International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 08 Issue: 12 | Dec 2021 www.irjet.net p-ISSN: 2395-0072

# CLASSIFICATION OF MUSIC GENRE USING MACHINE LEARNING

**Isha Pathania[1], Dr Anuj Bhardwaj[2]**

*[1] M.E. Dept. of Computer Science and Engineering, Chandigarh University, Gharuan*
*[2]Assistant Professor, Dept. of Computer Science and Engineering, Chandigarh University, Gharuan*

---

**Abstract -** The classification of music files in accordance with their genre is a very demanding task, particularly in the zone of mainly MIR(Music Information Retrieval). In research paper, we have used two datasets. The first dataset is the English music (GTZAN) dataset and the second dataset is the Indian (Hindi) music dataset. In the English music, dataset we have used 10 genre namely blues, classical, country, disco, hip-hop, jazz, metal, pop, reggae and rock. For the Hindi music dataset, we have used six genres namely Bhajan, Bhojhpuri, Bollywood, Garhwali, Ghazal and Sufi. Both the dataset will run separately. Firstly, the python libraries will be imported. Then the Chroma features and zero crossing rate displayed. Confusion matrix of SVM, KNN, Gradient boosting, validation accuracy and confusion matrix of neural network will give the accuracy output.Music has nowadays categories which are used to categorise and classify songs,albums and artists into broader groups which can share alike musical characteristics become a significant proportion of Internet content.In this context,the automatic procedures, which are able to deal with very huge amounts of quantities in formats such as digital formats, are salient.Labels of music genre are very crucial.

*Key Words*: Machine Learning, Spectrogram, Music genre, Support Vector Machine, Deep Neural Network

## 1. INTRODUCTION

The various objectives of this research paper are to learn the importance of music genre classification, to know about the Chroma features, to understand about the different approaches of machine learning,to learn how to generate spectrogram, to find the zero crossing rate, to find the confusion matrix, to know about the importance of wave plots.

On similar note, classification and segmentation of the audio content analysis can be done in various ways. Music genre classification can also be done using neural networks, DNN (Deep Neural Network), CNN, and deep learning. In research paper, we have used different machine learning approaches for music genre classification.

TensorFlow is widely regarded as one of the best in the world. TensorFlow, as the name suggests, is a system for describing and executing calculations involving tensors. Deep brain networks that can be used in some AI applications can be prepared and run by this system. When it comes to Deep Learning (DL) research and application, TensorFlow is commonly used.

Keras is a well-known Python library for machine learning. TensorFlow, CNTK, and Theano can all benefit from this high-level brain networks API. It runs perfectly on both a CPU and a graphics card.A Neural Network can be assembled and planned using Keras, making it accessible to ML novices. Keras takes into account simple and quick prototyping, which is one of the most incredible things about it.

PyTorch supports many ML programs. With the help of the GPU, it is possible to perform complex calculations on Tensors in a more efficient manner.

The categorisation of music files is usually an important task as well as a challenging task.It's very difficult to categorise music files.The signals of an audio can be accordingly classified into a hierarchy of musical genres.

The various features that are extracted from the various audio clips like firstly the statistical spectral features,secondly the rhythmic content and lastly the pitch content are less dependable and produces very less accurate models.

## 2. DATASET

In this research paper, we have used two dataset.The first dataset is the English music (GTZAN) dataset and the second dataset is the Indian (Hindi) music dataset. In the English music, dataset we have used 10 genre namely blues, classical, country, disco, hip-hop, jazz, metal, pop, reggae and rock. For the Hindi music dataset, we have used six genres namely Bhajan, Bhojhpuri, Bollywood, Garhwali, Ghazal and Sufi. Both the dataset will run separately.

The first step of implementation would be dataset selection. By extracting approximately ten seconds sound clips sum of very large 2.1 millions videos of youtube the dataset was formed. On the basis of an ontology,the audio files had been annotated,it wraps five hundred and twenty seven different classes of sounds that includes instruments of music,speech,sounds of vehicles,sounds of animals and many more.

This study makes use of only the files of audio which belongs to the category of music,basically having one of the different seven tags of genre.The second step is that the audio wav files needs to be downloaded by making the use of the tool youtube-dl. It should be noted that the each file is about eight hundred and eighty KB, totally upto thirty four GB.After that the MEL spectrogram will be generated.Then feature extraction would be performed.

## 3. VARIOUS DATA PRE-PROCESSING STEPS

This project designed into the following three distinct components:

1. Audio Processing (Time and Frequency Domain)

2. Feature Extraction

3. Network Modelling

Audio Processing unit consists of analysing the time domain features such as Tempo, Amplitude, etc. of the data along with frequency domain features of the data. This analysis helps us to identify the defining features of an audio wave and understand the required methodology for features, which influence the distinction of any musical genre.Feature Extraction Unit consists of gathering all the required and characteristic features of audio and consolidating them all in an ordered format for further ad hoc data analysis and identifying any anomalies or discrepancies in the data. Classification of music based on genre follows certain rules and distinct characteristics for any musical piece to belong to a certain genre. By using Networks for Supervised Learning, we will be training our network to classify music genres based on the parameters obtained through feature extraction of the audio files. Frequency and Time Domain Audio processing of the audio data will do the feature extraction.

## 4. LITERATURE REVIEW

### 4.1 Lie Lu. et al., (2002)

This paper have put forward their study of classification as well as segmentation of the analysis of audio contents.

### 4.2 Tom LH.et al.,(2010)

This paper made a huge effort which will be able to know about the various important properties which generally helps to make the requisite design utilized for the Classification of Music Genre.

### 4.3 Kavukcuoglu.et al., (2016)

This paper gave a brief description of how the audio generation tasks will be carried out.

### 4.4 Schindler.et al.,(2016)

This paper proposed a usual uncommon characterization, which is the spectrogram that exist in signal; itcould capture the details of either frequency or time. Spectrograms could be utilized to train mainly the (CNNs) convolutional neural networks and they could be regarded as images.

### 4.5 Bhardwaj.et al.,(2021)

Deep learning approach is the first approach in their research work and for predicting the genre label of a signal, a CNN model would be trained usually from end-to-end.

### 4.6 Naik.et al., (2021)

The dataset which was used is the GTZAN that consists of thousands of clips of music of the duration of time of nearly 30 seconds with 22050 Hz frequency of sampling. They prepared their data by making use of missing value treatment, outlier treatment, define dummy variable for categorical variables and encode genre label. Outliers in any dataset have to be dealt with since these values can skew the results of the neural network. Outliers are usually eliminated from the dataset to maintain consistency in the data. In their case, the dataset was absent of any outliers, hence further processing was not required.Any Neural Network can only accept numerical data for processing and learning (Activation Functions and Loss Functions are all formulated for numerical data). In case of categorical data with no numerical value, the network cannot be trained.To overcome this issue, categorical variables are assigned numerical tags called Dummy Variables.The dummy variables were not required.As discussed above, Categorical data cannot be used as input for a Neural Network due to its non-numerical nature. Similarly, output of any Neural Network is also of numeric nature. To identify genres (Categorical), we have tagged all the genres to an integer, which the neural network can understand to validate the result.

## 5. RESULTS ANALYSIS AND FUTURE SCOPE

In this research, full experimental material is supplied, including the outcomes of each test as well as the interpretation of these data. This section covers the experiment outcomes. This displays the findings of the research, which was carried out using the Python programming language and Kaggle environment. The experiment's results are presented in a variety of graphs, metrics, and tables. The following section thoroughly examines the experiment's results.

### 5.1) GTZAN Dataset (English Music)

5.1.1)

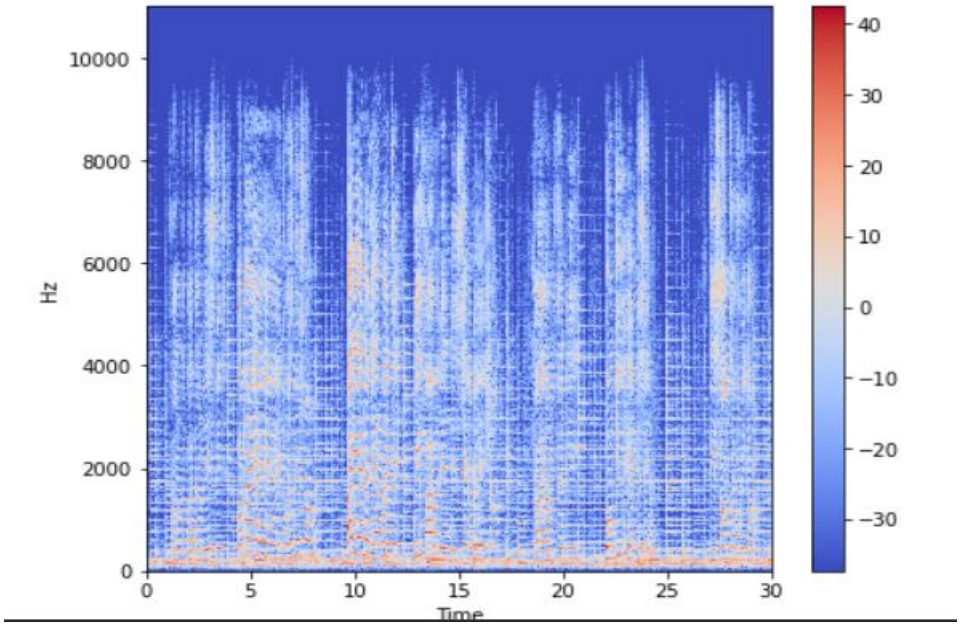



**Figure 5.1:Spectrogram of audio of English music genre**

5.1.2)The figure shown below depicts the spectral rolloff of English music genre.The width is taken as 7 and the height is taken as 6.The colour is taken as "#2B4F72".

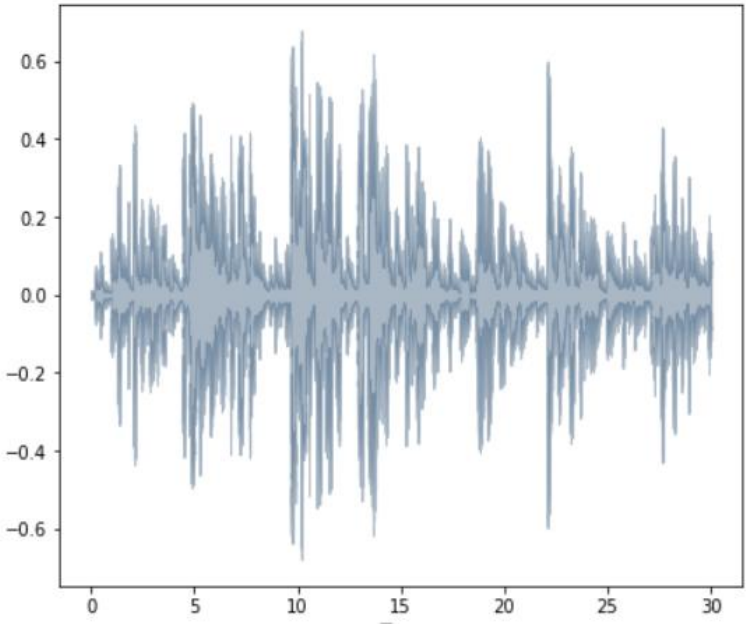



**Figure 5.2:Spectral rolloff of English music genre**

5.1.3)The figure below shows the waveplot and the Mel-spectrogram of Reggae music.

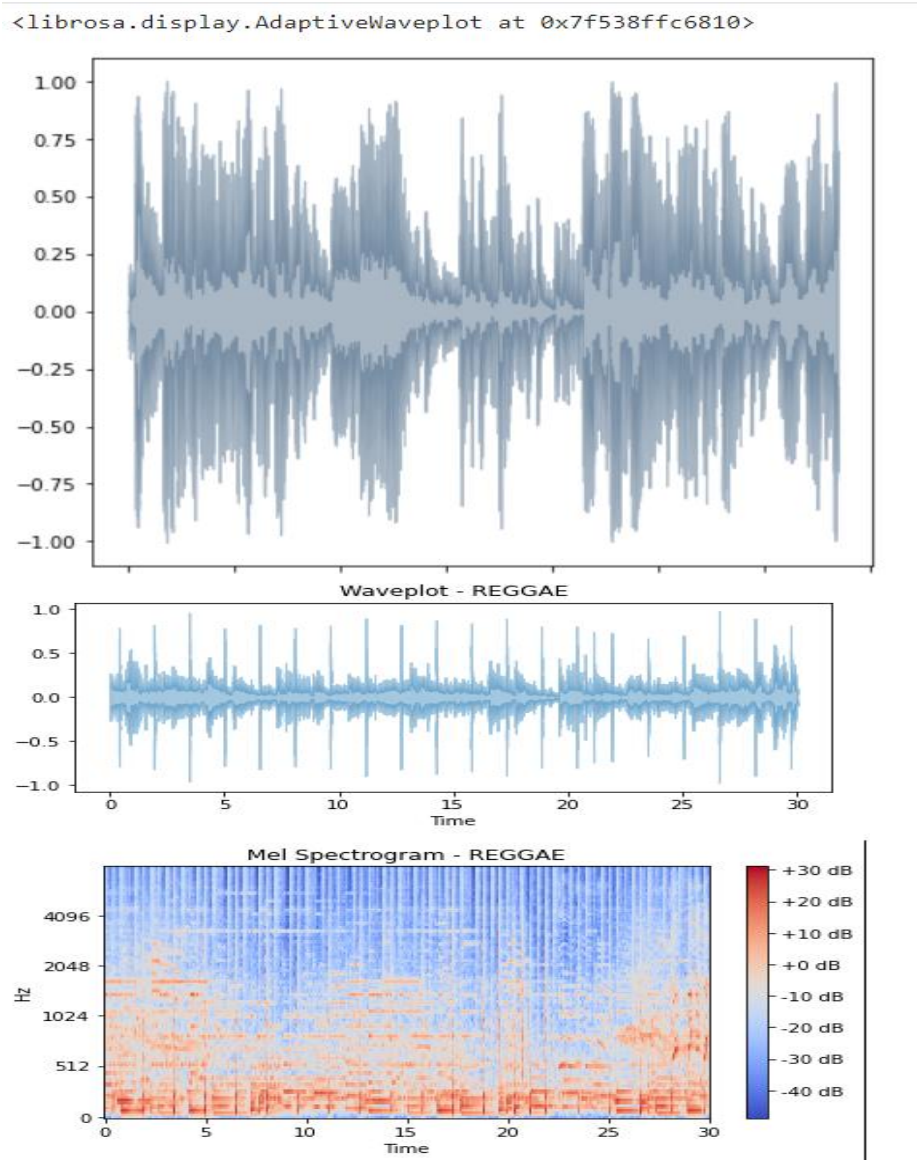



**Figure 5.3:Waveform and spectrogram of reggae music**

### 5.2) Hindi music

5.2.1.The below figure shows the spectrogram of audio of Hindi music dataset with time as the x axis and frequency as the y axis.

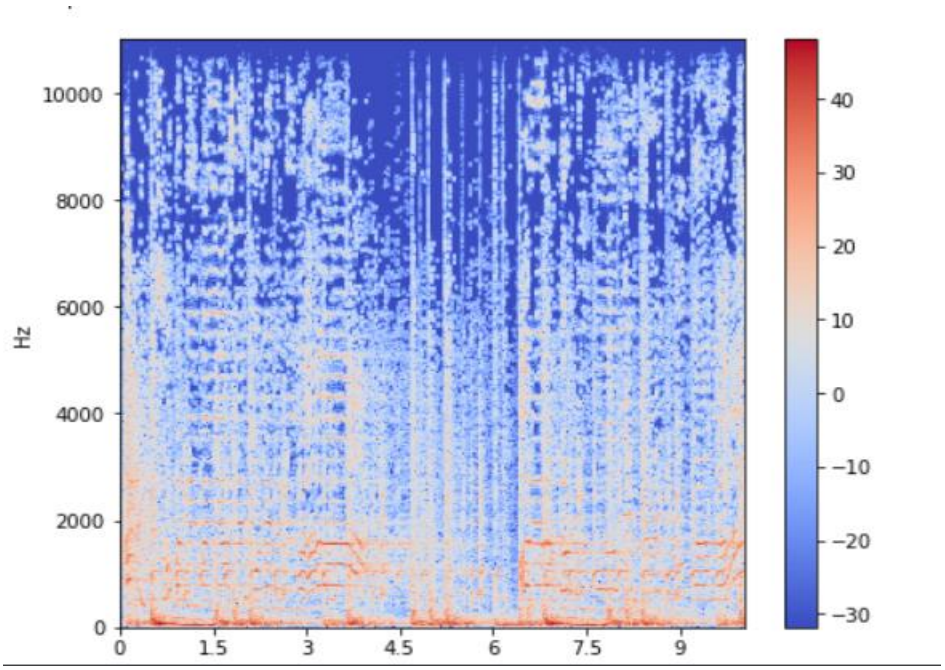
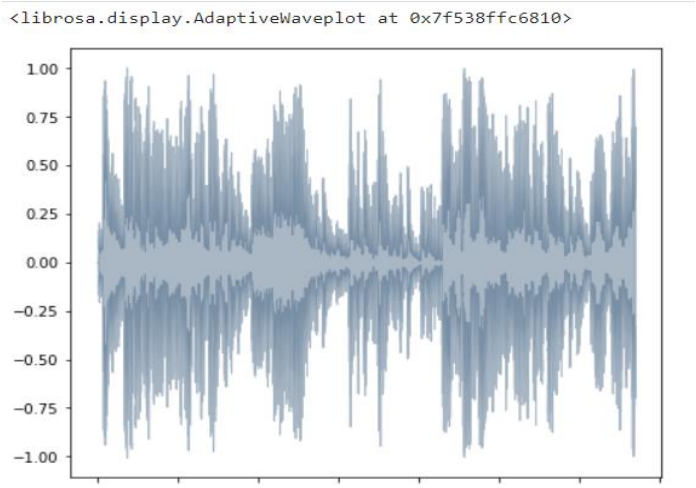



**Figure 5.4:Spectrogram of audio of Hindi music genre**

5.2.2.

The figure below shows the waveplot and the mel spectrogram of Garhwali music.



5.2.3

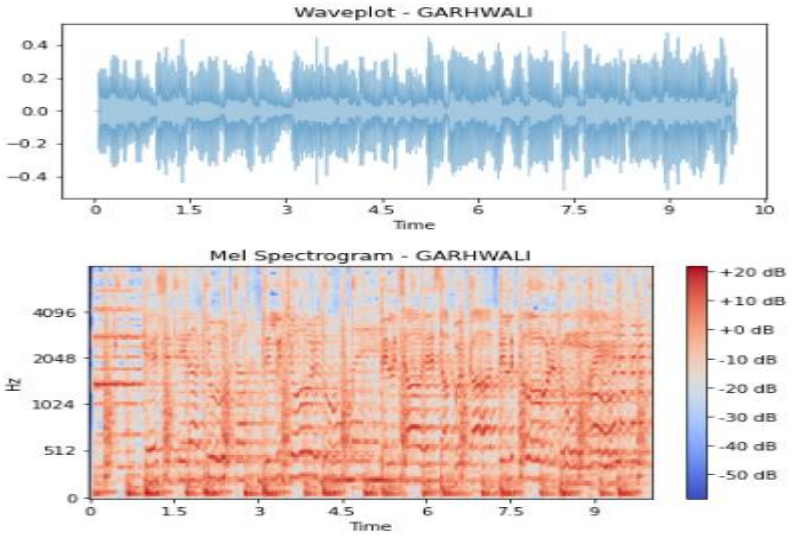



**Figure 5.6:Waveplot and spectrogram of GARHWALI music**

## 6. CONCLUSION

Firstly the python libraries were imported.Dataset from CSV files was loaded and the spectrogram of various audio files were displayed.Confusion matrix of KNN,SVM,Neural network and gradient boosting was plotted for Hindi music dataset and English music dataset. Validation accuracy and ROC curves were also plotted.

There are many pre-processing steps for classification of music genre like data pre- processing,spectrogram generation and deep neural networks.

Pandas is basically an open source library for the purpose of data manipulation and data analysis.It usually provides simple handling of data structures along with the high performance. Pandas have been used throughout this project for processing and handling data along with data analysis.

Matplotlib is usually a Python library which is dedicated for plotting figures, graphs and diagrams. It was basically used in the combination with that of Jupyter Notebook for visualization.

NumPy is a very important module used for Python. The name is basically an acronym for the "Numeric Python" or the "Numerical Python". It is basically an extension module for the language Python.I have used python for the implementation of my research paper.

An online community for data scientists is Kaggle. As of 2021,there are 8 million registered users on Kaggle.

**REFERENCES**

1. Anirudh Ghidiyal,Komal Singh and Sachin Sharma,Music Genre Classification Using Machine Learning,2020.

2. Tzanetakis,Musical genre classification of the various audio signal,2002.

3. Nitin and Punam Singh, Confusion Matrix in Machine Learning,2021.[online]Available:https://www.geeksforgeeks.org/confusion-matrix-machine-learning/

4. Akhand Pratap Mishra,Introduction to Convolutional Neural Network,2021.[online]Available: https://www.geeksforgeeks.org/introduction-convolution-neural-network/

5. Ahmet Elbir,Hilmi Bilal Cam,Mehmet EmreIyican and Berkay Ozturk,Music Genre Classification and Recommendation Using Machine Learning Techniques,2018

6. George Tzanetakis and Perry Cook.,Musical genre classification of the different audio signals,2002.

7. Thomas Lidyand Alexander Schindler,Parallel Convolutional neural networks for the music genre,2016.

8. Sawan Rai,Music Genre Classification Using Deep Learning Techniques,2021.[online]Available: https://www.analyticsvidhya.com/blog/2021/06/music-genres-classification-using-deep-learning-techniques/

9. Parul Pandey,Music Genre Classification with Python,2018. [online]Available: https://towardsdatascience.com/music-genre-classification-with-python-c714d032f0d8

10. Rajeeva Shreedhara Bhat,Rohit B. R.,Mamatha K. R.,"Music Genre Classification", *2020.*

11. Corinna Cortes and Vladimir Vapnik. 1995. Support vector networks. Machine learning 20(3):273–297.

12. Pawan,XGBoost,2021.[online]Available: https://www.geeksforgeeks.org/xgboost/

13. Trevor Hastie, Robert Tibshirani, and Jerome Friedman," The elements of statistical learning",2001

14. Hagen Soltau, Tanja Schultz, Martin Westphal, and Alex Waibel,"Recognition of music types",1998

15. Yandre M.G. Costa, Luiz S. Oliveira, Carlos N. Silla Jr., "An evaluation of Convolutional Neural Networks for music classification using spectrograms", Applied Soft Computing, Volume 52, March 2017, Pages 28-38