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EEE-485 Fall 2019 Project Proposal

Music Genre Classification using Spotify API Metrics

As the music industry grows from day to day, various music with many different energies are being introduced to the industry. It may become challenging to specify these songs according to their genres since music is somewhat a subjective topic. However, specification according to genre is actually very important because it is a tool for people to easily access new music in a genre that they are interested in. Even though it seems very subjective, music has its own science to it and hence, genre specification is dependent on the music, and some metrics related to that music and not the subjective opinions of many different critics.

Over this problem, the project that we have chosen to implement is a music genre classification task using various metrics that are offered by the Spotify API, which contain many different metrics that are used by the recommendation services on Spotify. In the project, we will be using the Spotify Tracks DB database (<https://www.kaggle.com/zaheenhamidani/ultimate-spotify-tracks-db/version/3>) that offers 232 thousand tracks with a generalized 26 genre categories. The data contains features that are given below.

- Genre
- Artist Name
- Track Name
- Track ID
- Popularity
- Acousticness
- Danceability
- Duration (ms)
- Energy
- Instrumentalness
- Key
- Liveness
- Loudness
- Mode
- Speechiness
- Tempo
- Time Signature
- Valence

Feature Selection, Extraction and Visualization

Since there are various metrics, we will be doing some data visualization in order to choose the better metrics that will be the most useful while applying this task. We will also be using some feature extraction from the raw features via PCA, ICA or using a pretrained neural network, which will be decided during the progress. We won't be using the Artist Name features for our algorithms since it is directly related with the genre because most artists only compose songs in one or two types of genres. Also, specifying the artists would be illogical since the algorithm should also be able to detect the genre of a newly composed song from a new artist.

Algorithm Choices

The algorithms that we have chosen to implement are feed-forward neural network (Multilayered Perceptron - MLP), linear regression and decision tree. We have chosen a neural network structure since it will be a challenge to implement a generalizable, dynamic and easily adjustable structure. The reason behind implementing a linear regression in combination with data visualization is to be able to feature engineer some of the features by looking at their relations with the label by looking at these visualizations, which is a good practice in classical machine learning. Furthermore, the reason behind using the decision tree structure is to implement a structure that is easily trainable.

Challenges

The most important challenge for us in this project is the diversity of the features. This diversity will complicate the model and we will be taking time on selecting, extracting and engineering features so that we would achieve more optimal and lightweight machine learning models. Since we will be building a neural network with a standard and simple optimizer like SGD optimizer and standard back-propagation techniques, the training durations and computational power will be a challenge that we will be facing. Also handling the neural network with a from-scratch approach without using an advanced framework like Keras, Tensorflow or PyTorch will become a difficult challenge. Furthermore, we currently don't know and won't be able to understand how complicated the network should be by looking at the task itself, so trying different approaches with different combinations of activation functions, optimizers, loss functions, number of layers and how many neurons each network will contain will be quite a challenge.

For this project, we will be using Python3 as the choice of programming language. We plan to use Jupyter Notebook since this project can be easier if a script base approach is used rather than a class-based strategy like PyCharm, however these can change according to the needs of our project. We possess a computer with a GPU Nvidia GTX 1060 Max-Q and plan to use that if this GPU is enough for our needs. However, if this is not an efficient solution, we will be using online systems with GPUs such as Google Colab.