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Music Classification and Recommendation System

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Abstract: *Today, music is important too an inseparable part of everyday life. There are many types of music and genres are different from all others, which leads to people having different types of music. As a result, it becomes an important and recent issue for separating music and praising new music in listening to music apps and forums. Dividing music by genre is one of the most useful methods used to solve this problem. There are many ways to distinguish music and compliments. One approach is based on the acoustic elements of music. This study, a system to classify the genre of music and the music recommendation engine, focused on output unique features found in the neural network with a deep novel model, suggested. Acoustic features have been removed from this networks used to classify genre and genre recommendations on the data set.*

Keywords: Music.

I. INTRODUCTION

1.1 Machine Learning:

We know that Music is very important in everyone's life, it brings take out a lot of emotions in us like nostalgia, happiness. Music it can change a person's condition, make him productive, the possibilities are endless. Also, in this field recommendations engine is widely used to recommend users previous choice music.

Now-a-day, machine learning is used for a variety of purposes applications. Probably one of the most popular examples machine learning in practice is a recommendation feed engine.

Now everywhere machine reading is used to make it your own you own how each member's offer is delivered. If you are a normal person the member stops doing things, the recommendation engine will start show more activity related to previous feeds.

The Artificial Intelligence (AI) branch of machine learning and computer science focuses on data usage and algorithms in the way people learn, they are gradually improving its accuracy. IBM has a rich history of machine learning. One of them, Arthur Samuel is said to have coined the terms “machine learning” and his research (link stays outside IBM) on time a game of testers. Robert Nealey, who calls himself a checker, played a game on the IBM 7094 computer in 1962, was defeated on the computer. from what can be done today, this is almost a little impossible, but it is considered a great milestone in field design intelligence. in the next few decades, in technology upgrades around storage and processing power will work other new products that we love and love today, like Netflix recommendation engine or self-driving cars. Machine learning an important part of growing data science. Through the use of mathematical methods, algorithms trained to perform categories or forecasts, to reveal important details of data mining projects. This information leads to internal decisions as well as applications businesses, which have a positive impact on significant growth.

1.2 Music Genere Classification

The classification of species is an important task for many applications. As the amount of music released on every day it continues to thunder, especially on the internet platforms like Soundcloud and Spotify - 2016 number one suggests that tens of thousands of songs be released regularly per month on Spotify - the need for accurate metadata required website management and search / retention purposes equally.

Ability to quickly distinguish songs from any a given playlist or library by genre is an important function with any music streaming / purchasing service, and power with accurate and complete mathematical analysis of the labels of the supply of music and sound is unlimited.

The sound is represented between the sound signal type has parameters such as frequency, decibel, bandwidth etc. A

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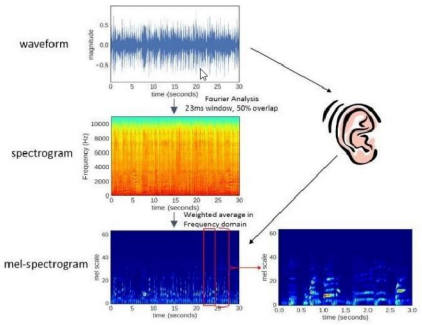
normal audio signal is usually expressed as a function of Amplitude and time. These sound signals are available in a variety of forms different formats make it happen and straight forward so that the PC can read and analyze them. Some formats are: mp3 format, WMA (Windows Media Audio) and wav format (Waveform Audio File) format. Companies (such as Soundcloud, Apple Music, Spotify, Wynk etc.) use music classification, or putting recommendations to their customers, or as a product (like Shazam). To be ready to do any of the above specified functions, determining the types of music to be original step. to realize this, we will take the help of the Machine Learning algorithms. These machine learning algorithms prove to be very helpful in Music Analysis too.



Music analysis complete with digital song writing signatures for a few things, including acoustics, dance, tempo, power etc., to find the type of songs one likes to focus on. Music is characterized by self-classification labels called called species. These types are categorized labels X A type of music is separated by features often shared by it members. Often, these factors are linked with rhythmic structure, instruments, and hence the harmonic content of the music. Divorce music files in their various, authentic genres challenging task instead of retrieving music information (MIR), field related to browsing, editing and searching large music collections. The classification of genres is often very important in order to clarify some interesting ones problems such as creating song indexes, tracking related songs, finding communities that will love that particular song, sometimes it can be too used for used for research purposes. Automatic categorization of music may be helpful people or maybe instead of them during the process and it can be very an important addition to music acquisition programs. moreover, in meanwhile, the automatic classification of music by genre can provide a framework in order to develop and evaluate features of any type of content based music signal analysis is the concept of classification of default music type has become very fashionable in recent years due to the rapid growth of digital show business. Dividing music into genres is a great idea, but they are there visual perception associated with instrumentation, the formation of the rhythm and texture of the music that will play the role of separating the characters some kind. so far the distinction of digital genres has been achieved done in person. Therefore, the methods of differentiating the default type can be an important addition to the development of audio retrieval music systems. Nowadays lots of music industries like amazon music, wink music, gaana. com, Spotify and many more industries are using recommender systems and the old-fashioned way of selling music has changed to a totally different cloud based. Now all the music resources are present in their cloud and users can listen to the songs directly But the problem is that there are so many songs out there a cloud system. hence, we need to classify all songs based on different genres, artists places, age groups, languages and the main goal is to classify these songs according to user taste. Because the user is expecting a significant return after time and money investments can therefore attract a many customers by providing their various essential services interests of this project we use various machine learning algorithms and methods for data mining. Since used various algorithms and compared the results with it each other to find a compatible functional algorithm our model.

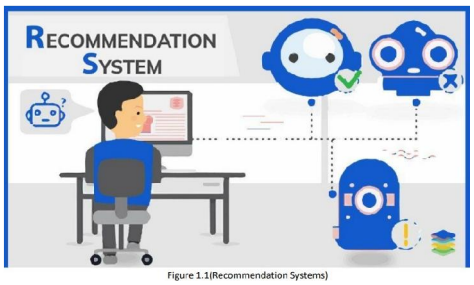


Figure 1.1(Recommendation Systems)

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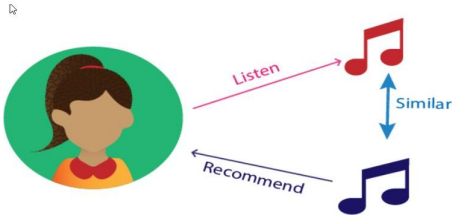
1.3 Recommendation System

With the advent of the internet and the emergence of E-commerce, Ecommerce sites now offer a variety of products for purchase.

Consumers find it difficult to choose from such a wide range of options. As a result, clients are often completely at a loss for words a guide to a big data repository and you can't find products they really need you. Because of this problem, recommender buildings have grown thunderstorms Recommendation The framework E-commerce site describes the most important things possible to meet client needs.

Why Recommender Systems?

A modern services such as Netflix, Spotify, YouTube offer its customers many options. Someone who uses such a service as well known as a client or user to assist the user, the resources that can be used filter information to recommend users' items. Things can be things like books, music, movies, stories etc. Recommendations systems need information to work, data about something user. This particular data can be downloaded directly or indirectly. Certainly data collection means a user of a particular service provides feedback and item reviews. Indirectly it means that the system will analyze user interaction with it a particular service that combines history with current services.



II. SYSTEM ARCHITECTURE

2.1 Approach

1. Gathering the data (choosing dataset)
2. Applying data mining techniques on dataset (data pre-processing and data cleaning)
3. Using Librosa features for visualization.
4. Making dataset ready to be used in various algorithms
5. Choosing the right algorithms for the project
6. Applying various machine learning algorithms
7. Comparing the results and then choosing the right model.

While preparing the machine learning mode for the first time something you have to do to collect data. we have a lot open available data for music recommendation as well we used a regular and reliable database.

2.2 Dataset

For this project we have selected the GTZAN data set. This The database included the history of listening to the song of many people but because the database was too large (1.2GB) it so we had to take a lower set of data for our project. The info set had various attributes such as, song file name, Length and Lebel, the database is also divided in two parts which is a train set and a test set. We were trained again test model using feature_3.csv file.

Figure 3.1 Data set

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2.3 Data pre-processing:

We dropped unnecessary column called file name.

```
#drop the first column 'filename' as it is unnecessary
data = data.drop(['filename'], axis=1)
```

2.4 Audio Libraries

LIBROSA

Librosa is a python package for music and audio analysis. Provides the building blocks needed to create music information access systems. By using Librosa, we can extract some important features from such sound samples such as Tempo, Chroma Energy Normalized, Mel-Frequency Cepstral Coefficients, Spectral Centroid, Spectral Contrast, Spectral Rolloff, and Zero Crossing Rate.

Python.display.Audio

With the help of Python.display.Audio can play audio in a notebook. It is a library used to play audio in it a notebook.

Feature Extraction

In this part of the paper, some important aspect of publication The methodology used in this study has been described. In music processing the signal, the means to extract the feature can be separated several features. Digital signal processing - time zone and frequency range– is one of these. Another useful strategy used for the issuance of a mathematical adjective as a definition, moderate, normal deviations etc. All methods described below split the green music signal into the N-number of windows again all these methods are run N times.

Label Encoder

Pre-data analysis is required before we can finally train the data. We will try and focus on the last column of 'label' and favorite enter code with sklearn LabelEncoder () function. pre-processing.

We cannot have text in our data if we are to use any model over you. So before we can use the model, we need to fix this data for model. To convert this type of category text data into a model

- Intelligible numeric data, using the Label Encoder category.

Scaling Feature

A standard scale is used to quantify features by removing a description and measuring unit variations.

A typical sample school x is calculated as:

$$z = (x - u) / s$$

Database setting is a common requirement for most machines learning standards: may be misbehaving if each person has characteristics don't look too much like normal streaming data.

Zero Crossing Rate:

Zero crossing level is defined as the number of signal changes at some point. Signal change is defined as a change in signal between negative and positive values. More details definitions can be found at.

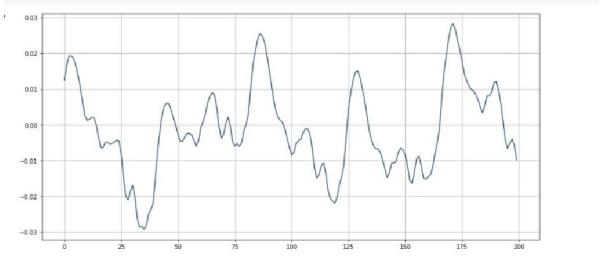

Fig .3.5.1 Zero crossing wave

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Plot Raw Wave Files:

Waves are a visual representation of sound as time goes on x axis and amplitude on y axis. They are good for allowing us to quickly scan audio data and compare visually compare what types very similar to others.

"Information behavior" is the currently preferred term used to describe the many ways in which human beings interact with information, in particular, the ways in which people seek and utilize information. Information behavior is also the term of art used in library and information science to refer to a sub-discipline that engages in a wide range of types of research conducted in order to understand the human relationship to information.

Interest in this area developed out of several streams. Librarians wanted to understand library users better, government agencies wanted to understand how scientists and engineers used technical information in order to promote more rapid uptake of new research results, and social scientists generally were interested in the social uses of information in a variety of senses. In more recent years, social studies of information technology and social informatics have contributed to this area as well. Within library and information science, these various streams of research are drawn on for what they can contribute to a richer understanding of information behavior.

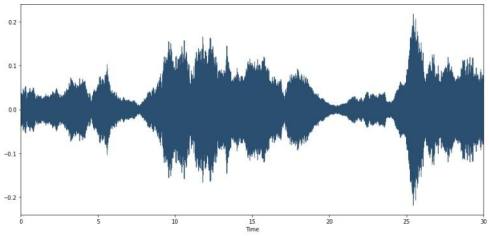

Fig .3.5.2 Raw wave

Spectral Centroid:

Spectral centroid is a feature used in the frequency range and indicates the point of the center of gravity frequencies in the frequency bar.

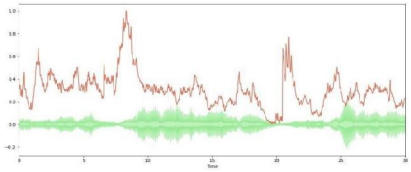

Fig .3.5.3 Spectral centroid

Spectral Rolloff

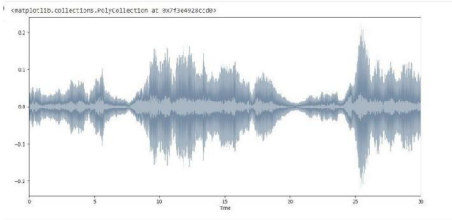

Fig .3.5.4 Spectral Rolloff

Mel Frequency Coefficient of Cepstrum-MFCC

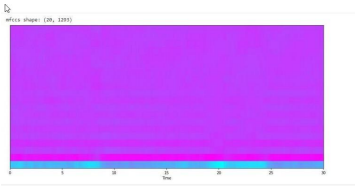

Fig .3.5.5 Mel Frequency Coefficient of Cepstrum

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Spectrograms:

The spectrogram is a visual representation of the signal height over time at various frequencies existing in some form of waves.

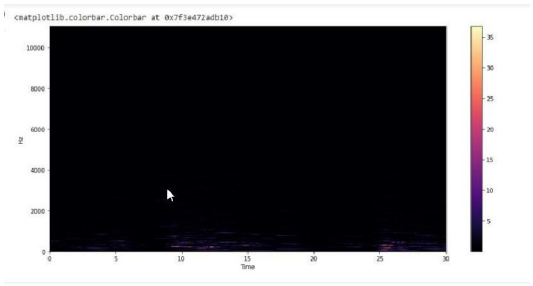


Fig .3.5.6 Spectogram

Chroma Feature:

It is a powerful tool for analyzing the musical aspects of their themes can be distinguished in a logical way and its tuning is close on an equal air scale.

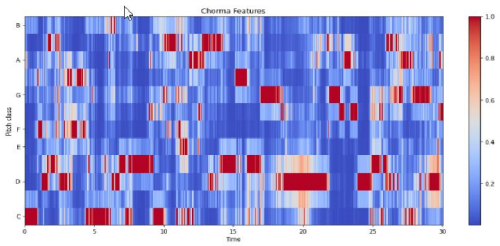


Fig .3.5.7 Chroma Feature

Box Plot for Genre Distributions:

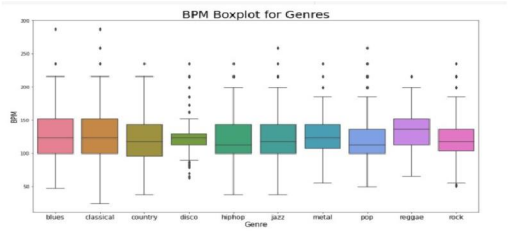
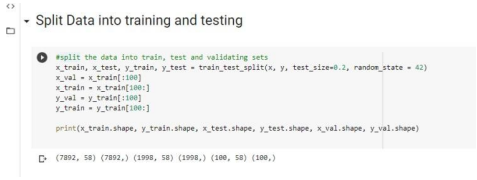


Fig .3.5.8 Box plot for genres Distribution

Dividing Data into Training and Testing Sets:



Convolutional Neural Network:

This was our most advanced model, using 3 layers of convolution, each has its own large pool as well standard, consumes 3 layers fully integrated with ReLU activation, softmax output, and entropy loss. Most of them Statistics can be found above, and our design is the same look presented below: This method includes convolution windows to scan the

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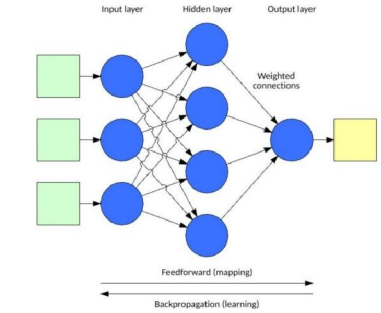
installation data and extract the file total number of items inside the window. This then finds out embedded in a large pool layer that selects the top element in another window. After that, the result is given by model. This has been used with TensorFlow and Keras

```
#build the model
model = keras.models.Sequential()
model.add(keras.layers.Dense(256, activation='relu', input_shape=(x_train.shape[1],)))
keras.layers.Dropout(0,2)
model.add(keras.layers.Dense(128, activation='relu'))
keras.layers.Dropout(0,2)
model.add(keras.layers.Dense(64, activation='relu'))
keras.layers.Dropout(0,2)
model.add(keras.layers.Dense(10, activation='softmax'))
print(model.summary())
model_history = train_model_op(model,epochs,x_train,y_train,x_val,y_val,optim='adam')
```

```
Model: "sequential_2"
_________________________________________________________________
Layer (type)                 Output Shape              Param #
=================================================================
dense_8 (Dense)              (None, 256)               15104
_________________________________________________________________
dense_9 (Dense)              (None, 128)               32895
_________________________________________________________________
dense_10 (Dense)             (None, 64)                8256
_________________________________________________________________
dense_11 (Dense)             (None, 10)                650
=================================================================
Total params: 56,906
Trainable params: 56,906
Non-trainable params: 0
_________________________________________________________________
None
```

Figure 3. Layers of a typical neural network



One of the most popular supervised learning methods for emotional networks are called back distribution. Back stream, using input vector and calculate output vector. Error calculated (actual compared to required), then broadcast back to correct the error weights once bias from the output layer to the input layer (like those contribution work on the result, to improve the quality of reading).

K- Nearest Neighbors-KNN:

The algorithm for the K-Nearest Neighbors route is as follows:

1. Find the parameter k (number of nearby neighbors).
2. Calculate the distance between the data to be checked and all training data.
3. Sort a built-in distance (by ascending order) and decide distance near k-order.
4. Attach the correct class (c).
5. Find the number of classes in the closest neighborhood, too specify a class as data analysis.

```
[ ] # making predictions using KNN
    leng = len(testSet)
    predictions = []
    for x in range(leng):
        predictions.append(nearestClass(getNeighbors(trainingSet, testSet[x], 5)))

    accuracy1 = getAccuracy(testSet, predictions)
    print(accuracy1)

    0.7163323782234957
```

XGboost Algorithm

XGboost is an algorithm widely used in machine learning, whether the problem is a program or a retrospective problem. It is known for its efficiency compared to all the others Machine learning algorithm.

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III. RESULT

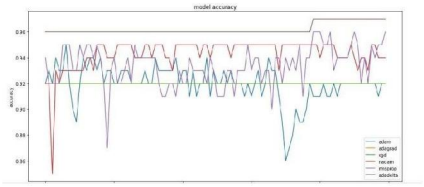

Fig .4.1 Model accuracy

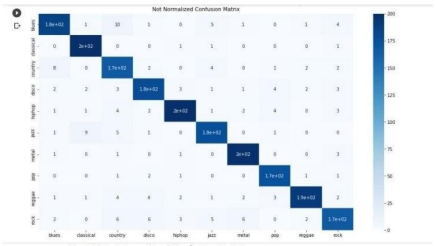

Fig .4.2 Not Normalized Confusion Matrix

Fig .4.3 Normalized Confusion Matrix

History of loss :

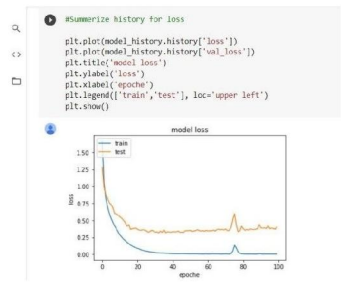

Fig .4.5 Model loss

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IV. CONCLUSION

We had a great learning experience doing this project. sine learn about data purification .this is the first function of the machine a learning model to remove every problem that creates things from data. data cleaning and data testing have been very helpful to make the database algorithm correct. learn to create machine learning model, and then CNN is trained as another feature to extract and perform a test on. Then the acoustic features of the songs are used in the decomposition to determine the best classification algorithm and the best recommendation results.