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Music Genre Classification

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Abstract: A music genre is a term used to classify certain types of music as belonging to a common tradition or set of rules. It must be distinguished from musical style and form. Music can be classified into several genres in a variety of ways. Pop, hip-hop, rock, jazz, blues, country, and metal are some of the most popular music genres. Machine learning techniques have been used for music genre classification for decades now.

As the amount of music released on a daily basis continues to rise, especially on online platforms like Soundcloud and Spotify — according to a 2016 estimate, tens of thousands of songs were posted on Streaming services every month.

Music classification is increasingly widely used by businesses, whether to provide suggestions to clients or simply as a commodity. The initial stage in the music selection process is determining music genres. Machine learning techniques are used in the majority of today's music genre classification methods.

I. INTRODUCTION

In today's world, an average person's music collection consists of hundreds of songs, whilst a professional collection often consists of tens of thousands of audio files. In connection to specialist archives and private sound collections, music databases are steadily developing a name. The number of individuals using the music database has increased as internet services have improved and network bandwidth has increased. It's tedious and time-consuming to work with massive music databases.

Machine Learning is an Artificial Intelligence technology in which computers or machines learn from information (data) provided to them. Machine Learning assists computers in automatically constructing interpretative patterns and analytical models based on data fed into the machines.

As computers and smartphones have become the new music equipment, Machine Learning has facilitated the classification of music genres using several techniques. One of them, K-Nearest Neighbour (KNN), is a technique that has been reportedly successful in categorizing music into different genres.

The KNN algorithm, when implemented in music genre classification, looks at similar songs and assumes that they belong to the same category because they seem to be near to each other. Among various other techniques that prevail in this concept, the best results have been procured out of this technique.

This paper however aims at content-based classification, focusing on information within the audio. We used traditional machine learning approach for classification by finding suitable features of audio signals, training classifier on feature data and make predictions.

Rest of this paper is organized as follows. Section II deals with the Related Work done by others. Section III provides an overview about the Dataset that was used to carry out this research work. Section IV deals with the Feature Extraction. Section V explains the Methodology used to implement. Section VI contains the experiment results. Section VII consists of the conclusion and future work.

II. RELATED WORK

Machine learning techniques have been used for music genre classification for decides now. In 2002, G. Tzanetakis and P. Cook [8] used both the mixture of Gaussians model and k-nearest neighbours along with three sets of carefully hand-extracted features representing timbrel texture, rhythmic content and pitch content. They achieved 61% accuracy.

As a benchmark, human accuracy averages around 70% for this kind of genre classification work [4]. Tzanetakis and Cook used MFCCs, a close cousin of mel-spectrograms, and essentially all work has followed in their footsteps in transforming their data in this manner.

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In the following years, methods such as support vector machines were also applied to this task, such as in 2003 when C. Xu et al. used multiple layers of SVMs to achieve over 90% accuracy on a dataset containing only four genres.

Many of the papers which implemented CNNs compared their models to other ML techniques, including k-NN, mixture of Gaussians, and SVMs, and KNNs performed favourably in all cases. Therefore we decided to focus our efforts on implementing a high-accuracy KNN, with other models used as a baseline.

III. DATASET

For the classification, the GTZAN Genre Collection dataset was used. MARSYAS, a prominent software framework, provided the data for this study. Marsyas (Music Analysis, Retrieval, and Synthesis for Audio Signals) is an open source audio processing software framework with a focus on Music Information Retrieval applications. George Tzanetakis (gtzan@cs.uvic.ca) was the one who created and wrote it. Marsyas has been used in both academia and industry for a range of tasks.

1000 audio tracks, each lasting 30 seconds, make up the data set. There are 100 tracks in each of the ten genres (Blues, Classical, Country, Disco, Hip-Hop, Jazz, Metal, Pop, Reggae, and Rock). The tracks are all.wav files with a frequency of 22050Hz Mono 16-bit audio.

Table 1. Distribution of the Dataset

Genre	Number of tracks
Blues	100
Classical	100
Country	100
Disco	100
Hip-Hop	100
Jazz	100
Metal	100
Pop	100
Reggae	100
Rock	100
Total	**1000**

IV. FEATURE EXTRACTION

Feature extraction is the transformation of high-dimensional data into a meaningful representation of reduced dimensionality. The representation extracted are often beneficial to mitigate the computational complexity and improve the accuracy of a particular classifier. The first step for music genre classification project would be to extract features and components from the audio files. It includes identifying the linguistic content and discarding noise.

Mel Frequency Cepstral Coefficients:

These are state-of-the-art features used in automatic speech and speech recognition studies. There are a set of steps for generation of these features:

- Since the audio signals are constantly changing, first we divide these signals into smaller frames. Each frame is around 20-40 ms long.
- Then we try to identify different frequencies present in each frame
- Now, separate linguistic frequencies from the noise
- To discard the noise, it then takes discrete cosine transform (DCT) of these frequencies. Using DCT we keep only a specific sequence of frequencies that have a high probability of information.

```
for folder in os.listdir(directory):
  i+=1
  if i==11 :
```

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```
        break
for file in os.listdir(directory+folder):
   (rate,sig) = wav.read(directory+folder+"/"+file)
   mfcc_feat = mfcc(sig,rate ,winlen=0.020,    appendEnergy = False)
    covariance=np.cov(np.matrix.transpose(mfcc_feat))
mean_matrix = mfcc_feat.mean(0)
feature = (mean_matrix , covariance , i)
pickle.dump(feature , f)
```

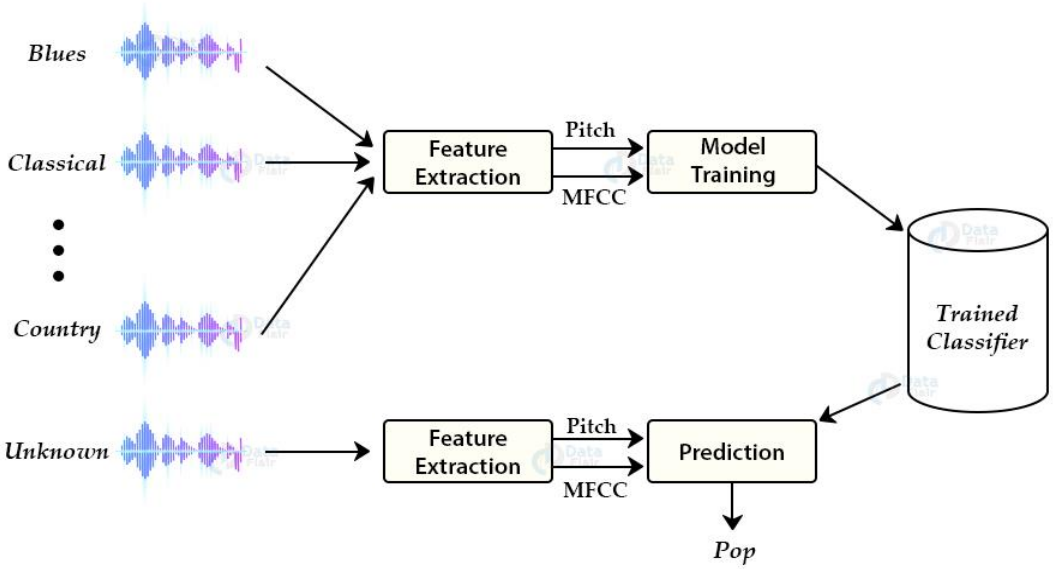

Fig-1 Graphical Representation of Music Genre Classification.

V. METHODOLOGY

This section provides the details of the data pre-processing steps followed by the description of the proposed approaches to this classification problem.

K-Nearest Neighbour

A supervised machine learning algorithm, the K-Nearest Neighbour technique is used to find solutions for classification and regression problems. Relying on labelled input data to process unlabelled data in the future, this ML technique is used in music genre classification.

In the process of music genre classification, any technique of Machine Learning constitutes 5 steps. These are as follows:-

1. Prerequisite Data

The prerequisite data involves past datasets that are required by machines to analyse past information and build analysis on that basis. The prerequisite for machine learning, in this the most necessary step involved in preparing machines for music genre classification using Machine Learning Algorithm.

2. Theoretical Foundation

The theoretical foundation of this concept implies that different techniques of Machine Learning can be incorporated to classify music into different genres based on pre-data sets and their subsequent analysis. It is important for us to understand the theory of music genre classification before proceeding to the next step. The KNN algorithm, which is considered to be the most successful algorithm, in this case, is involved in this theory.

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3. Data pre-processing Analysis

The Data pre-processing Analysis involves machines scanning through the prerequisite data and analysing them for procuring patterns. This stage particularly helps computers to study data and build patterns so that it leads to successful testing.

4. Training Dataset

The training dataset involves feeding the machine with new data that will test the efficacy of the algorithm. The music genre classification dataset can be procured in any manner since it only requires random songs that can be classified by the algorithm into different genres.

5. Testing New Inputs

The last step, testing new inputs, refers to the machine working on the training data and testing data so that the algorithm can now filter music and carry out the task of music genre recognition.

VI. RESULTS

To train the Model and make the necessary predictions, an 80% - 20% splitting strategy of the dataset was used for training and testing respectively.

To calculate the accuracy:

```
leng = len(testSet)
predictions = []
for x in range (leng):
   predictions.append(nearestClass(getNeighbors(trainingSet ,testSet[x] , 5)))
accuracy1 = getAccuracy(testSet , predictions)
print(accuracy1)
```

```
> predicted=10, actual=10
> predicted=10, actual=10
Accuracy: 0.7085714285714285%
```

The Model yielded an accuracy of 70%.

VII. CONCLUSION AND FUTURE SCOPE

The classification of music genres using various Machine Learning algorithms is a complex yet compatible process that helps software applications to categorize millions of songs using schemas formulated by pre-data sets. It is extremely surprising that technology has percolated deep into our lives, and even in the field of music. Enabling machines to carry out music recommendation services and music genre recognition, Machine Learning has a vast application in our day-to-day lives.

This work could be expanded to take into account larger data sets as well as tracks in other formats (mp3, au etc). Furthermore, each genre's style will evolve through time. So, in the future, our goal will be to keep updated with changes in genre styles and to upgrade our software to support these new styles. This work can also be used as a mood-based music recommendation system.

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