MIDI format.

The process that will be used during this project will be based on Scrum (with some modifications- most notable is the fact that the roles Scrum Master, Product Owner and the Develpoment team will all be fulfilled by one person). The sprints will last one week (starting on Wednedsays, and ending on Tuesdays before the meeting with the project supervisor). The Product Backlog will be the document that lists all of the tasks that are needed to be done to consider the project complete, and the Sprint Backlog will document the progress made each sprint.

Proposed Tasks

- Collection of training data- all of the known songs composed by Bach in MIDI format. If there is time left after all work is done, other datasets (other composers? works of different composers, but only within one sub-genre of classical music?) might be considered.
- A more detailed research on Neural Networks, focusing on Recurrent Neural Networks and Long Short-Memory Networks
- A more detailed resarch on previous attempts on AI music generation made by other people.
- Design a Neural Network (what information needs to be taken as an input, what information needs to be output, the topology of the hidden layers, etc.) that should be able to imitate the style of Johann Sebastian Bach.
- Implement the aforementioned design in Java using the DL4J library.
- Learn how to extract needed information from MIDI files, and how to encode the output into a new MIDI file.

Project Deliverables

- Program that uses a Neural Network to generate music.
- Example MIDI files showcasing the progress made at different stages of training the network.
- Program that converts the output made by the Neural Network into a MIDI file.
- Program that exctracts information from a MIDI file to be used as input for training the

Neural Network.

- Documentation explaining the design of all aforementioned programs (and how this design was implemented).
- Final report that will discuss all of the work done, draw conclusions from the results and acknowledge all of the 3rd party resources that were used for this project.
- Product Backlog and Sprint Backlogs for all of the Sprints.

Initial Annotated Bibliography

[1] Composing music with RNNs

An article on generating music using RNNs. It is a good starting point for conducting research on this subject. [Accessed 03.02.2020]

[2] Deep Learning 4J

An open source Java library for deep-learning. [Accessed 03.02.2020]

[3] Deep Learning Techniques for Music Generation -- A Survey

An analysis on different ways of using deep learning to generate musical content. [Accessed 03.02.2020]

[4] “Lisl’s Stis”: Recurrent Neural Networks for Folk Music Generation

A project with an objective very similar to this project's objective. Seeing what has been tried and what were the results in that project will be very heplful when making design decisions in this project. [Accessed 03.02.2020]

[5] The Scrum Guide

The document defining the Scrum methodology. [Accessed 07.02.2020]